



Award Category

Lighting Design/Retrofit

Green Features

Retrofit plan based on photometric study

Daylighting sensors and controls

Occupancy sensors installed in 60 offices

Removed 940 fixtures

Installed 4100K 28-watt T8 lamps and low power ballasts

Direct/indirect fixtures in selected public areas

Peak load reduction of 218 kW expected

Size

269,018 ft²

Annual Energy and Cost Savings

889,600 kWh

\$110,300

Cost

\$637,000

Completion Date

May 2011

California State University, Chico Meriam Library Lighting Retrofit

The lighting retrofit of the Meriam Library was the first building-wide energy retrofit on the CSU Chico campus. After a photometric study, the original retrofit plan was modified to include the removal of a significant number of fixtures in addition to delamping, resulting in a 61 percent lighting energy reduction.

The Meriam Library is the largest building at CSU Chico at just over 269,000 square feet. The library was originally built in 1958, expanded with a fourth floor addition in 1972, and again in 1985 with an additional build-out of the fourth floor. Due to these changes, several spaces in the library had significantly different lighting and daylighting conditions, and used a number of different light fixtures. More importantly, the spacing at which fixtures were installed had changed incrementally as lighting technology evolved. Before the retrofit, the building contained 5,300 light fixtures, all of which contained T12 fluorescent lamps. The lights were operated for 3,900 hours annually.

The lighting retrofit was initiated in 2010 and awarded design funds. The original retrofit plan, based on an investment grade audit by AECOM, was a one-for-one retrofit from T12 to T8 lamps with standard power ballasts, with two lamps per fixture. The retrofit would install 60 occupancy sensors and several daylight sensors. The estimated annual energy savings of this proposed retrofit was approximately 467,500 kWh, with cost savings of \$68,800.

However, CSUC facilities staff requested a photometric study of the entire building to confirm that the retrofit would result in appropriate lighting levels, and to gauge the impact of a one-for-one retrofit to T8 lamps on average lighting levels, since they are brighter than T12 lamps. The study, done by TruBrite subcontractor Precision-Paragon, estimated via simulation that the lighting levels after the retrofit would average 60-80 footcandles (fc) exceeding the recommended lighting of 30-40 fc. Based on this study, the project team staff developed a new option — delamping in some areas, retrofitting to T8s with low power ballasts, and removing a percentage of fixtures in other areas. On

the fourth floor, where the fixture spacing was different, a one-for-one retrofit was done and no fixtures were removed. In an older part of the building fixtures had been recessed in a ceiling which contained asbestos. Rather than removing the fixtures in that area, the team instead left the fixtures in place and modified them to accommodate a single lamp.

A photometric study revealed that substantial additional energy savings were attainable beyond a simple one-for-one retrofit to T8 lamps.



The lighter ceiling tiles show where fixtures were removed during the retrofit. Image: CSU Chico.

As a result of the project, 940 fixtures were removed entirely. Remaining fixtures were either delamped or retrofitted. In addition, occupancy sensors were installed in 60 offices, and 13 daylight sensors installed so lights can be switched off in areas with good daylighting access such as corner reading areas. To improve the overall lighting quality new direct/indirect fixtures were installed in several areas, including the lobby, several large offices and the laptop lounge. Because the new fixtures are more efficient, fewer total fixtures were needed for these spaces.

The new retrofit resulted in estimated annual energy savings of 889,600 kWh and estimated

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More Information

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annual cost savings of \$110,300, a significant improvement over the original retrofit plan and an overall reduction of 61 percent in lighting energy. The new retrofit plan is also expected to reduce peak demand by 218 kW. Finally, these changes are expected to reduce future maintenance costs as there are fewer total fixtures to maintain.

The retrofit resulted in energy savings of 889,600 kWh, which is equivalent to 324 metric tons of reduced carbon output per year.

The retrofit implementation required a number of HVAC changes, because many fixtures were return air fixtures, and some in the basement and near the building perimeter were supply air troffer fixtures. Since the



Daylighting sensors turn off pendant lights in corner reading areas when light is sufficient. Image: CSU Chico.

lighting retrofit included a plan to remove a large number of lighting fixtures, additional return air grilles and supply air troffers had to be added in a number of locations.

The building occupants have responded favorably to the new 4100K lamps and were surprised at how many lamps and fixtures could be removed while maintaining good lighting levels and quality. The retrofit team met with all staff who worked in the library to make sure their needs were met, especially

in areas with special lighting needs, such as the historical document rooms. Because the previous fixtures provided such low light levels, a few occupants believed that their spaces were too bright even at 35 footcandles, therefore additional delamping was done after the retrofit. The project team also determined that several of the occupancy and daylighting sensors required fine tuning to meet occupants' desires.

LESSONS LEARNED

It was important that the contractor team be flexible to accommodate changes during the course of the project. The original retrofit plan changed from a simple one-for-one retrofit to one better tailored for the specifics of the building. The design stage of the project took longer than anticipated due to the photometric studies and revisions. Once the new retrofit plan was initiated, the team discovered that a number of fixtures were air troffer returns, with ducts above the fixtures. In some cases, the team opted to keep the fixtures, especially in the perimeter area, to reduce the need for substantial modifications to the ductwork that were not in the project scope.

From the success of this approach, CSU Chico will now require comparable photometric studies on all future lighting retrofits to ensure appropriate light levels.

Another important lesson was regarding how to communicate the benefits of energy efficiency retrofit projects. For example, CSUC energy managers converted the energy savings from this retrofit to the electricity use of an equivalent number of homes (37 homes). They anticipate converting energy savings to the energy used by an equivalent number of vehicles, and translating the carbon savings to the equivalent carbon sequestered by an acre of pine forest. Energy managers have found such metrics to be more useful to students and other campus stakeholders than simply reporting the calculated kWh savings.

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.

