PROJECT facts

U.S. Department of Energy
Office of Fossil Energy
National Energy Technology Laboratory

Clean Coal Power Initiative (CCPI 2)

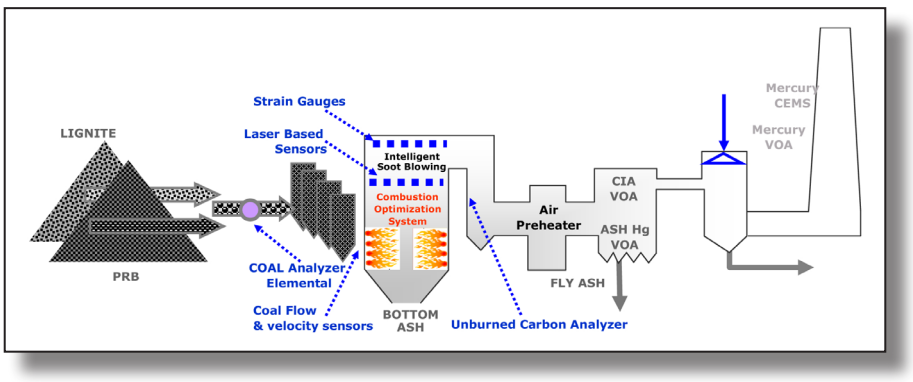
10/2008

Mercury Specie and Multi-Pollutant Control Project

Pegasus Technologies (Pegasus), a division of NeuCo, Inc., and a developer of power plant control and optimization technologies, will demonstrate the capability to optimize mercury speciation and control of emissions from an existing power plant. This demonstration will take place at an 890 megawatt (MW) utility boiler in Jewett, Texas owned by NRG Energy.

This project was selected in Round 2 of the Department of Energy's (DOE) Clean Coal Power Initiative to demonstrate advanced mercury control technologies. Although coal-fired power plants contribute only a small part of the total worldwide emissions of mercury, the estimated 48 tons of mercury they emit annually is about one-third of the total amount of mercury released annually by human activities in the United States. Mercury emissions can take a number of chemical forms – or species – including as a pure element, as part of a gaseous compound, or bound to particulates in the flue gas. Certain mercury species, such as mercury that is adsorbed onto fly-ash particles, are relatively easy to remove from the flue gas. Adjustment of certain parameters during combustion can optimize the speciation process, maximizing the mercury captured in particle bonds. This results in greater capture of mercury and less uncontrolled releases.

Pegasus will utilize state-of-the-art sensors and neural network-based optimization and control technologies to maximize the proportion of mercury species which are easy to remove from the boiler flue. Artificial intelligence and simulation technologies will be used to control and optimize all the major facets of the power plant. During this project, critical sensing devices will be added to the unit to monitor inputs and emissions from the plant. Data from these sensors will be analyzed by the neural network to optimize the use of raw materials, while simultaneously minimizing emissions. This project will demonstrate how integrating sensors, controls, and advanced analysis techniques into multiple facets of plant operation can lead to improved economics and environmental compliance.



Schematic of Sensors and Control Systems

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PARTNER

Pegasus Technologies
Chardon, OH

LOCATION

NRG Texas Limestone Plant
Jewett, Leon County, Texas

ADDITIONAL TEAM MEMBER

NRG Energy
Princeton, NJ

COST

Total Project Value
$15,560,811

DOE/Non-DOE Share
$6,079,480 / $9,481,332

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WEBSITE

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The demonstration power plant is equipped with a tangentially-fired boiler rated to supply steam to power a turbine generator and fires a blend of 70 percent lignite and 30 percent Powder River Basin sub-bituminous coal. The unit is equipped with a cold-side electrostatic precipitator with 99.8 percent particulate nominal removal efficiency and a wet limestone flue gas desulfurization system with 90 percent SO2 nominal removal efficiency. Both of the devices are capable of removing specie-optimized mercury from the unit's flue gas.

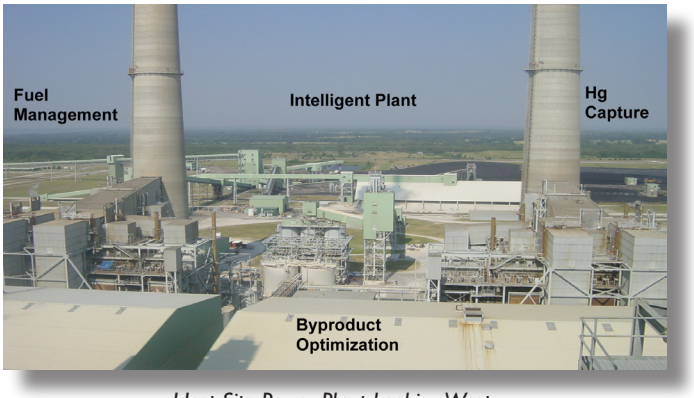
Sensor installation, software system design and baseline operating metric testing will be achieved during performance period 1. Instruments or instrument technology packages to be installed include: coal elemental analyzer (part of the fuel management system), mercury sensors, coal flow sensors, laser-based furnace gas speciation sensors, on-line carbon in ash sensor (located in the ESP), installation of related communications links for data acquisition and control, related computers, controllers and Pegasus optimization products. After installation, baseline testing will be performed to establish comparative data for follow on operational testing in Phase 3. After baseline testing, parametric testing will be performed to exercise various combinations of control variables to determine their effect on mercury speciation and byproduct generation as well as overall plant performance. These data will be used in phase 2 to design construct the neural network for optimization control. Performance period 1 runs from April 12, 2006 through May 31, 2007. Software installation, data communications modification and DCS modification will be achieved during performance period 2. Performance period 2 runs from June 1, 2007 through Sept. 30, 2008. System validation and demonstration operation will be performed in performance period 3. Performance period 3 runs from October 1, 2008 through May 31, 2010.

Benefits

This project will demonstrate plant-wide advanced control and optimization systems on a coal-fired steam electric power plant that could minimize emissions of mercury and other pollutants into the atmosphere.

The improved control and knowledge of plant conditions could also provide the capability to maximize plant efficiency for electricity production. This project will also address concerns that higher mercury concentrations in existing byproducts may adversely affect the commercial value of those byproducts. This technology is expected to have widespread application since it can be directly retrofitted to existing coal power plants or integrated into future new plant designs.

The Pegasus project is part of the DOE's plan to meet the nation's growing demand for electricity, provide a secure and low-cost coal-based energy source, and protect the environment. This project and others will provide the technical foundation to build the zero-emissions, coal-based power and hydrogen production plants of the future.



Host Site Power Plant Looking West

Project372.pmd