PROJECT facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Environmental and Water Resources

11/2006

REDUCTION OF WATER USE IN WET FGD SYSTEMS

Background

Coal-fired power plants require large volumes of water for efficient operation, primarily for cooling purposes. Public concern over water use is increasing, particularly in water stressed areas of the country. Analyses conducted by the U.S. Department of Energy's National Energy Technology Laboratory predict significant increases in power plant freshwater consumption over the coming years, encouraging the development of technologies to reduce this water loss. Power plant freshwater consumption refers to the quantity of water withdrawn from a water body that is not returned to the source but is lost to evaporation, while water withdrawal refers to the total quantity of water removed from a water source.

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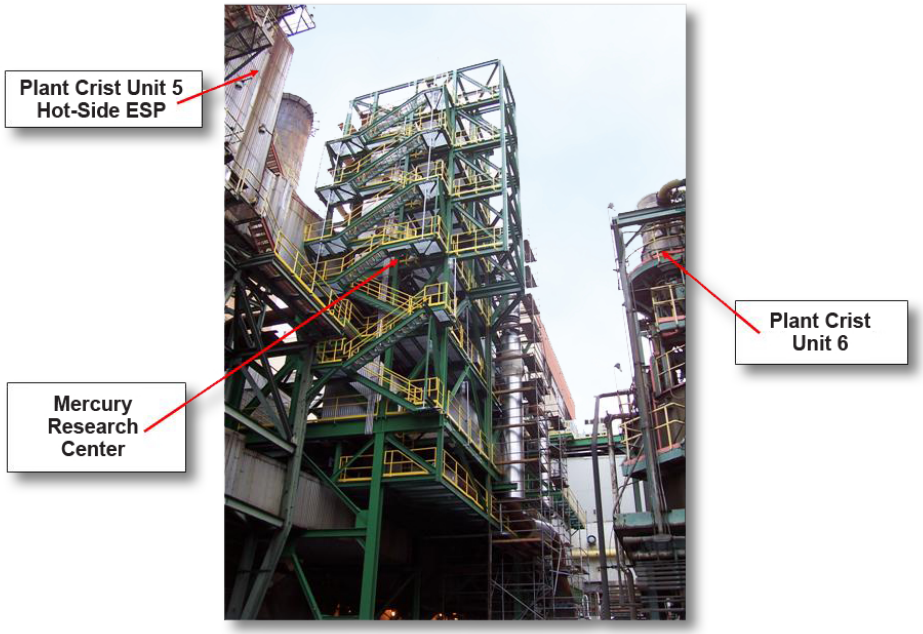

Pilot-scale tests of the regenerative heat exchange technology will be conducted at Gulf Power Company's Plant Crist in Pensacola, Florida.

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In power plants equipped with recirculating cooling water systems and wet flue gas desulfurization (FGD) systems, 90 percent of the evaporative water loss occurs in the cooling towers and 10 percent in the wet FGD system. Although water use in wet FGD systems represents a smaller percentage of evaporative water loss compared to cooling tower loss, technologies to reduce the wet FGD consumption are important because of the large number of wet FGD systems to be installed, at new and existing plants, in coming years due to recent regulations promulgated by the Environmental Protection Agency. As a result of these regulations, aimed at controlling precursors of ozone, fine participates, and mercury, an estimated 82 gigawatts (GW) of FGD capacity will be installed in the United States by the year 2020.

Primary Project Goal

The primary goal of this project is to demonstrate the use of regenerative heat exchange to reduce flue gas temperatures and thereby minimize evaporative water consumption in wet FGD systems on coal-fired boilers. Pilot-scale tests will be performed at a southeastern U.S. coal-fired power plant.

