Crew keeps state's Central Utility Plant humming

New facility is far more efficient than the old one, but it needs 'boots on the ground' to make decisions

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Dennis McCoy | Sacramento Business Journal

Stationary engineer Laura Davis works the pump mezzanine at the Central Utility Plant in downtown Sacramento.

The state's Central Utility Plant, which provides water to heat and cool 23 state-owned buildings around the Capitol, was designed to be hardly noticed and highly automated.

Still, it takes a staff of 29 highly skilled workers to operate the plant, which came online last year.

The plant sits on a city block in a downtown neighborhood that is partly residential. A 126-foot-tall steel water-storage tower is wrapped with a decorative structure to make it appear less massive. Giant carbon-fiber fans inside cooling towers are designed to minimize noise and steam plumes.

The $181 million plant produces steam and chilled water to provide heating and cooling for 20,000 state employees.

While much of the plant is automated, engineers and administrators still must monitor and maintain equipment, and make sure the plant operates efficiently.

The Central Utility Plant has a work force of 29, up from 15 at the original plant, chief engineer Mike Donoho said.

The new LEED platinum plant, built by Skanska USA , replaced an inefficient, worn-out, 42-year-old plant.

The original plant ran at a constant speed, set to meet maximum demand. The new plant operates at only the speed needed to meet the current demand.

But "With efficiency comes a price. You have to maintain that," building manager Jerry Piotrowski said. "It takes more people, but it takes less energy."

On staff are 25 engineers, the building manager, an office tech and two apprentices.

The new plant requires two operators at any one time, instead of one, plus a maintenance crew that's more than tripled in size. The maintenance crew works from 7 a.m. to 3:30 p.m. and provides vacation relief for what are known as watch-standers.

The maintenance crew does preventative maintenance on all the equipment, including the distribution system. Sensors are calibrated, roofs are inspected and generators and air compressors get regular oil changes, for example.

'Boots on the ground'

Watch-standers, also engineers, work in pairs around the clock to monitor the performance of the plant, and ensure that it's operating as efficiently as possible. They staff three 8-hour shifts beginning at 7 a.m., 3 p.m. and 11 p.m.

"They monitor everything that happens in the plant and the distribution system," which consists of an estimated three miles of piping, Piotrowski said.

Engineer Bill Wells was recently in the plant's control room monitoring information on four computer screens. Engineers, he said, are still learning how to make the plant run at it highest potential in terms of energy efficiency. Some of that involves manual adjustments.

"The operator has to be intuitive," Donoho said.

For instance, on a hot summer day an engineer might need to manipulate the rate at which the chilled water flows to the buildings, he said. Engineers also have to be skilled enough to operate equipment manually in the unlikely event that computers go down, he said.

The plant consists of an 80,000-square-foot building filled with brightly colored water pipes, four gas-fired water tube boilers, seven electric chillers and a steam turbine generator, as well as the steel tower, which holds 4.2 million gallons of water.

The tower acts as a thermal-energy storage tank. Chillers in the plant can be run at night when electricity rates are cheaper, cooling water in the tank for use the next day.

Still, it's often not that simple. While computers are helpful for calculating how much water is in the tank and how long it will last, operators are still needed to tell the computer what to do.

For example, ideally, to save electricity, chillers would be shut off during the day and cold water, cooled the night before, would be pulled from the bottom of the tank. However, on very hot days, if operators shut the chillers off and begin discharging water from the tank at noon, by 5 p.m. all the cold water is gone, Donoho said.

"Now we have to crank up the chillers" when electricity rates are "ghastly," he said. "So we play a numbers game."

The plant's electrical steam turbine generator provides emergency power in the case of a power failure or if there's an opportunity to help the electrical grid handle heavy demand.

"We can decrease our load on the grid," said Department of General Services' acting deputy director Eric Lamoureux. "We couldn't do that with the old plant."

A watch-tender's role has become more critical over the years, with the importance of keeping massive computer rooms cool so that millions of dollars worth of information is not lost, Wells said.

Besides one person in the control room, a second engineer physically checks on the boilers, chillers and cooling towers.

"It takes some foot work — boots on the ground," Piotrowski said. Computers can't tell engineers about equipment noise, for example, or whether it's vibrating or leaking, he said.

Upgrading control systems

Other work is ongoing at the plant. For example, employees are currently putting a chlorine-dioxide system in the water-storage tank to keep bacteria or other biological growth down.

The state also aims to upgrade antiquated control systems that run heating and air conditioning systems in each of the 23 state-owned buildings. So far, seven buildings have received digital zone control systems and two more are getting upgraded systems now, thanks to a smart grid investment grant from Sacramento Municipal Utility District .

Buildings with the new systems can take full advantage of the Central Utility Plant's maximum efficiency.

"We can't get the maximum efficiency from the plant until we update these controls," Lamoureux said.

More buildings will get updated controls as funds become available, he said.

Upgraded controls also allow for increased automation. For instance, if a request comes for cooling or heating after hours to accommodate certain employees working overtime, the central plant could grant that request, Piotrowski said.