



DuPage County Governmental Complex

Wheaton, Illinois

Central Plant Serves 12-Building Campus

Hybrid Plant and Storage System Give DuPage County Ultimate Flexibility

"On the hottest day of the year, we've got 1,000 tons of chiller capacity in reserve. That helps me feel secure." Dan Baran is the facilities supervisor of power plant operations at the DuPage County Governmental Complex in Wheaton, Illinois. Baran is discussing the recent upgrade of the chiller plant and chilled water distribution system on the sprawling government campus.

Wheaton is located approximately 20 miles west of Chicago. It, and all of DuPage County, has seen dramatic growth in the last 30 years with the expansion of the Chicago metropolitan area. Today the county has a municipal complex that includes 12 buildings totaling 1.5 million square feet. These include an administration building, jail and sheriff's office, judicial office building, health department, convalescent center, juvenile detention center, and power plant building. The chillers that serve the facility are located in the power plant building that dates back to 1970.





High-Temperature Hot Water Supply

The power plant building also contains three Cleaver-Brooks boilers that produce high temperature hot water for building heating, domestic water heating, and laundry as well as steam for humidifiers and food service. The boilers have a dual fuel configuration, operable on either natural gas or fuel oil. Nicor Gas delivers natural gas on an interruptible contract. Baran notes that although Nicor could interrupt service, that option has not yet been exercised. "But we are prepared to switch over to fuel oil quickly if we need to."

The county recently completed an upgrade of the chiller plant and chilled water distribution system. The project involved replacing three single-stage centrifugal chillers ranging in age from 18 to 30 years and totaling 3,300 tons of capacity. According to Baran, the reasons for the replacement were a desire for greater efficiency, concern about the

R-11, R-12 and R-114 refrigerants used in the old machines, and increasing concern about unit reliability because of age.

Hybrid Plant Solution

In 1998 the county had performed an evaluation of chiller plant options, considering both electric centrifugal and hot water absorption. Colin Oakley, facilities manager with DuPage County, was instrumental in driving the design to maximize efficiency and to take advantage of off-peak electric and gas rates. His concept was to install a sophisticated hybrid system with both absorption and electric centrifugal capacity. A chilled water storage tank was being installed under an earlier contract.



The facility design, which eventually won a regional award from ASHRAE, has increased system security and improved the county's position in contracting for energy supplies. Chilled water storage allows the county to reduce demand charges and to take advantage of off-peak energy rates from ComEd, the local electric power supplier. Plans were also made to upgrade the chilled water distribution network.

The electric chillers chosen were a 1,000-ton Trane CenTraVac™ centrifugal chiller and a 2,000-ton Trane duplex CenTraVac machine. The absorption machine is a 1,150-ton Trane Horizon™ two-stage absorption chiller. The existing boilers supply hot water at 360°F (182°C) to the absorption machine. At full load, the chiller requires about half of the plant's boiler capacity.

Flexible Chiller Scheme

The three new chillers are all connected in parallel and can be operated in any combination, serving cooling load directly or delivering chilled water to the 1.2-million-gallon chilled water storage tank. Cooling

A Trane duplex CenTraVac chiller.





Trane Horizon two-stage absorption chiller.

The boilers have a dual fuel configuration, operable on either natural gas or fuel oil.

water at a temperature of 55°F to 58°F (13°C to 14°C). According to Baran, the stored chilled water gives the equivalent cooling capacity of another 1,000-ton chiller.

In normal summer operations, the absorption chiller is base-loaded during the day with the electric chillers operated to meet additional cooling needs. However, with both electric and gas-fired absorption capabilities, the county can choose which unit to base-load, depending on fuel costs, energy charges, and demand charges. Under current rate conditions, at night the electric chillers operate to charge the storage tank and for direct cooling. Both hot water and chilled water are delivered to large built-up air handlers in all of the large buildings.

Lower Temperatures Reduce Pumping Costs

As a part of the system upgrade, the chilled water distribution system was converted from a conventional primary-secondary system to a variable volume primary system. According to Oakley, this change along with the greater capabilities of the new chillers allows the system to deliver chilled water in the range of 39°F (4°C). Lower temperature chilled water offers several advantages over the earlier system that delivered water at around 45°F (7°C). Pumping cost is significantly reduced. The new system also produces superior dehumidification, which is especially important in the judicial office building where large groups frequently gather.

The low chilled water temperatures also reduced the necessary investment in chilled water piping. As part of the chilled water plant improvement, new chilled water pipelines were installed in a tunnel system supplying all of the major

towers for the chillers are located next to the power plant. Their water supplier is the City of Chicago system and the water is of good quality, requiring minimal treatment.

The new chiller plant equipment was installed in late 1998 and first came on line in 1999. According to Baran, the low temperature chilled water capability of the centrifugal chillers allows him to send water at 38°F (3°C) to the storage tank at night, in effect banking chilled water capacity for the following day. The 10:00 p.m. to 9:00 a.m. energy rate is 2.273 cents per kWh versus the on-peak period where the charge is 5.172 cents. These rates do not include the demand charge. This rate window allows DuPage County ample time to bring the storage tank down to temperature.

