UC/CSU/CCC SUSTAINABILITY CONFERENCE 2009
UC Santa Barbara
June 21 – June 24

ENERGY EFFICIENCY PARTNERSHIP PROGRAM
BEST PRACTICE AWARDS APPLICATION FORM

Deadline: March 6, 2009

I. CONTACT INFORMATION

Campus: Cal Poly SLO
Department: Facility Services
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II. PROJECT CATEGORY- see attached category descriptions

NEW CONSTRUCTION
___ Best Overall Sustainable Design
___ HVAC Design/Retrofit
_X_ Lighting Design/Retrofit

SUSTAINABLE OPERATIONS
___ Water Efficiency/Site Water Quality
___ Innovative Waste Reduction
___ Student Energy Efficiency
___ Student Sustainability Program

III. PROJECT/ PRACTICE INFORMATION

A. GENERAL QUESTIONS

Project/practice name: Lighting Technology Demonstration Projects
Project/practice location: Various
Implementation cost:
Estimated *annual* energy savings (as applicable): Saves 51,300 kWh per year, a 79% reduction.
Estimated *annual* energy cost savings (as applicable): Saves $5,100 per year.

Description- Provide a detailed narrative describing the project or practice.

Cal Poly, as the host of the 2008 UC/CSU/CCC Sustainability Conference, worked in partnership with the California Lighting Technology Center and the CEC's Public Interest Energy Research Program to develop and implement nine different interior and exterior lighting technology demonstration projects. These projects were showcased at the conference in a series of walking tours that were very well attended. In addition, CLTC staff were invited to present to the University's ESCO during the campus wide investment grade energy audit, to educate them about these new technologies, make CLTC resources available, and look for opportunities for more wide spread adoption. Demonstration projects included:

Smart Bi-Level Stairwell Light Fixture Retrofit
In two locations, Sierra Madre Hall and Faculty Offices East, a total of 67 four foot fluorescent light fixtures were replaced with Lamar Lighting's four foot Smart Bi-level Stairwell Fixtures – see:
http://www.occu-smart.com/
These use an integral ultrasonic motion sensor to detect occupancy and a dimmable ballast to reduce light output to approximately 20% when the stairwell is not occupied. Due to the nature of traffic patterns in stairwells, the opportunity for conservation based on occupancy is substantial. Post retrofit analysis found the energy consumption of these fixtures was reduced by approximately 90%. In the case of the Faculty Offices East project, implementation of Smart Bi-Level Stairwell Fixtures (along with LED Bollard Lights – see below) played an important part in the building achieving an EPA Energy Star rating in the 98th percentile for office buildings, and receiving LEED-EB Silver certification from the USGBC.

Integrated Office Lighting System – IOLS/PLS
In the Facility Services/Facilities Planning office building, the existing lighting system had been installed in the early 1990's, using surface mounted aluminum parabolic troffers with 2, 3, or 4 32 watt T8 lamps, and a color temperature of 3500K. The light quality in offices was poor, with numerous complaints about glare and poor distribution. Some occupants had resorted to partial delamping of the fixtures to reduce glare, or had to install glare filters on their computer displays. The ceiling fixtures were retrofit with Lithonia RT5R troffer retrofit kits, which use a direct/indirect design to produce volumetric lighting with enhanced distribution and reduced glare – see:
http://www.lithonia.com/RT5/default.asp
Color temperature was increased to 4100K, which resulted in higher perceived light levels and quality. The RT5 fixtures were also specified with two step dimmable ballasts and after commissioning, were found to produce adequate light levels with the ballasts set to 50% output. In addition to redesigning the overhead lighting to enhance quality at a much reduced wattage, high efficiency task lighting was installed using the Finelite PLS (Personal Lighting System) – see:
http://www.finelite.com/products/pls-overview.html
The PLS uses high efficiency LED desk lamps and under-cabinet LED strip lights with outputs of 3, 6, or 9 watts, and a passive infrared motion sensor mounted under the desktop to shut the system off when the office is not occupied. The PLS was extremely well received by users, some of which have stopped using their overhead lighting all together, preferring the LED light directly at the task plane. Total lighting energy consumption was reduced by approximately 80%.

