UC San Diego meets most of its daily electrical demand with a 25-megawatt cogeneration plant. Two Titan 130 gas turbine generators, manufactured by Solar Turbines, provide 90 percent of the campus’s peak electrical demand and capture the exhaust heat to generate up to 75 percent of its steam demand. Producing such a large fraction of its own energy saves the university roughly $250,000 each month.

During the summer, however, the campus’s electricity demand exceeds the capacity of the cogeneration plant. To reduce expenditures on utility-provided power during peak times, the Physical Plant Services department developed a load-shedding program that automatically curbs energy use across the campus. The program targets energy reduction in comfort-cooling areas in 39 of the largest buildings equipped with temperature-control systems.

Meticulous care was taken to ensure that critical zones such as labs, research areas, animal rooms, and computer rooms are not affected.

The program works by placing all non-critical zones into “unoccupied” mode when load-shedding is required. This allows temperatures to “float” between 66°F - 78°F, and reduces the zone-level variable air volume (VAV) control to minimum ventilation requirements. In buildings with VAV systems, static pressure setpoints on non-critical area air handling units (AHUs) are reduced by 50 to 70 percent of their normal value. AHUs in buildings with constant volume systems are cycled off for 20 minutes per hour on a rotational basis throughout the building.

Applying differing thermostat values to predefined occupied, standby, and unoccupied time periods optimize the reduction of comfort-cooling loads on campus. Thermostats are programmed for occupied mode Monday through Friday 9 am to 5 pm for 70°F - 74°F. Standby mode is set for 68°F - 76°F Monday through Friday 5pm to 8pm, and 6am to 9am. Unoccupied mode is set for 66°F - 78°F for nights and weekends. Additionally, all major AHUs and exhaust fans are programmed with night and weekend static pressure setbacks. This secures non-critical fans, lowers static pressure setpoints for AHUs and chilled water pumps, and lowers the setpoint for the building medium temperature water system.

Implementing the load-shed programming required a review of the time schedules for every HVAC system, as well as manual reprogramming of over 4,000 thermostats.

Through this process, Physical Plant Services found that all systems had an opportunity for increased energy management or conservation programming. UC San Diego responded by adopting the load shed program’s thermostat setpoints as the new campus standard. The program’s requirements are now applied in all new buildings as part of the commissioning process.

The load-shedding program reduces the campus electrical demand by approximately 1,500 kW, resulting in energy savings of $240,000 annually.

UC San Diego load profile, 2005: Central plant production is charted in blue; the total campus load is charted in red. Image: John Dilliott.
1,500 kW when implemented. This substantial energy savings lowers UC San Diego’s electrical bill by $200,000 each year. Participating in the statewide Demand Reduction Program (DRP), offered by San Diego Gas and Electric and administered by Celerity Energy, saves the university an additional $40,000 annually. The DRP rewards large businesses for reducing or shifting demand during critical peak periods.

John Dilliott, Energy and Utilities Manager for UC San Diego, explains that a small number of occupants present a significant obstacle to effectively implementing load-shed programming. Some individuals who prefer to have a constant temperature in their space have complained about the automatic thermostat setpoints. Oftentimes, Physical Plant Services must then remove an entire floor or building from the programming. Learning from these experiences, Mr. Dilliott supports early education and careful coordination with the campus community as effective ways to gain maximum cooperation with this type of energy reduction strategy.

**Demand response data for peak load period 3pm to 4pm:** A load reduction of over 1,500 kW is seen when load-shed programming is implemented during peak hours. Image: John Dilliott.

**Daily cycle of a typical fan:** The fan responds to the automatic zone set points by adjusting its speed. The sudden spike at 6 pm reflects a thermal response to high space temperatures. More air is delivered to address the problem, and the fan resets in a short period of time. Image: John Dilliott.