

CaseStudy: University of California

Santa Barbara, California

Leading University Implements Campus-Wide Energy Saving Technologies

The University of California, Santa Barbara (UCSB) is school to nearly 20,000 students and work to more than 9,000 faculty and staff. Originally a small, independent teacher's college, Santa Barbara joined the University of California system in 1944. Since that time UCSB has been building new facilities and renovating old ones. Johnson Controls has been helping the university implement energy saving technologies in those facilities for more than 25 years.



Located 100 miles northwest of Los Angeles, the UCSB campus encompasses 989 acres on the California coast. Among other impressive statistics, UCSB is one of only 62 institutions elected to membership in the prestigious Association of American Universities. The university's international status and widely recognized faculty consistently increase demand for admission each year.

While the university's growth is cause for new construction it also requires upgrades to existing facilities and equipment. Some of the UCSB buildings were originally erected for military operations during World War II. Nearly all of the buildings were constructed before the energy crisis and the subsequent utility cost increases associated with the 1980's. As a result, the buildings and their equipment were not designed to maximize energy efficiency.

With at least four generations of building control systems on campus, Johnson Controls works closely with UCSB personnel to optimize those original technologies while gradually migrating to the newer Web-based Metasys® building management system. Today the new system is applied to the entire campus, encompassing more than 50 academic facilities. The system is comprised of eight Network Integration Engines, 65 NCM Supervisory Controllers and one Extended Applications and Data Server for monitoring and control. "By taking advantage of the monitoring, control and integration capabilities of the Metasys system in our energy conservation programs, we have saved more than \$26 million dollars in energy costs since 1997," says Jim Dewey, the UCSB campus energy manager.



Campus-wide Focus on Energy Conservation

The focus on energy conservation was triggered by a State funded energy study of the campus' State-owned buildings. That study, conducted by Verle A. Williams and Associates, a San Diego based energy efficiency consulting firm, identified over \$12 million worth of cost effective projects that would reduce utility costs by more than \$2 million a year. "We worked closely with the campus maintenance and operations personnel to ensure that the projects we submitted were acceptable and that the revised systems could be effectively operated by the operations personnel," states Verle Williams, principal of the consulting firm. "Extensive operator training and systems commissioning would be required to assure overall success of the existing

system modifications and new system installations. The projects identified included campus-wide lighting retrofit, modifications to laboratory hood and air handler systems, control valve replacement, new chiller and cooling tower, modifications to some air handlers, significant changes to many pumping and piping systems, the virtual central plant and a campus-wide energy management system upgrade."

Dewey indicates that while the university had already been taking measures to reduce energy consumption in its facilities, the California energy crisis made it a campus priority. In addition, a new state mandate required the use of renewable energy sources and an overall reduction in energy usage of 20 percent by 2017.

In response to state mandates and continuing its effort to reduce costs, UCSB and Johnson Controls embarked on energy conservation initiatives as designed by the Williams firm to reduce energy consumption in the short-term while lessening the impact of future campus growth. "Initially, we needed to upgrade our communications with all buildings, adding more redundancy and greater flexibility between the facilities and their controls," says Ed Marini, design and construction project manager at UCSB.

Johnson Controls implemented a plan to migrate existing systems to the Metasys system technology wherever possible and to expand the system to buildings that didn't have controls. "The new robust system is extremely helpful from an energy management standpoint. It allows us to monitor and control more equipment, including older and third-party systems, without having to deal with different vendors. And, we're able to look at specific equipment, fine-tune its operation and troubleshoot through trending reports, all from a central location," states Dewey.

Dewey explains that the \$26 million overall savings represents a reduction in total electrical energy use by more than 30 percent and total natural gas use by more than 32 percent. The cost savings is also a result of energy procurement practices, tariff savings and negotiated rates. "The Metasys system helps us here too because we know exactly how much gas and electricity we are using and when. This enables us to shop our exact load profile and better negotiate buying rates," says Dewey.

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University of California,
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Virtual Central Plant Leverages Metasys System

With buildings dating back to World War II, only a few of the original UCSB facilities had cooling. These and other buildings being constructed were equipped with stand-alone chillers and boilers. "No central utilities were established for these buildings. And many of the individual systems were over-engineered for the building or needed to be replaced," says Dewey. The resulting energy inefficiencies from operating each of these facilities independently became the focus of a project Williams dubbed the "virtual central plant."

The project involved a chilled water loop, which interconnected eight major buildings via underground piping. Once connected, all building systems operate at the same system pressure allowing a single chiller and pump system to meet the cooling needs of any or all building(s) on the loop. "It is a very complex control and monitoring system that relies heavily on the Metasys system for control and information gathering so we produce the right amount of chilled water when it is needed, and maintain peak performance of all of the operating equipment," says Dewey. "Besides the improved total system operating efficiency, through Metasys calculations, we're able to determine the amount of energy used by the various buildings and do charge backs. In addition, the improved and efficient use of the equipment ultimately saves on capital costs."

Continued Growth Requires Working Relationship

The UCSB campus has been growing tremendously, calling for renovations and new buildings to meet academic departmental needs. "Because Johnson Controls has taken the time to understand our facilities' needs, they serve as our advocate during the design and construction process; and through the commissioning process, they ensure our needs will be met and that systems are working properly," says Dewey.

"Johnson Controls guides us in how to best achieve our energy goals and still maintain a quality environment that satisfies our customers. They interface with our design team early on to counsel us on how our buildings are controlled, which helps us maintain consistency in our controls strategies for new buildings on campus," says Marini. "They have become our first contact for system design and are specified to our contractors as sole source for controls."

New Facilities Incorporate "Green" Standards

According to Dewey, a 2003 UCSB mandate states that any building coming into the development stage will have a Silver certification under the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED™) rating system. The university has already achieved a Platinum rating on its Donald Bren School of Engineering & Management completed in 2004. Upon completion, the university's Marine Science Research building will also be certified.



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The university is also piloting a LEED for Existing Buildings program in an effort to operate its existing facilities in a sustainable manner. "Any time you operate green you're saving energy and ultimately money," says Dewey. "Johnson Controls supports these efforts on a day-to-day basis since many certification credits apply directly to the equipment monitoring done by the Metasys system, such as indoor air quality and energy consumption. In addition, Johnson Controls contributes through its continuous commissioning processes, its ongoing system maintenance and by writing programs to optimize the performance of equipment where necessary."



Making the Most of Technology and Expertise

As proficient users of the Metasys system, UCSB has found and continues to find unique ways to leverage its capabilities as exemplified by the virtual central plant. The Web-based Metasys system has built-in Internet protocols and IT standards that provide the university immediate and future benefits, according to Dewey. For example, UCSB is able to access powerful building information using off-the-shelf software rather than proprietary Johnson Controls software.

"The system has already become our primary data repository since we no longer have to have a separate database for our energy management information system," says Dewey. Instead, UCSB can store all the information in a Sequel database, create queries and do more comprehensive trending, even on third party applications. "As we become more wireless, the standard Web browser user interface will also be beneficial thanks to the increased flexibility in accessing this information," adds Dewey.

As the university continues to grow so does its relationship with Johnson Controls. The amount of activity at UCSB requires university staff to take full advantage of its automated systems and their reliability. "As we add or change floor space our maintenance staff has remained the same. Johnson Controls has staffed our projects with very capable people both technically and in their communication skills, which is especially important in the new construction setting," explains Marini. A dedicated Johnson Controls team remains on site to assist UCSB personnel with systems design and enhancements. "Whether working directly for us on system enhancements or as our advocate in new construction, Johnson Controls responds very well to our needs," adds Dewey.

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