Integrated Classroom Lighting System – ICLS

To demonstrate the latest technology in classroom lighting design, two separate ICLS systems were installed – one in an auditorium style lecture hall in the Science building, and one in a conference room in the Facility Services building. Both utilize Finelite pendant mounted T8 direct/indirect light fixtures – see:
http://www.finelite.com/products/icls-overview
The Science lecture hall project demonstrated the use of separate downlight and uplight features, with an AV mode for digital projector use or film viewing. Dual technology motion sensors were installed to turn lights off when no occupancy was detected. An instructor control panel was installed at the front of the room to allow easy change of lighting mode by lecturers. The Science building ICLS resulted in an energy savings of approximately 50%. The Facility Services conference room demonstrated the use of dimmable indirect lighting in an 8 foot ceiling application. The original eight 2 lamp T8 surface mount fixtures and 8 dimmable 75W incandescent track lights were replaced by a total of six 2 lamp T8 Finelite fixtures. Again, a dual technology motion sensor turns the lights off when the room is not occupied. In both instances, color temperature was increased from 3500K to 4100K, resulting in higher perceived light levels and quality. The Facility Services ICLS resulted in an energy savings of 30%.

Hybrid Bathroom LED Switch

Research into hotel and dormitory behavior has found that many users will leave the bathroom lights on at night to provide a night light function. This project installed Hybrid Bathroom LED Switches in 50 bathrooms in Cerro Vista Hall. The switch has an integral passive infrared motion sensor that shuts off the lights when no occupancy is detected. In addition, the switch has an integral 2 watt LED night light, which allows users to find and use the bathroom at night without turning on any lights at all. These were intentionally installed in the rooms that were occupied by conference attendees to get maximum exposure. Post retrofit analysis found that the Hybrid Bathroom LED Switches resulted in an energy savings of approximately 50%.

Smart Bi-Level LED Bollard Walkway Lighting

On the plaza between the Fisher Science and Science North Buildings, aging and unattractive 50W high pressure sodium walkway lights were replaced with new Gardco Smart Bi-Level LED Bollard Lights. The LED's provide 50W of clear white light when motion is detected and dim down to 5W when no motion is detected. The significant amount of time spent at minimum output resulted in an energy savings of approximately 70%. The higher quality light resulted in higher perceived light levels and greatly improved color rendition. Rather than using infrared or ultrasonic motion sensing technologies which do not perform well outdoors, microwave technology is used. The next generation version will include wireless mesh networking to allow an entire area of bollard lights to switch to full output if motion is detected at any point, rather than switching individually. It was found that motion sensing exterior lights provide enhanced security by switching to full output when movement is sensed, making it more difficult for an assailant to hide undetected. Finally, the LED lamps are expected to provide up to 100,000 hours of service before needing replacement, reducing maintenance costs significantly.

Bi-Level Streetlights

In parking lot H4 next to the Facilities building, four 250 watt high pressure sodium cobrahead street lights were replaced with 100 watt induction streetlights. In addition,

these fixtures utilize a pole mounted passive infrared motion sensor and a two step dimming ballast to reduce the light's output to 50% when no motion is detected. Color rendition was greatly improved over the HPS lamps, and a lamp life of up to 100,000 hours is expected, which will significantly reduce maintenance costs. Energy consumption was reduced by approximately 70% compared to the HPS fixtures. In front of the Cerro Vista apartments, four 100 watt shoebox type HPS streetlights were replaced with a combination of 80 watt bi-level LED lights that dim down to 35% output when no motion is detected, and 150 watt HID lights that dim to 50% output. In both cases, the perception of light level and light quality were greatly improved, and the amount of time spent at low output generated significant energy savings – approximately 40%.

