The satellite central chiller plant, located within the Engineering IV building, provides cooling to the new cluster of engineering buildings in the north-west portion of campus, including Engineering III, Engineering IV, and the Bonderson Senior Projects Building. Prior to deciding to construct the new satellite plant, the campus facilities team first explored providing cooling from the main central plant, located in the southern portion of campus. They determined that connecting to the central plant would have meant costly distribution piping and an expansion of the central plant load capacity to serve the new buildings.

Another option, localized cooling equipment for each individual building, was also ruled out, as prior studies had shown that the total life-cycle cost of centralized cooling to be half that of localized cooling. Also, local cooling at each of the three new buildings would only barely meet Title 24 requirements, as the cooling systems would be sized to meet the peak cooling loads of each individual building and could not take advantage of load diversity.

The new plant combined the efficiency of a central plant - allowing sizing for a smaller peak capacity by accounting for load diversity - with the lower distribution costs of a localized system. The satellite plant also reduces maintenance costs by having one system serving three buildings as opposed to separate systems for each building. The satellite central plant also complies with the campus utility master plan, which states that central cooling and heating should be supplied whenever possible on all new projects. The plant contains two Carrier 210 ton 30HXC206 “Evergreen” water-cooled screw chillers, with efficiency rated at 0.53 kW/ton, which is approximately twice as efficient as air-cooled chillers.

By locating the satellite chiller plant in the engineering quad, the chiller plant is not only a smart addition to the campus utility system, but is also a learning resource for engineering students.

Accounting for the additional fan energy for the cooling towers, water-cooled chillers use about 37% less energy than air-cooled chillers of the same capacity. The implementation of water-cooled chillers, delivering water using variable-speed pumping, accounts for annual energy savings of 150,000 kWh or approxi...
mately $15,000, compared to air-cooled chillers. The occupants of the three buildings served by the satellite plant have been satisfied with the chiller plant’s ability to adjust to the variety of load size resulting from the 24-hour use of the buildings. One drawback has been the high noise level of the chillers, but sound dampening strategies have been employed to improve the problem.

Over the next five years, the campus will carry out a ten-million dollar upgrade to the main campus central plant and distribution system, to meet both the cooling needs of the future Center for Science building and to improve campus cooling efficiency overall. The upgrade will involve increasing load capacity from 1200 tons to a total of 5000 tons, and will extend the distribution piping throughout campus, connecting the engineering quad satellite plant with the main central plant. The satellite chiller plant will then be utilized to meet central plant overflow capacity in campus peak load conditions, and will backup the main chiller plant during maintenance.

The upgraded central plant will also include a 19,000-ton-hour chilled water thermal energy storage tank, allowing the central plant chillers to run at maximum efficiency while shifting their entire load to off-peak hours. The fully upgraded central plant system will result in a one-megawatt decrease in peak electrical demand.

LESSONS LEARNED

Dennis Elliot, Cal Poly Manager of Engineering and Utilities, states that it is important to have a campus utility master plan that accounts for long-term goals while being flexible enough to adapt to short-term needs. The satellite chiller plant project involved the cooperation of a number of different stakeholders – planners, project managers, energy manager, facility director, building engineers, and refrigeration mechanics, as well as the engineering related academic departments housed in the new cluster of buildings. By involving consultants and project stakeholders in the decision making process as early as possible, a cooling strategy was implemented for three buildings that is both energy efficient and will produce a net cost savings. By locating the satellite chiller plant in the engineering quad, the chiller plant is not only a smart addition to the campus utility system, but is also a learning resource for engineering students.