UC/CSU/CCC SUSTAINABILITY CONFERENCE 2008
CAL POLY SAN LUIS OBISPO
July 31 – August 3

ENERGY EFFICIENCY PARTNERSHIP PROGRAM
BEST PRACTICE AWARDS APPLICATION FORM

Due Friday March 7, 2008

I. CONTACT INFORMATION

Campus: Cal Poly San Luis Obispo
Department: Facility Services
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***Conference presenter name:** Dennis Elliot
***Conference presenter telephone:** (805) 756-2090
*The Partnership will cover the conference registration and on-campus housing fees for ONE person per each project selected as a Best Practice Award winner. This person must be the main presenter in a conference session track and submit their name here.

II. PROJECT CATEGORY- see attached category descriptions

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

SUSTAINABLE OPERATIONS
- ___ HVAC Retrofit (labs included)
- ___ Renewables/Innovative Energy Generation or Procurement
- ___ Water Efficiency/Site Water Quality
- ___ Innovative Waste Reduction
- ___ Student Energy Efficiency
- ___ Student Sustainability Program

III. PROJECT/ PRACTICE INFORMATION

A. GENERAL QUESTIONS

Project/practice name: Satellite Central Plant
Project/practice location: Engineering III, Engineering IV, Bonderson Bldg.
Implementation cost: Total plant cost - $450,000. Net savings compared to installation of separate air cooled chillers in each of three buildings - $50,000. This is due to the smaller net chiller capacity due to load diversity, and fewer total units installed.

Additional costs for extended electrical service and underground chilled water piping were more than offset by reduced cost of material and labor for the major equipment.
Estimated *annual* energy savings (as applicable): 150,000 kWh per year
Estimated *annual* energy cost savings (as applicable): $15,000 per year
Description- Provide a detailed narrative describing the project or practice.

When design began for the new Engineering Quad on the Cal Poly campus (Engineering III, Engineering IV, and Bonderson Senior Projects Building), the first choice for chilled water supply was the existing central chiller plant, as prior engineering studies have shown that the total life cycle cost of cooling from the central plant is approximately half that of distributed package equipment. Unfortunately, the central plant did not have adequate chiller capacity to serve these new loads, and the nearest campus chilled water distribution piping was over 2000 feet away. It was clear that the project budgets for these new buildings would not be adequate to both increase central plant capacity and extend the distribution system. Local cooling systems would have to be provided until the next major capital improvement for the central plant and chilled water distribution system could take place.

Rather than installing air cooled chillers at each building that would be minimally Title 24 compliant, it was desired to serve all three buildings from a single satellite plant – this would allow the plant to take advantage of load diversity, reducing the required peak cooling capacity. Further, it would provide some redundancy for maintenance needs by serving the buildings from two smaller central chillers rather than one separate unit at each building. It was also desired to specify these chillers as high efficiency water cooled units rather than air cooled, due to the inherently higher efficiency.

Finally, a satellite plant serving all three buildings fits better with the campus Utility Master Plan, which states that central plant hot and chilled water will be used for new buildings whenever possible.
The satellite plant provides a single point of connection to the Utilidor for future connection to the main campus central plant. A $10M upgrade to the central plant and distribution system is now currently in design as part of the Center for Science building project. This infrastructure project will extend the existing chilled water distribution piping all the way around the campus core, including the Engineering Quad, so that these buildings may be served by central plant chilled water – the most efficient source available on campus. The upgraded central plant will also include a 19,000 ton-hour chilled water thermal energy storage tank, allowing the central plant chillers to run at maximum efficiency while shifting their entire load to off peak hours. The satellite chiller plant at the Engineering Quad will remain to provide back up cooling to these buildings in the event that the central plant or distribution systems are down for maintenance. As the campus grows, future upgrades to the central chiller plant will be necessary. The satellite chiller plant will add flexibility to campus operating schemes. Once connected, the satellite chillers will allow the central plant to shed 420 tons of load if a situation occurs where central plant capacity is not adequate to serve the total campus.

