BEST PRACTICES 2011

CSU Long Beach Campus-wide Lighting Energy Efficiency Project

As part of a campus-wide lighting retrofit, measures were implemented in 35 campus buildings, including the installation of bi-level LED technology in a parking structure. The project resulted in significant energy savings with a simple payback of less than seven years.

Award Category
Lighting Design/Retrofit

Green Features
LED luminaires
High output T5 lamps
Digital lighting controllers and switching relays
Multiple motion control sensors for bi-level lighting control
Stairwell and corridor lighting occupancy sensors
Wireless lighting control

Annual Energy and Cost Savings
Campus-wide retrofit: 657 MWh (estimate)
Parking structure: 667 MWh (estimate)
Combined cost savings: $145,000

Size
Campus-wide retrofit: 110,100 ft^2
Parking: 829,000 ft^2

Cost
Campus-wide retrofit: $681,500
Parking: $493,900

Completion Date
June 2011

An extensive campus-wide energy retrofit at California State University (CSU) Long Beach involved energy efficiency measures implemented in a total of 35 buildings over two years. The project was championed by a collaborative group of campus experts as well as representatives from the lighting manufacturer, the University of California, and the investor-owned utility (IOU) Energy Efficiency Partnership.

As part of the overall effort, an extensive LED lighting retrofit was conducted in a large parking garage known as Parking Structure 1. According to Paul Wingco, energy and sustainability manager in the school's Office of Physical Planning and Facilities Management, the campus was focused on driving operations costs down, and a major cost item was the energy used for Parking Structure 1, the largest and oldest parking structure on campus. Parking staff was also interested in creating uniform, standardized lighting across all parking structures. They had previously installed LED fixtures in their newest parking structure and were pleased with the fixture performance and found the technology to be cost effective. Bi-level LED fixtures were not yet available for that project, however when they did become available, the project team analyzed the savings potential for Parking Structure 1, factored in incentives, and determined that bi-level LEDs would be cost-effective for the project.

New LED fixtures installed in Parking Structure 1. Images: CSU Long Beach.

The parking garage upgrade replaced 539 high pressure sodium (HPS) lighting fixtures with energy-efficient pendant and direct-mounted LED fixtures from lighting manufacturer BetaLED. Post-top HPS fixtures were replaced with LED area light fixtures. All fixtures were equipped with motion sensors and bi-level lighting control. The existing 188-watt fixtures were replaced with 71/36-watt fixtures (which use 71 watts at full power and 36 watts at low power). The resulting calculated savings are 62 percent at full power and 81 percent at the lower lighting level. The existing parking structure wiring was re-circuited, and a new digital lighting controller was installed to implement a daylighting control strategy.

Bi-level LED lighting was selected due to the campus' favorable past experience with LED technology.

LED technology also has non-energy benefits: LEDs have improved color rendering over HPS lamps, they have the potential to reduce light pollution, and they have an extra-long service life, resulting in maintenance savings due to less frequent replacement. The fixtures selected for the parking structure include a five-year warranty.

Lighting efficiency measures implemented in other buildings include motion sensors, digital control systems, motion controlled lighting in stairwells, and replacing inefficient or low-quality lamps and fixtures. Inefficient T12 and HPS lamps in existing fixtures were replaced with T8 and T5 fixtures, and HID lamps in downlight fixtures were replaced by compact fluorescent lamps. Exterior lighting was also included in the retrofit effort. Bi-level 217/70-watt LED area lights replaced the existing 460-watt fixtures, resulting in calculated savings of 53 or 85 percent. Switching to LED

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Project Team

Project Management: CSULB Facilities Management

Electrical Engineer: P2S Engineering

General Contractor: Mackone Development

Electrical Subcontractor: Lectrify

Utility Partners: Southern California Edison

Manufacturer's Representative: David Silverman and Associates

More Information

http://cf.papubs.csulb.edu/news-events/story.cfm?hackid=1622

http://daf.csulb.edu/offices/ppfm/facilitiesmanagement/sustainability/

http://www.betaled.com

lighting also improved the exterior lighting quality due to an increase in color temperature and improved color rendering.

The campus-wide upgrade also included a full interior lighting retrofit in the Student Health Center, the University Art Museum, and the KKJZ radio station building. In these spaces T12 lamps were replaced with "volumetric" fixtures, T5 lamps, two-step electronic ballasts for bi-level switching, and occupancy sensors. (Volumetric fixtures are those that balance direct and indirect distribution.)

High-bay T5 high output lighting in the School of Dance. Image: CSU Long Beach.

Lamps and fixtures were replaced in several engineering buildings, swapping out 91-watt high-intensity discharge (HID) lamps and fixtures with 59-watt compact fluorescent downlights, producing energy savings of 35 percent. At the School of Dance, HIDs were replaced with T5 high-bay fluorescent lighting with motion sensors.

The campus-wide lighting retrofit also included a complete digital lighting control upgrade for the Horn Center, a computing center for CSULB students, faculty and staff, and a complete multi-scene digital lighting control upgrade for the sports facility.

Although stairwells are frequently unoccupied, they are required by code to be lit all the time in case of emergency. As part of the retrofit, stairwell lighting was upgraded from the existing 68-watt fixtures to bi-level, motion controlled fixtures at 51/25-watts in 13 campus buildings, for a calculated savings of 25 or 63 percent below the original fixtures. Corridor lighting in the liberal arts and social sciences buildings was upgraded using 25-watt lamps, occupancy sensors and addressable digital switching relays and controllers.

The project benefitted from incentives valued at over $232,000 through the partnership and Southern California Edison.

The campus-wide retrofit cost a total of $1.2 million and is estimated to result in annual energy cost savings of $145,000. Taking into account incentives worth $232,000, the $968,000 net cost of the entire project will yield a simple payback of 6.7 years.

LESSONS LEARNED

Paul Wingco noted a number of specific lessons learned about the coordination of this major retrofit project. He advises that project managers should allow sufficicient time for the audit and design phases of the project, apply for incentives as early as possible, allow sufficient time for pre- and post-inspections and material lead times, and coordinate closely with department representatives. The project team also learned that not all LED luminaires and lamps qualify for incentives, and that it is therefore necessary to be open to considering other technology options.

The campus-wide lighting retrofit has been well-received, and building users have noted the improved lighting quality. The parking administration staff has provided positive feedback on the LED fixtures, noting that the new LED lights appear brighter and more uniform. They note that for some users the bi-level lighting may take time to get used to, but that the energy-savings are worth the effort to make this transition.

Best Practices case studies are coordinated by the Green Building Research Center, at the University of California, Berkeley.

The Best Practices Competition showcases successful projects on UC and CSU campuses to assist campuses in achieving energy efficiency and sustainability goals. Funding for *Best Practices* is provided by the UC/CSU/IOU Energy Efficiency Partnership.