CASE STUDY

Central Utility Plant Upgrade Project Improves Airport Efficiency

The replacement of aging chillers and water-based pumps and the upgrade of a cooling tower at O'Hare International Airport provided the chance to add system redundancy while contributing to Chicago's sustainability program.

Challenge

O'Hare International Airport in Chicago began operating commercial flights in 1955, with its main terminals built in 1962. The Chicago Department of Aviation (CDA) is working to turn O'Hare — one of the world's busiest airports — into one of the most sustainable through energy efficiency improvements and energy consumption reduction.

As part of its Sustainable Path initiative, CDA called for improvements to the Central Heating & Refrigeration (H&R) Plant at O'Hare. The chilled water processes had minimal redundancy, were operated using outdated chiller and booster pump controls, and the system was using equipment that was more than 50 years old. Likewise, the South Cooling Tower was 20 years old, experiencing high maintenance costs and delivering reduced reliability and efficiency. Regardless, the H&R Plant and its aging infrastructure were relied upon to meet the airport's chilled water needs.

Project Stats

Client
Chicago Department of Aviation

Location
Chicago, Illinois

Total Project Cost
$70 million

5.5K
tons of net increase in chiller capacity

13.5K
tons of chilling capacity in tower upgrade

40
chilled water booster pumps replaced

Solution

CDA chose Burns & McDonnell for planning, design, engineering and construction services to support the replacement of five chillers; upgrades to four chillers, the South Cooling Tower and the chilled water booster pump systems; and the replacement of the chilled water system controls at O'Hare. This equipment was in the H&R Plant and the utility tunnels serving the main terminal mechanical rooms.

To increase capacity and improve the efficiency of the H&R Plant, the team evaluated multiple options. Variable speed chillers, a combination of variable and constant speed chillers, variable speed pumps, and a thermal energy storage (TES) tank to upgrade the chilled water system were all considered. A final design was selected that included variable speed chillers and a variable primary pumping system.

H&R Plant upgrades included replacing four existing 2,000-ton chillers with three 4,500-ton chillers for an increased capacity of 5,500 tons. Chiller upgrades also included the replacement of an existing 4,500-ton constant speed chiller with a new variable speed chiller, and new controls on four existing 4,500-ton chillers. The existing constant speed primary chilled water pumps were replaced with 10 new 1,000-horsepower variable speed chilled water pumps, and the central chilled water system controls for the entire H&R Plant were replaced.

The existing 8,000-ton South Cooling Tower was renovated and expanded to 13,500 tons, two 3,000-ton plate heat exchangers were added for free cooling duty, and cooling tower controls were replaced. Free cooling heat exchangers were piped in tandem and designed to satisfy the entire winter cooling demand when outdoor air was below 30°F. The system cools 54° water to 42° from the cooling towers, which have steam basin heaters to facilitate winter operation.

Terminal booster pump upgrades included replacing 40 chilled water booster pumps and upgrading all associated controls in 16 booster pump zones throughout the terminals.

Results

The project required careful planning, communication and broad stakeholder and operational staff involvement. To keep O'Hare functioning, phasing of equipment replacement and upgrades was critical to see that the project met the airport's chilled water needs during all phases of construction.

Replacing and upgrading central plant cooling equipment that had been in service since the 1960s provides O'Hare with increased energy efficiency and capacity, redundancy protection, and improved H&R operation. The improvements also contribute to goals set out in the CDA's Sustainable Path initiative.

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