The Engineering Quad satellite chiller plant utilizes two 210 ton Carrier 30HXC206 water cooled screw chillers, running R134a refrigerant, rated at 0.53 kW/ton efficiency. Chilled water is delivered to the three buildings using variable speed pumping. Even after including the additional fan energy for the cooling towers, these chillers use

approximately 37% less energy than air cooled chillers of equivalent capacity. This results in a peak demand reduction of approximately 100 kW, and an annual energy savings of 150,000 kWh or $15,000.

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).

Every campus can develop a Utility Master Plan and update it as conditions change. After careful life cycle cost analysis, Cal Poly made a commitment in 1997 to using central plant hot and chilled water to serve new buildings as the campus grows. Even when faced with a budget situation that would not allow three new buildings to be connected to the central chiller plant, Cal Poly chose a path that achieved the greatest possible energy efficiency in the short term, and provided for the opportunity to integrate these systems into the central plant in the future to achieve the greatest long term energy efficiency. This thought process, prioritization of projects, and commitment to a utility master plan could be replicated on other campuses.

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.

This project involved the cooperation of a number of different stakeholders – planners, project managers, energy manager, facility director, building engineers, and refrigeration mechanics, as well as the engineering related academic departments housed in the new buildings. By involving this broad group of stakeholders early and listening to their input, a win-win solution was found that met the project needs within budget in the most sustainable way possible, and actually resulted in a net capital savings to the projects. Cal Poly has worked to build and strengthen the relationship between Facility Services and Facilities Planning so that the people that will be responsible to operate and maintain new buildings and utility systems have every opportunity to review, comment, and provide input on new designs. This open dialog allows for more sustainability and energy efficiency issues to be identified and addressed early in the design process. In addition, location of this satellite chiller plant in the heart of the Engineering Quad makes it easily available as a teaching tool to the Engineering classes taking place.

Load management- If appropriate, describe how the project/practice provides on-peak electricity demand reduction, or demand response capability.

The final design of this satellite chiller plant results in a peak demand reduction of 100 kW compared to air cooled local equipment. When the upcoming central plant upgrade project is completed and the campus is served by the TES tank, our peak electrical demand will be reduced by over 1 MW.

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.

Building occupants are pleased with the plant's ability to provide cooling as needed to these three buildings, and that the turndown ratio of these high efficiency screw chillers can effectively operate at very low part load conditions - critical for the 24/7 schedule of these buildings. Further, the plant provides a convenient and visible example of a state of the art chiller plant to the engineering classes held nearby. The only drawback has been the high noise level of the screw chillers. Some noise attenuation measures have been employed and more are still needed. Luckily, when the central plant upgrade project is complete in 2011 and this satellite plant is connected to the utilidor, these chillers will not normally operate during regular academic hours, and the building occupants will not experience any noise.

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. PLEASE NOTE: If you are submitting in the Best Overall Sustainable Design category, the following must be submitted:
1. Completed submittal form, 2. Floor Plans, 3. Elevations and Sections illustrating sustainable features, 4. Perspectives (or photographs if the project is constructed). This information will enable the selection committee to adequately evaluate the building design.

V. SUBMISSION DIRECTIONS

Please submit proposals (electronic transmission is preferable) by Friday March 7 to:

Trista Little
Sustainability Analyst
University of California, Office of the President
390 Wurster Hall # 1839
Berkeley, CA 94720-1839
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Please visit the UC/CSU/CCC Sustainability Conference webpage at <http://sustainability.calpoly.edu> for information about this year's conference.

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

2. **Renewables/ Innovative Energy Generation or Procurement -** Projects in this category should increase the campus' consumption of renewable energy through the installation of alternative energy technologies or renewable energy procurement.

3. **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, riparian zone restoration or other sustainable landscaping design.

4. **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.

5. **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.

6. **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.