



Award Category

Lighting and Controls

Green Features

T8 fluorescent lamps with electronic ballasts

HID lighting

LED exit signs

Occupancy sensors

Annual Energy Savings

28% reduction in electricity used for lighting

1.48 million kWh

14,000 therms (reduced cooling load)

\$273,000

Scope

23,700 fixtures retrofitted or installed

Cost

\$1.6 million

Contacts

Chief Engineer:
Phillip Westbrook,
pwestbro@csusb.edu
909.537.3183

Team

P2S Engineering
DMJM Harris

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CSU San Bernardino High-Efficiency Lighting Retrofits

Sweeping upgrades to CSU San Bernardino's lighting systems will provide higher quality lighting and lower the campus's utility bills. About 35 percent of the implementation cost was provided through the UC/CSU/IOU Energy Efficiency Partnership Program, which is available to all UC and CSU campuses.

An exhaustive lighting retrofit project at CSU San Bernardino has eliminated incandescent lamps from the campus and upgraded thousands of existing fixtures with energy-saving technology. The retrofits reduce the university's lighting electricity use by 28 percent, producing an operational cost savings that will recover the project's implementation cost in just under six years.

CSU San Bernardino began the project with a survey of its existing lighting systems, and determined that retrofit opportunities existed in most facilities. Recognizing the large energy drain from incandescent bulbs, the campus replaced all incandescents with compact fluorescents. The new lamps are 25 to 35 percent more efficient than the original lamps, and last about ten times longer.

CSU San Bernardino retrofitted or installed 23,700 fixtures, which will produce over 1.9 million kWh of electrical and thermal savings annually.

Converting all fixtures using T12 compact fluorescent lamps with magnetic ballasts to T8 lamps with electronic ballasts yields energy savings of roughly 30 percent. Magnetic ballasts operate at 60 hertz (Hz), the frequency of power delivered by utilities to end users. Electronic ballasts produce light more efficiently by converting input electricity from 60 Hz to a much higher frequency of 20,000 to 40,000 Hz. Notable improvements to lighting quality are also achieved with this type of retrofit. Operating ballasts at a higher frequency lessens the visible flicker and eliminates the

humming sound common to compact fluorescent lamps with magnetic ballasts.

Metal halide high intensity discharge (HID) lighting was installed above the center court of the Coussoulis Arena to provide a bright, white light suitable for indoor sports. HID lighting has the highest efficacy, or ratio of light produced to energy consumed, of any lighting type. A T5 linear fluorescent hi-bay system was also installed as part of a complete redesign of lighting in the Arena.

The campus installed hundreds of LED exit signs which use 10 to 50 times less energy than signs illuminated with incandescent bulbs. The new signs will operate for up to 10 years without requiring replacement lamps, virtually eliminating maintenance. For comparison, the EPA reports that exit signs powered by incandescents may need up to 30 lamp change-outs over the same 10 year period.

Conference rooms, restrooms, offices, and utility areas received occupancy sensors to automatically prevent lights from running unnecessarily. The sensors cut energy consumption by 20 percent. The campus received mixed reviews from building occupants on the usability of the new sensors, and will use this feedback when developing lighting control strategies for future retrofits.

LESSONS LEARNED

CSU San Bernardino recommends providing occupants with written instructions for the operation of new fixtures to reduce confusion and facilitate a smooth transition between old and new lighting systems.

Best Practices is written and produced 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.

