Multi-Campus Makeover

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Putting a premium on flexibility, from flow controls to fuel sources, helps a central plant makeover to make the grade for three Atlanta institutions of higher learning.

Figure 1. Two D-type 40,000 lb/hr watertube boilers equipped with economizers and a single 40,000 lb/hr, 12 MW electrode boiler were utilized to provide steam and high temperature hot water load at the John B. Shepherd Central Utility Plant.

The John B. Shepherd Central Utility Plant, located on the campus of Clark Atlanta University (CAU) in Atlanta, services 23 buildings at Spelman College, 14 at CAU and 14 at Morehouse College. Initially built in 1937 with modifications in 1968 and 1982, senior leadership at the Atlanta University Center (AUC) institutions recognized the necessity to upgrade the ailing utility plant. After a thorough bidding process, Energy Systems Group (ESG) was selected in October 2006 to completely renovate the central utility plant to provide steam, chilled water, and high temperature hot water to Spelman College and CAU, and steam to Morehouse College for the next 15 years.

ESG Responds to Emergency Boiler Failure

Renovation plans were underway in December 2006 when a boiler failure curtailed heat and hot water service on the AUC campuses. Unfortunately, some students living on campus were inconvenienced and relocated to off-campus living facilities for one night while temporary boilers were installed to restore heat and hot water to the campus community.

The plant failure forced ESG, prior to contract signing, to accelerate the project schedule and bring in temporary boilers to run the plant until the new boilers were operational and a switchover took place. The newly completed and fully operational John B. Shepherd Central Utility Plant now delivers steam, chilled water, and high-temperature hot water to Spelman College and CAU, and delivers steam to Morehouse College.

First-Rate Flexibility

ESG's key objective was to design, build, and operate a state-of-the-art central utility plant that would feature fuel-switching capabilities and enhanced energy efficiency features; fit within the existing building footprint; and be built while providing steam from the existing central plant. ESG, working with the project design team at Griffith Engineering, Inc. (GEI), developed a distinct approach that met all of the demands of the project as required by the AUC senior leadership.

On the chilled-water side, a 1,300-ton centrifugal chiller with an efficiency of 0.56 kW/ton was initially installed. The future cooling loads of Spelman College and Clark Atlanta University are expected to be at least 6,000 tons. The decision was made to incorporate a design with an energy-efficient variable-primary flow (VPF) chilled water system. The VPF system eliminates the need for secondary chilled-water pumps while also improving the efficiency of this system.

The VPF system utilizes VFDs on the pumps for the closed-loop chilled-water system pumping water through the chillers. Water flow volume in gpm varies proportionally to closely match the actual load on the chiller. This system saves energy because the chiller only has to cool the actual gpm flowing through the chiller for a given load, rather than the chiller having to cool a constant gpm at all times as found in a typical primary secondary system. When using a VPF system, provisions were made to ensure that the gpm flowing through the chiller is never below the minimum gpm required for the chiller to operate. In addition, a waterside economizer is utilized to provide free cooling on low dewpoint days resulting in significant energy savings.

On the heating side, two D-type 40,000 lb/hr Nebraska watertube boilers equipped with economizers and a single 40,000 lb/hr, 12-MW electrode boiler were utilized to provide the primary steam and high temperature hot water load. The electrode boiler was provided to allow for fuel switching to take advantage of Georgia Power's real-time pricing rate structure and to hedge risk occurring from sometimes volatile natural gas prices.

To further reduce space requirements and cost, the electrode boiler was selected at distribution voltage of 20 kilovolts (kV), eliminating the need for any transformers on the building or site for this equipment. A further measure to save space within the plant was the utilization of a combination skid-mounted surge tank and DA system. The plant operated by ESG features a fully automated energy management system.

In order to save costs while still taking advantage of interruptible natural gas tariffs, ESG utilized a propane-air system that includes an 18,000-gal underground propane storage to allow this cleaner burning fuel to supply the boilers during a natural gas curtailment. The system blends propane with air to match the Btuh rate of natural gas, allowing for a smooth transition between the fuels and not require any orifice changes or tuning for the boilers to use propane rather than natural gas. This system also offered potential savings in maintenance costs when compared with traditional fuel oil backup systems which might require extensive cleaning after use.

A pressurized, high-temperature 250°F hot water system is used to distribute hot water to the various buildings within the campuses for comfort heating and domestic hot water. Due to its temperature ranges, this system limits the flow requirement and reduces distribution pipe sizes, pump sizes, and pumping energy requirements. Steam-powered condensate return pumps return condensate from the heat exchangers to the surge tank. A flash tank is provided to efficiently recover low-pressure steam from high-pressure condensate. This low-pressure steam is supplied to buildings within the campuses for their requirements for low-pressure steam.

AUC Campus Goes Green

"We are extremely excited about the completion of this renovation which means efficiency and reliability for our students, faculty and staff. This marks a milestone and time for celebration for our campuses," said Robert Flanigan, vice president for Business and Financial Affairs and treasurer for Spelman College. "Since 2005, we have wrestled with various corrective options for the

plant and are proud of the outcome and collaboration with our member institutions."

"The success of this project clearly exemplifies the spirit of collaborative leadership that CAU and Spelman College demonstrated to implement measures for costs savings, efficiency and sound energy practices, while providing a state-of-the-art energy system to buildings served by the newly renovated plant,"said Michael Lacour, vice president for Management Services, CAU. "Clean energy is a topical issue for our nation, and we are proud to be at the forefront providing an innovative solution to this issue within our campus community."

The John B. Shepherd Central Utility Plant was completed ahead of schedule and is fully operational. The plant renovation has been a major success for the AUC institutions as they look to provide a better learning and living environment for their students. The plant will be able to serve future renovation and expansion needs of the colleges while reducing their carbon footprint and leading the way with energy efficiency and sustainability. **ES**

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ESG is an award-winning energy services company that specializes in delivering sustainable energy solutions which allow building owners to maximize their energy efficiency and operational performance, while reducing their carbon footprint. Through its core business of performance contracting, ESG provides customers with innovative energy efficiency, technology, and long-term financing solutions for modernization of their facilities and energy infrastructure. Renewable energy solutions and assets are adding a whole new dimension to ESG's growth. To learn more about ESG, visit www.energysystemsgroup.com.

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