Ten Green Tips for Achieving Energy Efficiency and Environmental Compliance on a Solid Fuel Fired Steam Generator

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Optimize Combustion Efficiency: When poor combustion occurs, this often results with flame impingement and carbon char quenching of the boiler components, elevated exit gas temperatures, dry gas losses, decreased furnace heat absorption and a myriad of other steam cycle, reliability and air pollution control equipment challenges. Thus, optimizing the furnace inputs with the proper air to fuel ratios is essential. Ensuring a combustion program is in place to measure performance is the first step towards managing and preserving it.

Optimize Soot Blowing: The performance and condition of boiler cleaning systems are vital to the overall health a performance of a boiler, airheater and SCR. By keeping the gas paths clean through the boiler and all air pollution control equipment, this can positively influence overall boiler heat absorption, unit efficiency, relieve system draft and improve gas flow distribution while reducing localized erosion. Under or over-blowing can also create its challenges with efficiency and unit reliability and thus boiler cleaning cannot be an overlooked process.

Identify and Reduce Boiler Air Infiltration | Manage Excess Air: On balanced draft boilers, additional air in- leakage upstream of the air heater from leaky penthouses, casing and expansion joints result in non-optimum measuring conditions for accurately controlling excess oxygen. It is not uncommon to have large deviations from boiler design attributable to these leakage issues. Air in-leakage exacerbates problems with combustion systems, increases the velocity of suspended ash cinders and devolatilized carbon char that challenges available residence time within the furnace, convection pass, air heater and air pollution control equipment. Air in-leakage can also influence the oxidation rates and also dilute the flue gas providing misleading "lower" flue gas temperatures when compared to the actual "no-leakage" gas temperatures.

Improve Airheater Performance: The airheater often accounts for over 10% of thermal efficiency of a large utility boiler. Since the air heater is also a critical component of the combustion system, evaluating and optimizing an air heater's performance must be done with the requirements of the combustion system in mind. This process should include an integrated evaluation of fuel variations, operating conditions, combustion systems, mill performance, air/gas ratios, related auxiliary equipment, excess oxygen measurement equipment and techniques. Other issues associated with boiler or air heater leakage can include problems with: corrosion, fouling, ammonium bisulfate plugging, auxiliary power consumption, particulate control and higher differentials that lead to fan limitations or large particle carry-over to a scrubber (if installed). The heating element design, condition, cleanliness, tightness and proper sealing between the air and gas zones are absolutely essential. Also, the available hot primary airflow supplied to the milling systems can impact coal fineness, reduce tempering airflow and a percentage of the air that could completely bypass the airheater and disturb the heat exchangers X-ratio.

Reduce System Pressure Drop: The undue pressure drop from boiler slagging, fouling, air in-leakage or misalignment can have a significant impact on a systems draft. Furthermore, the cleanliness and gas distribution in/out of Airheaters, SCRs, fabric filter bag houses, ESPs and scrubbers can also impact overall power consumption and the fan capacity of a unit. It is extremely important to ensure optimum cleaning cycles, proper evacuation of hoppers and usage of the right tools and equipment is getting the job done right.

Optimize Flow: Imbalances of gas flow distribution from the boiler, airheaters, SCR and/or particulate control equipment can reduce collection efficiency, elevate power consumption, erosion and particulate emissions.

Control voltage at the ESP: Too often unnecessary auxiliary power is wasted at the ESP. In some cases, you can actually achieve improved performance with less power consumption if one monitors and properly controls the voltage.

Reduce Steam Cycle Losses: Attention must be given be given to the overall steam cycle to ensure heat is not bypassing the turbine, internally leaking high energy steam or increasing condenser vacuum. All heater levels, drains and vents to the condenser should be periodically checked. Furthermore, comprehensive turbine cycle evaluations, steam purity and steam path audits should be periodically conducted.

Recycle Fly ash: A 10% change in unburned carbon directly represents about 1% change in boiler efficiency when firing a typical eastern bituminous coal. This heat rate factor and inter-relationship with other heat losses is often overlooked or underestimated. The fly ash unburned carbon on a boiler firing Eastern Bituminous coal should be less than 5%. However, high volatile sub-bituminous and more reactive fuels should have unburned carbon well below 0.5%. Furthermore, when carbon in ash is low, rather than landfilling fly ash, the ash has the potential of being sold as an additive for manufacturing of concrete, building products, road construction and so forth. Therefore, recycling and reuse of coal-ash is certainly a green initiative.

Monitor and Preserve Performance: Recognize patterns and use tools and resources to work smarter, not harder. Optimizing gas temperatures, steam temperatures, pressures and "controllable heat rate" variables is an essential.

For more information, support or "Going Green" through fuel conservation effort, training and consulting -- contact Stephen Storm at stephen@stephenstorm.com or visit us on the worldwide web at www.stephenstorm.com.