Relevancy to the Best Practices program- Describe the features of the project/practice that qualify it as a best practice of potential interest to other campuses (eg. replicability).

The lighting technology demonstration projects implemented at Cal Poly are a great example of cooperation between the CSU, the CEC, the PIER Program, the CLTC, and the Utility Partnership Program. Implementation of these new technologies successfully generated significant energy savings, educated designers and specifiers, enhanced the skill set of our ESCO, and added to Cal Poly's living laboratory for education of the next generation of architects, engineers, and energy professionals. Permanent signage was created to educate faculty, staff, and students as they make their way around campus, and these projects are pointed out as part of campus tours. In addition, PIER has created a Google Earth map of all technology demonstration projects in California – see: http://www.terradex.com/PublicPages/CIEE/pier-01.kmz
From the lessons learned on these demonstration projects, the campus hopes to implement a number of these technologies on a much larger scale.

Design integration- If appropriate, describe the ways in which this project/practice incorporated multiple disciplines and/or stakeholders into the design process. Describe how collaboration produced sustainable solutions or improved the project's performance.

To develop and implement these lighting technology demonstration projects, a number of stakeholders were involved in design, planning, review, and coordination – these included:

- Campus Electricians: Discussion of maintenance and service issues, impact of long life fixtures and lamps, training on new technologies, standardization of inventory, coordination for installation, outages, access, and assistance with M&V data collection.
- University Police and Parking Services: Discussions of security issues, perception of light levels at night, training on bi-level motion sensing technology.
- University Housing: Discussions of energy conservation opportunities, student behavior, educational outreach, and night security.
- Facility Services: There was a very interactive process between the campus energy manager, PIER, and CLTC to come up with a proposed design for the Facility Services office building lighting. Several different technologies were considered and one was actually installed and removed before the Lithonia RT5R fixtures were selected. There was substantial input and feedback from users about light levels, color temperature, glare, fixture placement, user friendliness, and configuration of controls. The process was enhanced by the breadth of disciplines involved – architects, engineers, project managers, administrators, skilled trades, support staff, and students.

Load management- If appropriate, describe how the project/practice provides on-peak electricity demand reduction, or demand response capability.
These lighting technology demonstration projects resulted in a peak demand reduction of 5.6 kW, or 42%.

B. DEPENDENT QUESTIONS- This section contains questions that are relevant ONLY for certain awards. If the award you are submitting under is listed, please address the question that follows.

Best Overall Sustainable Design:
Please describe the design of the building envelope, focusing on its effect on the facility's overall energy-efficiency.

Water Efficiency/Site Water Quality:
Please provide an estimate of the annual amount of water saved or treated.

Best Overall Sustainable Design; HVAC Design; HVAC Retrofit; Lighting Design/ Retrofit; and Water Efficiency/ Site Water Quality, if applicable:
Please describe how the project/practice has been received by building occupants. Describe what has been met with satisfaction or dissatisfaction, and why.
The response from faculty, staff, and students has been overwhelmingly positive. The conversion of exterior HPS lighting to either induction or LED was very well received. Color spectrum and color rendition were greatly improved, and people were pleased with the bi-level functionality. The LED Bollards were more successful than the LED streetlights because of the intensity of the LED source. The streetlight was perceived as too harsh. On the LED Bollard, the light source is not aimed directly into the eye and has well controlled distribution. On the office lighting retrofit, a first attempt at retrofitting the parabolic T8 troffers using the Lithonia ES8 fixture was a failure. It was found that this fixture did not work well in a low ceiling office application. The diffuser design left the lamps almost completely exposed. Again, this was perceived as too harsh and created too much glare. Replacing these fixtures with the Lithonia RT5R Volumetric fixture solved the problem. This fixture's lens and diffuser design produced a much softer light with far better distribution. The T5 lamps are not Cal Poly's choice for campus wide application due to the higher lamp cost. Lithonia states that they are working on a T8 version of this fixture, which when released, could potentially become the campus standard. In all lighting retrofits, a shift to a higher color temperature improved perceived light levels and quality. The biggest hit of all had to be Finelite's Personal Lighting System (PLS). The LED task lights were enormously popular – systems installed on unoccupied workstations were quickly "borrowed" by office neighbors. The PLS proved extremely easy to install – taking about 10 minutes per workstation. It was also very flexible in its design, allowing a wide variety of custom configurations. Overall, these lighting technology demonstration projects were very successful, providing a great learning opportunity to the campus energy manager, our campus electricians, electrical contractor, and consultants.