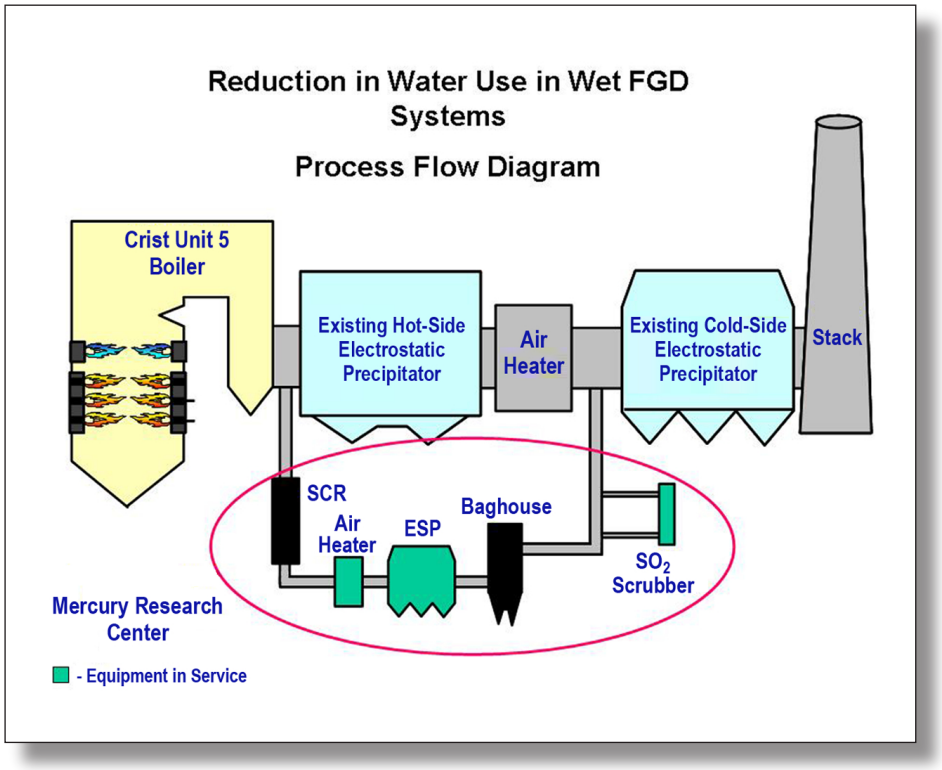
Objectives

This project, conducted by a team lead by URS Group, is working toward a main objective of reducing freshwater consumption by wet FGD systems by 50 percent or more. Additional objectives include:

- Demonstrate that cooling flue gas upstream of the electrostatic precipitator (ESP) and reheating flue gas downstream of the FGD system will result in the following benefits to air pollution control (APC) systems:
  - Improved ESP performance due to reduced gas volume and improved ash resistivity characteristics
  - Control of SO_3 emissions through condensation on the fly ash
  - Avoided need to install wet stacks or to provide flue gas reheat
- Examine the potential of increased mercury removal across the ESP and FGD systems due to the cooler flue gas temperature.

Accomplishments

This project is still in its initial stages and does not yet have any significant accomplishments.



The process at Plant Crist includes air pollution control devices that may be more effective at lower flue gas temperatures.

PERIOD OF PERFORMANCE

07/01/2006 to 09/30/2008

COST

Total Project Value
$858,396

DOE/Non-DOE Share
$573,116 / $285,280

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Benefits

By cooling the flue gas entering the FGD system, regenerative heat exchange is expected to reduce the amount of water evaporated by 50 percent or more. Additionally, when flue gas is cooled upstream of an ESP, significant co-benefits may be provided, including enhanced SO_3 emissions control via condensation on fly ash, improved ESP particulate control, mercury removal in the ESP, and avoided costs associated with flue gas reheat or wet stacks.

Planned Activities

The project will conduct pilot-scale tests of regenerative heat exchange to determine the achievable reduction in FGD water consumption at a variety of flue gas temperatures. Technical and economic analyses will be conducted to assess performance improvement of the APC systems and the resulting reduction in capital and operating costs. Testing will be conducted on a low-sulfur Eastern bituminous coal, and SO_3 will be spiked into the flue gas to simulate operation with higher SO_3 concentrations resulting from firing a higher sulfur coal or operating with a selective catalytic reduction unit. Pilot-scale testing will be performed at Gulf Power Company's Plant Crist in Pensacola, Florida.