Chilled Water Storage Adds Capacity

"With the chilled water in storage, we can hold down both our demand and our energy charges. It's a good system," Baran states. He indicates that the storage tank is large enough that the 38°F (3°C) chilled water remains stratified from the return

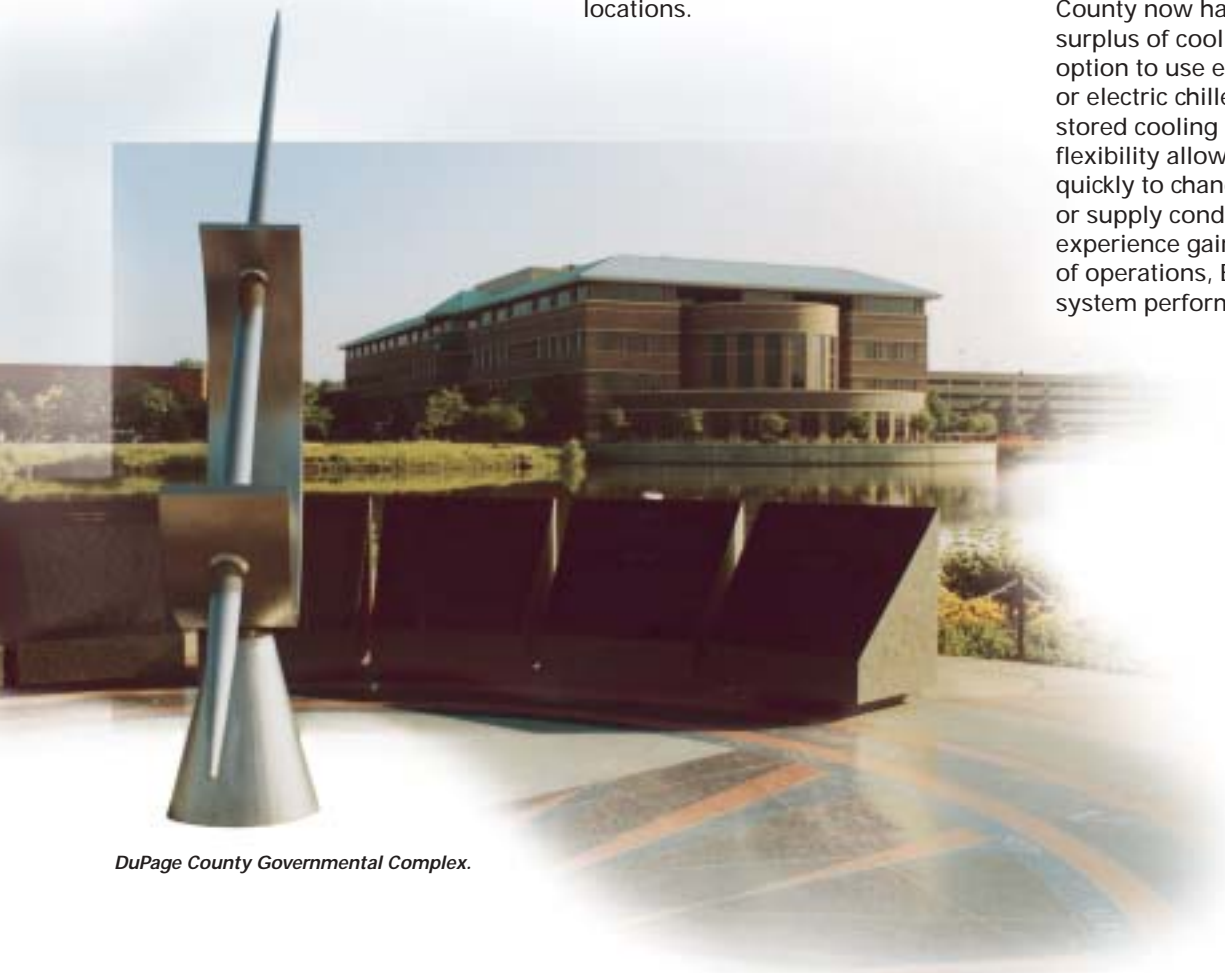
One-million-gallon chilled water storage tank.



buildings. The campus pipeline system consists of pairs of 20-inch chilled water pipes and 10-inch high-temperature hot water pipes. The system is designed for expansion to serve planned future construction.

New Tracer Summit™ System
 Another important improvement was the installation of a system-wide Tracer Summit control system. This allows optimization of the chiller plant and distribution system, and provides an opportunity to observe system conditions from the chiller plant control room or from remote locations.

Baran says that it took a little while to learn how to operate the storage system for the best results. "We've learned to watch the flows and temperatures in the storage system in order to optimize chilled water storage. It also means we have to anticipate what the requirements will be the following day." DuPage County now has a comfortable surplus of cooling capacity and the option to use either steam absorption or electric chillers directly or to use stored cooling capacity. This flexibility allows them to respond quickly to changing energy prices or supply conditions. With the experience gained from two years of operations, Baran says, "The system performs like a champ."



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