Greenidge Multi-Pollutant Control Project

Demonstration Operations Complete

PPII

Emissions Control

Mercury	■	NO_x	■
SO_2	■	$PM_{2.5}$	■

Participant

CONSOL Energy Inc.

Additional Team Members

AES Greenidge, LLC — host

Babcock Power Environmental, Inc. — (EPC Contractor)

Location

Dresden, NY
(AES Greenidge Unit 4)

Technology

Hybrid selective non-catalytic reduction (SNCR)/in-duct selective catalytic reduction (SCR) in combination with low-NO_x burners to control NO_x and a circulating fluidized-bed dry scrubber (CFBDS) to control SO_2, mercury, and acid gases

Plant Capacity/ Production

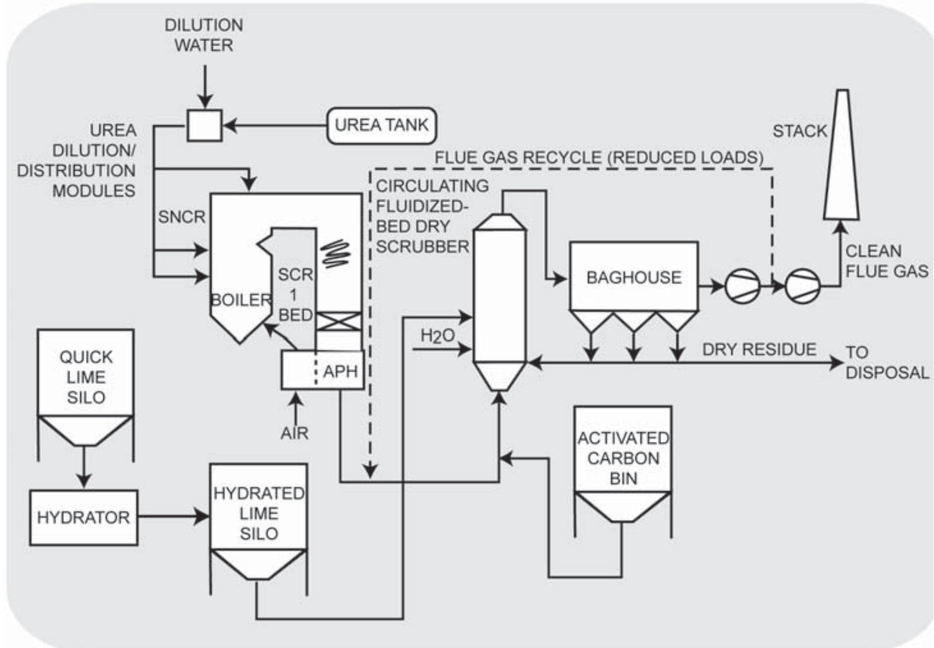
104 MW (Unit 4)

