Built in 1968, the central utility plant (central plant) serving the city of Sacramento, California, was out of date in the twenty-first century. Not only was it incapable of handling high-demand times, the current system could not expand its capacity and its use of well water in the single pass condenser barrels of the chillers thermally polluted the Sacramento River. The State required an entirely new central plant and it tapped L&H Airco, Alerton’s central California dealer, to perform the installation of the chiller plant and heating, ventilating and air conditioning (HVAC) system temperature controls and energy management systems.

The new central plant includes a steam boiler plant, chiller plant and steam turbine generator and thermal energy storage (TES) tank. L&H Airco faced a number of challenges in tackling the chiller plant and HVAC for a project of this scale. The plant’s TES tank stores 4.2 million gallons of chilled water to meet the daytime cooling needs of all 23 buildings. The tank would need to be tied into—and monitored by—the Alerton system.

In addition to extensive device-by-device integration, the HVAC system would also tie in monitoring and control of the steam turbine generator, a black-start generator, high-pressure steam boilers, solar arrays, rainwater capture and CO2 monitoring.

The plant’s design also required the incorporation of sustainability features into every aspect of its operations. The Alerton system would centrally monitor the HVAC to ensure it met the plant’s sustainability goals and achieved the required LEED Gold certification.

The central plant is located in downtown Sacramento. One major change to the design of the new plant was that it would incorporate a cooling tower instead of using a river—in this case the Sacramento River—as a cooling medium for the chillers. Because of the plant’s cooling capacity requirements, the cooling towers would be massive—its eight fans are

BACnet system inside Sacramento’s new state-of-the-art central utility plant generates powerful energy and water savings.

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The central plant uses the TES tank to reduce the peak chiller operation by spreading its cooling load during daytime hours, which eliminates the need to engage additional chillers during peak demand times. During the night, the chillers can less expensively generate chilled water, which is stored and used during the day. Due to the immense size of the tank, L&H Airco installed a temperature sensor array inside the tank to generate the most accurate readings of the thermacline for optimal cooling. Bifurcation valves enable the chillers to cool the 23 buildings during the day and then charge the TES tank at low cooling demand periods.

“The TES tank is the key to the new plant on the chill water side,” Piotrowski said. “Using Alerton software and all the components to integrate it was one of the major design advantages for the new plant.”

Occupancy-based sensing, which integrates the lighting system, reduces energy consumption in the plant’s administrative spaces by going into standby mode when those areas are unoccupied. The plant also generates some of its own energy from solar arrays, which are tied into the Alerton system as well. When an abundance of solar thermal energy is available, the system can also heat the HVAC hot water for space heating.

“In addition to extensive and complex device-by-device integration and centralized control of the chiller plant, steam boiler plant and HVAC, the Alerton system ties in monitoring and control of the steam turbine generator, a black-start generator, high-pressure steam boilers, solar arrays, rainwater capture and CO2 monitoring.”
L&H Airco also installed Alerton controls for the steam turbine generator, which provides the chillers with emergency power in the event of a power failure or during a demand response load-shedding event. In addition to integrating the steam turbine generator, L&H Airco used a field server gateway to integrate the black-start generator and four high-pressure, 250psi steam boilers.

The Alerton system monitors CO2 levels in the office space and tag-teams it with demand-based ventilation controls for optimal indoor air quality.

To reduce its visibility, the chiller plant uses the Alerton system to control eight cooling tower fans at slow rotational speeds to reduce telltale vapor overhead. The central plant’s use of evaporative cooling towers, instead of discharging warm water into the Sacramento River, substantially reduces the plant’s impact on the environment.

Dashboards are a major feature for every tour of the facility. Visitors can see all the central plant’s features, the layout of the chiller plant and steam boiler plant, the CO2 monitoring and the energy savings.

“The dashboard makes an impact should someone interested in plant design want to know how it works,” Piotrowski said.

Despite the massive scale of the project—and the enormous size of the equipment to be installed and integrated—L&H Airco’s expert coordination with the other on-site crews enabled them to complete the chiller plant and HVAC project on time per the State’s deadline. There was no downtime between construction and commissioning of the new central plant, and demolition of the old one.

“We transferred the boilers first, then the air system went from the old to the new,” Donoho said. “Then the chillers were transferred from the old to the new, so that, as we were transferring the system to the new plant, they could demo that section and start erecting equipment.”

“It was quite meticulous planning because you had to share time and space,” Piotrowski said. “If you were to look at the old plant and the new, and say, ‘Let’s build and demolish at the same time,’ the response would be, ‘Are you kidding?’”

The central plant’s facilities manager, chief engineers and their staff use the data from the plant-dedicated Alerton EMS to calculate energy use for the plant operation. The HVAC system installed by L&H Airco uses 70% less energy than current ASHRAE standards. Piotrowski estimates the total energy savings around 58%—which equates to 28,000 kWh per day—and the reduction in water consumption is approximately 90%

With the inherent energy efficiency measures in the new facility, the State of California estimates the new steam boiler plant will return its initial investment within two years, and the chilled water plant within six years thanks to significantly less energy consumption. Instead of achieving LEED Gold certification, the new plant earned Platinum—the highest level of “green” building design certification awarded by the U.S. Green Building Council (USGBC).

The native BACnet®-based nature of the Alerton system and its subsequent ability to integrate with other building systems was a major factor in the State’s decision to choose an Alerton EMS.

“It’s modern, it’s predictable, it’s accessible,” Piotrowski said. “We have all the software to operate the plant, we have people who are trained, and the plant delivered what the design demanded. What else can you ask for?”