PROJECT facts

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

Innovations for Existing Plants

01/2009

Improvement to Air2Air® Technology to Reduce Fresh-Water Evaporative Cooling Loss at Coal-Based Thermoelectric Power Plants
ProMIS/Project No. :DE-NT0005647

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Background

The production of electricity requires a reliable, abundant, and predictable source of freshwater - a resource that is limited in many parts of the United States and throughout the world. The process of thermoelectric generation from fossil fuels such as coal, oil, and natural gas is water intensive. According to the 2000 U.S. Geological Survey, thermoelectric-power withdrawals accounted for 48 percent of total water use, 39 percent of total freshwater withdrawals (136 billion gallons per day) for all categories, and 52 percent of fresh surface water withdrawals.

As a 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 off-stream 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 as well as the potential impact of power plant operations on freshwater quality are receiving increased attention.

Description

The Air2Air® involves contacting warm, wet air from the cooling tower with relatively drier and cooler ambient air. This is done in an air-to-air heat exchanger made up of plastic sheets with two discreet air pathways. As the warm, moist air

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from the tower is cooled, water condenses out and is collected. This water is very high quality and can be used either as an offset to cooling water or in another application where high quality water is needed, thus offsetting water treatment costs. The Air2Air® also acts as plume abatement for the cooling tower.

SPX Cooling Technologies is presently investigating the Air2Air® for evaporative cooling towers (Figure 1) under the U.S. Department of Energy (DOE) Grant No. DE-FC26-06NT42725. The preliminary findings from the research are encouraging in that the basic principles behind the technology are sound and the water savings are substantial. However, in the course of executing this project, construction costs of the validation cell (Figure 2) exceeded expectations. To be economically viable, more research is required to develop an efficient heat transfer pack and redesign the overall geometry of the tower including pack orientation and superstructure.

Primary Project Goal

The primary objective is to further enable Air2Air® to become a commercially viable water saving technology by solving issues of economy as they relate to cooling tower superstructure volume, pack cost, ducting details, heat transfer pack efficiency, and watertight wet path seals.

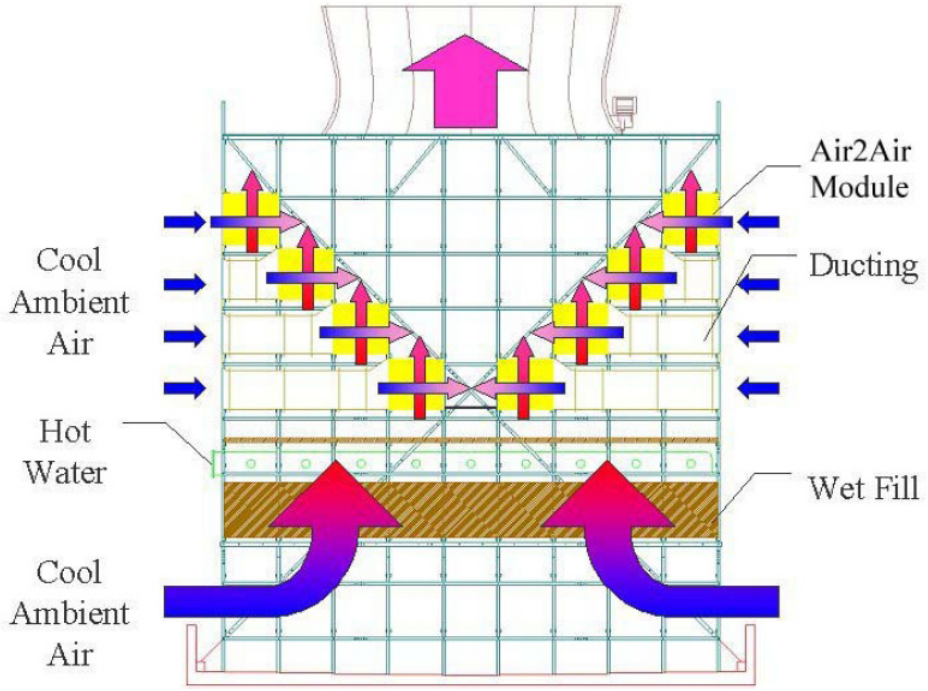

Diagram of Air2Air™ Water Conservation Cooling Tower

Objectives

The specific technical objectives to support the goal of increasing the commercial viability of the Air2Air® technology include:

- Increase the efficiency of the heat transfer pack.
- Ensure that wet path seals are watertight to allow for non-vertical pack module orientations.
- Design a shorter Air2Air® cooling tower, thus significantly reducing capital expenditures.
- Design a simpler duct configuration to reduce material and labor costs.

Benefits

The implementation of Air2Air® technology on existing cooling towers (retrofit) and new cooling towers would reduce freshwater consumption by thermoelectric power plants. Water savings could be expected to range from 15 to 25 percent, which for a typical 300 MW power plant would be approximately 600,000 gallons per day. In the case of salt-water cooling towers, high quality freshwater could be generated for other uses.

Planned Activities

- Design a new cooling tower configuration including plenum, support, and ducting design to improve material and labor costs.
- Determine a surface treatment for the heat transfer surfaces to enhance heat transfer.
- Adjust sheet spacing to optimize the balance between heat transfer and pressure drop.
- Investigate wet path seal technology to develop more effective seals.

PERIOD OF PERFORMANCE

10/01/08 to 12/31/10

COST

Total Project Value
$815,083

DOE/Non-DOE Share
$652,066 / $163,017

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- Identify one to three sealing methods.
- Design the tooling/machine required for the heat exchanger.
- Send tooling design to vendor.
- Test adequacy of tube seals.
- Determine thermal performance of test pack at SPX Research and Development Center.

Air2Air Validation Cell in Operation Next to Wet Only Cooling Cells