IV. ADDITIONAL INFORMATION

Please provide any additional information necessary to assist the selection team in understanding and evaluating the project. Supplemental information in the form of photos, drawings, etc. may be submitted.

If you are submitting in the Best Overall Sustainable Design category, you must submit several pictures of the project for the selection committee to adequately evaluate the building design.

V. SUBMISSION DIRECTIONS

Please submit proposals (electronic transmission only) by March 6, 2009 to:

Andy Coghlan
Sustainability Specialist
University of California, Office of the President
Email: andrew.coghlan@ucop.edu
Phone: 510.987.0119

Please visit the UC/CSU/CCC Sustainability Conference webpage at <http://sustainability.ucsb.edu/conference/index.php> for information about this year's conference.

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March 6, 2009

PROJECT CATEGORIES

NEW CONSTRUCTION/MAJOR REHABILITATION

1. **Best Overall Sustainable Design -** This category is for best overall sustainable design for a new building or major building renovation. The building should show outstanding implementation of sustainability principles and energy efficiency measures. The building design must have been completed between January 1, 2004 and January 1, 2008. Building must not be a previous recipient of an Energy Efficiency Partnership Program award.

2. **HVAC Design/Retrofit -** Projects in this category should demonstrate leadership in HVAC equipment selection, distribution system design, and controls specification. Laboratory designs and retrofits are included in this category. Examples include: appropriate equipment sizing; energy efficient equipment selection; maximizing the benefits of local climate; air distribution system innovation; and fume hood control innovation.

3. **Lighting Design/ Retrofit -** Projects in this category should demonstrate leadership in a new design or retrofit of lighting delivery systems and lighting control systems. Examples include: energy efficient fixture selection and deployment; utilization of daylighting technologies; and use of advanced lighting control technologies.

SUSTAINABLE OPERATIONS

1. **Water Efficiency/ Site Water Quality -** This category highlights outstanding water efficiency projects that have measurable and documented savings. Additionally, projects that significantly improve or protect site water quality may submit under this category. Water efficiency applicants with documentation or calculations of associated energy savings will be given special consideration throughout the review process. Examples of water quality projects include bioswales and riparian zone restoration.

2. **Innovative Waste Reduction Programs -** This award will spotlight a program, organization, or group that has demonstrated significant leadership in waste

reduction and recycling efforts. Award candidates in this category should be engaged in campus-wide programs that seek to leverage student, staff, faculty, and community interest and commitment to reduce waste and increase recycling. Programs should be able to demonstrate innovative strategies and programs in reducing waste while maximizing their collections of recyclables to lead the campus to achieve zero waste goals.

3. **Student Energy Efficiency -** This award will spotlight a program, organization, or group that has demonstrated real leadership in student-led energy efficiency and conservation efforts. Award candidates will be engaged in campus activities that seek to leverage student interest and commitment to sustainability in order to increase energy awareness on campus; realize environmentally-friendly campus policies and commitments; and involve students in efficiency activities that compliment their campus' goals and that result in measurable energy savings.

4. **Student Sustainability Programs -** This award will highlight a program, organization, or group that has demonstrated real leadership in student-led environmental sustainability efforts. Award candidates will be engaged in campus activities that seek to leverage student interest and commitment to sustainability.