PROJECT facts

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

Innovations for Existing Plants

01/2009

IMPROVED PERFORMANCE OF AN AIR COOLED CONDENSER (ACC) USING SPX WIND GUIDE TECHNOLOGY AT COAL-FIRED THERMOELECTRIC POWER PLANTS
PROMIS/PROJECT NO. : DE-NT0006549

CONTACTS

Jared Ciferno
Technology Manager
National Energy Technology Laboratory
626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940
412-386-4822
jared.ciferno@netl.doe.gov

Barbara Carney
Project Manager
National Energy Technology Laboratory
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507
304-285-4671
barbara.carney@netl.doe.gov

Ken Mortensen, PE
Principal Investigator
Technical Director, Water Resources
SPX Cooling Technologies
7401 West 129th Street
Overland Park, KS 66213
913-664-7723
ken.mortensen@spx.com

Background

As the growing economy drives the need for more electricity, demands on freshwater supplies for thermoelectric power generation will also grow. However, electric utilities will have to compete with demands from other water-use sectors, such as public supply, domestic, commercial, irrigation, industrial, and mining. In addition, the need to leave water in streams and rivers to achieve environmental, ecological, and recreational goals will further complicate the future allocation of the nation's freshwater resources. As such, the availability of adequate supplies of freshwater to produce electricity and the potential impact of power plant operations on freshwater quality are receiving increased attention.

The process of thermoelectric generation from fossil fuels such as coal, oil, and natural gas is water intensive since power generation from steam requires that process steam be condensed at the aft end of a turbine. This is achieved most frequently through the use of cooling water. According to the 2000 U.S. Geological Survey, thermoelectric-power withdrawals accounted for 48 percent of total water use. Therefore, developing technologies that improve performance and reduce costs of dry cooling towers is critical to manufacturers and plants looking to reduce water usage.

Description

Wind guide technology consists of guide vanes and wind screens associated with the fans on forced draft air cooled condensers (ACCs) that reduce crosswind effects by directing air towards the fan. This technology increases the flow of air in no wind

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SPX Cooling Technologies

and windy conditions. Degradation of fan performance is a common problem in ACCs and results in decreased cooling performance which causes a higher backpressure in the turbine resulting in overall lower plant efficiency.

SPX Cooling Technologies (SPX CT) has spent several years conducting research on wind guide technologies for ACCs. All of these studies have used computational fluid dynamics (CFD), a computer-based methodology, for the solution of the fundamental equations (Navier-Stokes equations) of fluid flow to model the wind effect on ACC fan performance. Preliminary results indicate that, using wind guide technology, airflow can be increased from 7% in no wind condition to 10% in a wind of 20 miles/hour.

For this project, a coal-fired power unit using an ACC will be selected, and the wind guide technology will be installed. Performance of the wind guide technology on the power plant will be determined by monitoring the steam temperature and pressure and condensate flow rate for the plant. Fan pressure and horsepower, and inlet/outlet air dry-bulb temperatures will be examined before and after the wind guide installation. The extent of performance gains that can be realized in both no wind and windy conditions will be determined.

SPX CT will partner with a utility company in the western United States to install and research the performance potential for the wind guide technology for use in thermoelectric power plants. This evaluation is a necessary step in bringing the wind guide technology to full-scale implementation with maximum efficiency gains and lowest costs.

