BEST PRACTICES 2012

UC Santa Cruz Campus-Wide Lighting Retrofit

UC Santa Cruz applied the latest in lighting design, technology, and controls, leveraged with helpful assistance from students, in this comprehensive lighting retrofit. The project resulted in significant energy savings with a simple payback of four years after incentives.

Award Category
Lighting Design/Retrofit

Green Features
Daylighting controls

Occupancy sensors HVAC control connection

Motion sensors for bi-level lighting

LED fixtures, lighting and fan controls in elevators

Wireless lighting controls coupled with smart ballasts

Bi-level LED wall-packs

LED street lighting

Pilot test of BACnet enabled control panel to connect with campus building management system

Annual Energy and Cost Savings
1,473 MWh

$184,000

Cost
$1,148,000

Completion Date
December 2012

A campus-wide lighting retrofit at UC Santa Cruz used creative approaches to identify energy saving opportunities throughout the campus. The project included retrofits in a gymnasium, in a recently constructed library, street and pathway lighting, elevator lighting, and a pilot for the implementation of a campus-wide lighting control system. A number of these projects had significant student involvement in both the project design and implementation.

Before and after installing bi-level LED wall-pack fixtures. Images: Andy Shatney.

One area of attention was the East Field House Gym that previously had uneven and insufficient lighting of approximately 20 foot-candles (fc). The lighting upgrade replaced thirty 175 or 250-watt metal-halide fixtures with twelve 315-watt induction fixtures, using a design based on 3D lighting simulation. The project posed several challenges, such as a wood gym floor easily damaged by a scissor lift, and motion and daylight sensors that were damaged by volleyballs soon after the retrofit. The damaged sensors were replaced and the fixtures rotated to keep the sensors away from potential future damage. Although fixture count was reduced by 60 percent, the result is evenly distributed lighting at 35 fc.

Another key part of the retrofit was the recently completed McHenry Library. The campus staff determined that spaces were over-lit and lacking in daylight controls as a result of value engineering. The 32-watt lamps were replaced with 28-watt lamps, and one third of the fixtures in the stack areas were delamped. The campus conducted daylighting studies, and installed two interior photocells, one each for the south and west exposures, to turn off hundreds of lights on four floors of the library when daylight is sufficient. Two daylight level setpoints were used for each photocell to separately control the two rows of fixtures at the building perimeter. The removal and replacement of lamps was done by student workers, reducing costs, improving payback, and giving students hands-on experience with energy conservation.

UCSC's lighting design and retrofit specialist, Andy Shatney, points out students provided valuable assistance for many aspects of the retrofit. "Find the interested students and help them do the projects they want to do. You can find some really good, motivated workers that way," he explains.

By leveraging student assistance, the projected payback for the library retrofit is less than one year, and students got hands-on experience.

The campus installed a wireless controls system from Lutron with assistance from students interested in energy efficiency. The group retrofitted all of the fixtures in the Porter College Study Room with smart ballasts, wireless occupancy sensors and photocells. The occupancy sensors were also set up to report to the HVAC system. The team found the Lutron system to be effective in this application as one sensor can control both lighting and HVAC, and avoiding the costs and disruptions that installing new wiring would entail.

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Project Team

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Lighting Design and Retrofit Specialist: Andy Shatney

Utility Partner: PG&E

More Information

http://sustainability.ucsc.edu/east-field-house-lighting-retrofit

http://sustainability.ucsc.edu/porter-greenovation

The project team also identified seventy elevators for lighting and occupancy control upgrades, and replaced MR16, T12, and T8 lamps with LEDs. Many of the existing fluorescent fixtures had "shunted" lamp holders that required replacement to enable the use of rapid start ballasts. Changing the lamps and fixtures alone resulted in energy savings of over 50 percent. The work included the installation of light and fan controls, since LED lights tend to fail from excessive heat, which can occur when they are constantly on. When elevator doors open, the lights and fan are turned on for eight minutes, after which time they turn off. The project team determined that such automatic operation of the elevator car lights is allowable even under highly stringent elevator codes.

To get the best return on the retrofit investment, campus staff focused on instances where lighting wattages and/or usage levels were high.

As part of the exterior lighting upgrade, 230 150-watt high-intensity discharge streetlights were replaced with dimmable 85-watt LED fixtures. Installation crews included electricians, building maintenance workers, and students. In addition to the energy savings, maintenance requirements for the streetlights have been reduced due to the 150,000-hour rated life of the new fixtures. Instead of traditional pathway lighting, bi-level LED “wall-pack” fixtures, switchable between 52 watts and 26 watts, were installed in over 300 locations. These fixtures reduce light pollution and provide a high level of visual perception and security outside buildings and along pathways. After utility incentives from PG&E and the Energy Technology Assistance Program, the payback is projected to be three years.

Finally, the retrofit included replacement of the last remaining T12 fixtures on campus, in a building previously owned by a manufacturer. Though the building was largely unoccupied, there were concerns about using occupancy sensors as the building includes many mechanical spaces, so time switches with a blink warn function were used instead. Most of the T12 fixtures were removed and replaced with either T8 fixtures or retrofitted with a programmable start low-ballast factor T8 ballast. All of the T12 stairwell lights were replaced with T8 bi-level fixtures. As a pilot to convert the entire campus lighting to the existing Tridium building management system, a BACnet enabled control panel from Wattstopper was also installed.

Perimeter in McHenry Library after delamping and retrofitting controls. Image: Andy Shatney.

LESSONS LEARNED

The McHenry Library staff had worked in a library where a lighting retrofit was found to have “false off” problems, consequently they were wary about another retrofit, so facilities staff met with them to discuss and resolve their concerns. Andy Shatney explains that it was vital to the success of the projects to work with the staff occupying a building to understand their needs and to explain how the retrofit may benefit them. He also notes that a project “redesign is often better than a one-for-one replacement,” and that rethinking an original design, even in new buildings such as McHenry Library, can save significant energy and reduce the retrofit costs.

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

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