Design of an Integrated Multi-Pollutant Control System for Reducing Emissions of SO_2, NO_x, Hg, Acid Gases, and Particulate Matter from Smaller Coal-Fired Power Plants

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The Greenidge Multi-Pollutant Control Project is being conducted as part of the U.S. Department of Energy's Power Plant Improvement Initiative to demonstrate an innovative combination of air pollution control technologies that can cost-effectively reduce emissions of SO_2, NO_x, Hg, acid gases (SO_3, HCl, and HF), and particulate matter from coal-fired electrical generating units with capacities of 50 - 300 MWe. The multi-pollutant control system is being installed and tested on the AES Greenidge Unit 4 (Boiler 6), a 107 MWe, 1950s vintage, tangentially-fired, reheat unit that burns mid-to-high sulfur eastern bituminous coal and co-fires up to 10% biomass. The Greenidge Project aims to confirm the commercial readiness of an emissions control system that is particularly suited, because of its relatively low capital and maintenance costs and small space requirements, to meet the requirements of smaller coal-fired units such as Greenidge Unit 4, which constitute a valuable asset base of existing electrical generating capacity but are becoming more susceptible to retirement or fuel switching as a result of increasingly stringent air emission regulations.

Construction and supply of the multi-pollutant control system by Babcock Power Environmental Inc. is underway at AES Greenidge, and startup is scheduled to commence by the end of 2006. This presentation focuses on the process design and performance targets of the system. The design seeks to reduce NO_x emissions to ≤0.10 lb/MMBtu at full load via a hybrid system consisting of combustion modifications, urea-based in-furnace selective non-catalytic reduction (SNCR), and a single-bed selective catalytic reduction (SCR) reactor that is being installed in the ductwork between the plant's economizer and air heaters and will be fed by ammonia slip generated by the urea-based SNCR system. Emissions of SO_2 and other acid gases will be reduced by ≥95% using a Turbosorp® circulating fluidized bed dry scrubber system. In the Turbosorp® scrubber system, water and dry hydrated lime, which will be supplied from a hydrator being installed on site at Greenidge, are injected separately into a fluidized bed absorber, where the flue gas is evaporatively cooled and brought into intimate contact with the hydrated lime reagent. The hydrated lime reacts with the acidic constituents of the flue gas (i.e., SO_2, SO_3, HCl, and HF) to form solid products, which are separated from the flue gas in a baghouse and recycled to the absorber at a high ratio to the inlet solids in order to maximize pollutant removal and lime utilization. Mercury removal of ≥90% in the multi-pollutant control system will be accomplished via the co-benefits afforded by the in-duct SCR, Turbosorp® scrubber system, and baghouse, as well as by injection of activated carbon into the Turbosorp® scrubber system as required. The design includes turndown capabilities for the SNCR and Turbosorp® scrubber systems, enabling operational flexibility and continued emissions reduction at reduced loads. The multi-pollutant control system is projected to cost about $330/kW and occupy an approximately 0.5-acre footprint for the AES Greenidge application, both substantially less than would have been required to retrofit a conventional stand-alone SCR and wet scrubber on a unit of this size.