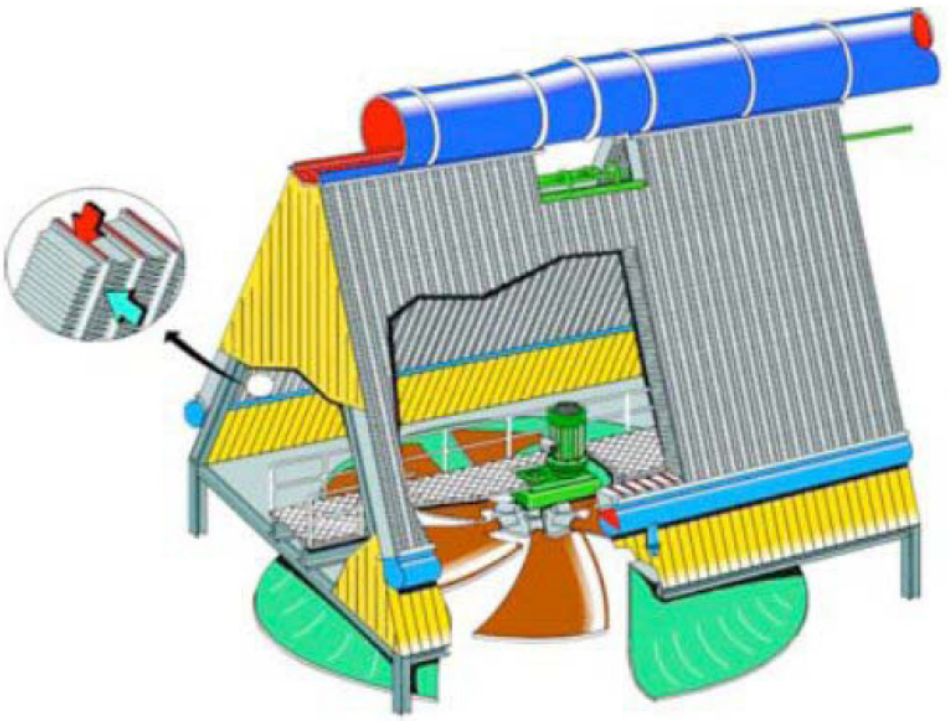

Diagram of an Air Cooled Condenser with Mechanical Draft

Primary Project Goal

The primary goal of this project is to improve forced draft ACC performance by using SPX wind guide technology to maintain optimum air flow over the fans. Removing cross-wind effects on ACC fans will increase the overall efficiency of the power plant, hence reducing the cost of using dry cooling.

Objectives

SPX will investigate the performance potential for the wind guide technology by completing the following tasks:

- Identify and partner with a utility company that has an existing ACC.
- Model the ACC with and without wind guide technology using CFD in order to calculate fan air flow gains.
- Monitor the existing ACC performance.
- Retrofit the ACC using wind guide technology.
- Monitor the ACC performance with wind guide technology and validate CFD modeling.
- Write Project Reports/Presentations.

Benefits

This technology will lessen the energy penalty associated with dry cooling. As the use of ACCs become more widespread, cost reduction and adequate cooling performance under windy conditions are more critical. SPX wind guide technology can boost the fan performance by seven percent in no wind conditions. It also helps reduce the wind effect by 10 percent under 20 miles/hour quartering wind. This performance gain has a direct impact on the efficiency of a coal-fired power plant. It lowers the turbine backpressure and increases the power plant output. Replacing wet cooled power plants with dry cooling would result in an enormous water savings.

PERIOD OF PERFORMANCE

09/30/08 to 12/29/10

COST

Total Project Value
$939,771

DOE/Non-DOE Share
$751,817 / $187,954

ADDRESS

National Energy Technology Laboratory
1450 Queen Avenue SW
Albany, OR 97321-2198
541-967-5892

2175 University Avenue South
Suite 201
Fairbanks, AK 99709
907-452-2559

3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880
304-285-4764

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940
412-386-4687

One West Third Street,
Suite 1400
Tulsa, OK 74103-3519
918-699-2000

CUSTOMER SERVICE

1-800-553-7681

WEBSITE

www.netl.doe.gov

Planned Activities

- Identify up to three utilities with existing ACC units.
- Negotiate an agreement with the partner utility.
- Model the existing ACC using CFD and wind guide technology.
- Install testing/monitoring instruments on the partner's ACC.
- Collect and analyze data.

An Actual SPX Air Cooled Condenser Module