Coal

Bituminous coal (>2% sulfur) co-fired with up to 10% biomass

Project Funding

Total	$32,742,976	100%
DOE	14,341,423	43.8
Participant	18,401,553	56.2

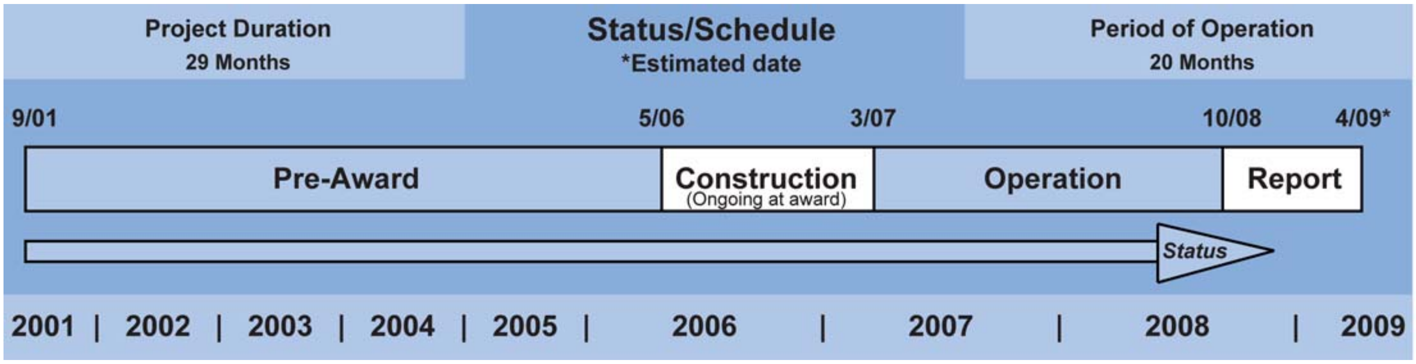


Objectives

To demonstrate cost-effective multi-pollutant control for relatively small power plants using a selective non-catalytic reduction (SNCR)/in-duct selective catalytic reduction (SCR) in combination with low-NO_x burners and a circulating fluidized-bed dry scrubber (CFBDS) system with recycled baghouse ash and activated carbon injection. To control nitrogen oxide (NO_x) emissions to 0.10 lb/10^6 Btu at full load, and reduce sulfur dioxide (SO_2) by 95 percent, mercury by 90 percent, and acid gases by 95 percent; and to evaluate the impact of biomass co-firing up to 10 percent heat input on the performance of the SNCR/SCR hybrid and CFBDS system.

Technology/Project Description

This project will demonstrate an in-duct SNCR/SCR hybrid in combination with low-NO_x burners and a CFBDS system using recycled baghouse ash and activated carbon injection to cost-effectively reduce emissions of NO_x, SO_2, mercury, and acidic gases to levels equal to or lower than those required by regulation at an existing 104-MW plant. The project also will evaluate the effect of biomass co-firing on the multi-pollutant control system. To complement existing low-NO_x burners, an SNCR is strategically located upstream of a single-bed in-duct SCR. Urea injection required for the SNCR also generates the ammonia required for the SCR. Having the SCR downstream of the SNCR allows the SNCR to operate at lower temperatures than normal (normally avoided to protect against ammonia slip), which enhances performance. The CFBDS system uses a reactor vessel to facilitate contact of flue gas with separately injected dry hydrated lime, activated carbon, and water. The activated carbon absorbs mercury, and the lime reacts with the sulfur dioxide (SO_2) and sulfur trioxide (SO_3), hydrochloric acid (HCl), and hydrofluoric acid (HF) gases to form benign solids, all of which are captured in the baghouse. Lime and activated carbon sorbents captured in the baghouse are recycled to the CFBDS to enhance utilization. Performance testing will include biomass co-firing at heat inputs up to 10 percent.



Benefits

The U.S. power industry is seeking lower cost and more compatible multi-pollutant control alternatives to SCR and wet scrubbers for the 473 domestic coal-fired generating units with capacities ranging from 50–300 MW. Economies of scale that make SCR and wet scrubbers viable for large plants do not apply to these relatively small units, and small units typically are space constrained, making it difficult, if not impossible, to install conventional SCR and wet scrubbers. Greenidge Unit 4 is representative of the small coal-fired electricity generating units that together represent almost one-quarter of the U.S. coal-fired generating capacity. The NO_x control technology to be demonstrated at Greenidge is estimated to require about 65 percent of the capital costs and 75 percent of the operating costs of a conventional SCR unit. The CFBDS is projected to use at least 2.5 times less activated carbon for a given level of mercury control. Reducing the carbon feed rate results in substantial mercury control cost savings. Also, the CFBDS is estimated to be about one-half the capital cost of a conventional wet scrubber. The acid gas control afforded by the CFBDS removes the precursors to acid aerosols, which can form $PM_{2.5}$ once emitted. Moreover, biomass co-firing may improve overall emissions performance through reduced fuel-bound nitrogen and sulfur levels, increased volatile content, and general combustion characteristics.

Status/Accomplishments

Following protracted negotiations, the project was awarded on May 19, 2006, with design and construction activities already under way. The project moved to the operations and testing phase in March 2007. At the end of June 2007, the project met the performance guarantee levels for NO_x, SO_2, SO_3, HCl, mercury, and ammonia slip. During the first year of operation, the project sought to resolve an accumulation of particle ash on the SCR catalyst bed. Through the addition of an ash screen and rotary sootblowers, the accumulation of ash deposits has been reduced to an acceptable level.

Three series of tests were conducted through June 2008. Test results demonstrated that the combination of technologies met all of the emissions reduction goals of the project. Moreover, the systems were installed with roughly 40 percent lower capital costs than conventional SCR and wet scrubbers, while space requirements were limited to approximately 0.4 acre. The project was completed on schedule on October 18, 2008.

The CFBDS demonstrated over 96 percent SO_2 emission reductions from high-sulfur coals.

The Multi-Pollutant Control System demonstrated 95 percent mercury removal without the need to inject activated carbon.

The Multi-Pollutant Control System demonstrated the capability to reduce NO_x emissions to 0.10 pounds per million Btu.

Contacts

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