Georgia Tech Adds Tonnage, Reduces Water Costs

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Georgia Tech's vision to develop a biomedical research facility on its downtown Atlanta campus is quickly becoming a reality as the $98 million Engineered Biosystems Building (EBB) is brought online in April 2015. To support the cooling needs of the facility, Georgia Tech has completed a 3,000-ton expansion of the existing 10th Street Chilled Water Plant.

The 10th Street Chilled Water Plant was originally constructed in 1995 as part of the development associated with the 1996 Olympic Games. Expanded incrementally over the years, the plant capacity prior to this project was approaching 9,000 tons. Although the plant expansion was initially driven by the need for increased capacity on the north end of campus to serve the EBB, a major goal for Georgia Tech was to increase energy efficiency and reduce water consumption at the plant. Driving the goal for water reduction are the highest water rates in the nation at approximately $29 per 1,000 gallons for water and sewer.

Georgia Tech has explored many water conservation options on campus and at their district energy facilities in order to reduce the strain placed on their energy budget by high municipal water rates. One such avenue applied with moderate success was using an on-site well to supply cooling tower make-up water.

The well at the 10th Street Chilled Water Plant is capable of producing over 50 GPM of water and could provide a large percentage of the plant's water needs throughout the year. However, the well water contained a high level of silica and became problematic to use with the traditional index chemistry water treatment system in place at the plant.

The design for the 3,000-ton chiller addition and various plant upgrades included a variable speed chiller, a field-erected cooling tower and various auxiliaries including a 1,700-ton waterside economizer. The single compressor chiller is designed to be the base-load machine in the facility, providing many run-hours at less than 0.4 kW/ton. Coupled with the composite field erected tower, redundant condenser water pumps (VFD), and GT's first medium voltage variable frequency drive, chilled water production at the plant will approach a new level of efficiency.

However in addition to the high productivity of this equipment, the most unique aspect of the design was the inclusion of a "Zero Liquid Discharge" condenser water system designed by Water Conservation Technologies, Inc. (WCTI). The system utilizes high-efficiency water softeners to deliver make-up water to the system. The water softeners remove the existing dissolved solids and the system relies on poly-

Chiller–GT's first medium voltage VFD chiller is a highly efficient 3,000T York YK-EP, R-134a machine. It was slotted into a bay originally designed for a 2,000T chiller.

Tower – A new 3,000T field erected, FRP, counterflow tower includes low sound fan, double wall panel construction, access stair, and lightweight basin screens. The tower is designed at 80F wet-bulb and 85-100F temperature split.

merized silica to inhibit corrosion making the existing high-silica well water a perfect fit. The high-pH system is biostatic and requires no chemical biocides, a pleasing side benefit.

Coupled with a parallel system installed on the city water main, the dual water treatment systems are capable of providing all of the make-up water needs at the 10th Street Plant and are designed to use a minimal amount of water in the softener backwash cycle, effectively reducing condenser water system blowdown from a standard 10 percent to less than 2 percent. Reducing the system blowdown is anticipated to save over 5M gallons of water per year. However, the largest factor in the cost savings is the ability to utilize the existing well water.

Considering water usage in 2011 as a baseline year, the 10th Street Plant used 48M gallons of water with traditional index chemistry condenser water treatment at a cost of $550,000. Assuming the 2011 load profile with an added 2,000 tons of load on the system, water usage would project to 57.6M gallons at a total cost of $660,000.

Left: Softeners – WCTI water softeners treat both well water and city water for condenser make-up. The patented technology substantially reduces water and sewer costs on campus while eliminating the use of biocides.

Right: Free Cooling – A new 1,700T plate and frame free cooling heat exchanger utilizes a connected tower capacity of 4,000Ts to maximize operational hours in Atlanta.

Implementing the WCTI system is projected to reduce the total water usage from 57.6M to 52.4M gallons (through reduced blow-down) and the existing on-site well can provide 20.0M gallons of this total, requiring only 32.4M gallons of city water at a total cost of $371,000. This produces a projected annual savings of $289,000.

System installation costs are approximately $350,000 for all components, piping, controls and finishes, and the system requires a proprietary monitoring contract. The system is relatively simple, relying on the proper operation of a water softener which by design has a fully redundant backup. As compared to a traditional index chemistry system that has multiple single points of failure and is not monitored, WCTI reliability is very high.

Georgia Tech is currently evaluating the system for potential installation at other chilled water production facilities. In a market where water can consume upwards of 30 percent of a campus utility budget, strategies to reduce water consumption can make a huge difference in the bottom line—and better yet, Georgia Tech is doing their part to reduce chemical usage and conserve a precious natural resource.

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