BEST PRACTICES 2010

Cal Poly San Luis Obispo Student Recreation Center

The center's indirect/direct evaporative cooling system will take advantage of the dry local climate to create a comfortable indoor environment while reducing utility and maintenance costs. The variable air volume design will supply 100 percent outside air while outperforming Title 24 by 24 percent.

Award Category

HVAC Design/Retrofit

Green Features

Indirect/direct evaporative cooling reduces cooling energy use by over 80%

100% outside air

High indoor air quality

Variable frequency drives

Reduced water consumption compared to central plant cooling

Annual Energy and Cost Savings

24% below Title 24

452 MWh and 27,000 therms total building

160 MWh HVAC

$65,000 total savings

$15,680 HVAC savings

Size

160,000 ft^2

Cost

MEP and technology: $790,000

Total renovation and expansion: $71 million

Completion Date

Scheduled Jan. 2012

Cal Poly is remodeling and expanding its recreation center — originally opened in 1993 — to accommodate a growing student population and increasing demand for recreation space. The expansion will provide students with an additional 95,000 square feet and triple the amount of exercise space. A new gymnasium, multi-activity center, fitness rooms, indoor track, wellness center, racquetball courts, and leisure pool are among the new amenities.

Campus stakeholders involved in the design process advocated strongly for an energy efficient facility. The design team proposed an indirect/direct evaporative cooling (IDEC) system as an economical and energy conserving alternative to traditional HVAC systems. IDEC uses evaporation to cool and humidify air in two stages, eliminating the need for chiller operation except during times of extreme outdoor temperatures. The technology is ideal for use in dry climates, and when applied correctly offers many advantages over traditional air conditioning, including improved energy efficiency and indoor air quality.

PG&E awarded over $200,000 in energy efficiency incentives through the UC/CSU/IOU Energy Efficiency Partnership Program.

In the first stage of IDEC, warm outside air is passed through an air-to-air heat exchanger and pre-cooled indirectly by an evaporative process using a direct spray heat exchanger. Both the drybulb and wetbulb temperatures of the incoming air are lowered in this process, since no moisture is added to the primary airstream. The pre-cooled air then passes through water-soaked media in the second stage, reducing the temperature further via direct evaporation and allowing the supply air to gain a comfortable level of humidity.

To see this type of HVAC system in operation, Cal Poly facilities staff and design engineers from P2S Engineering took a trip to Sonoma State University, which has implemented IDEC successfully in several buildings, including a new recreation center. The group was able to ask valuable questions of Sonoma State staff and tap their extensive experience with operating this type of system.

Rendering of recreation center renovation and expansion. Image: Cannon Design.

The Sonoma State visit led to several enhancements in the design of the center's IDEC system. The project team opted to provide humidity control for the building's most densely occupied spaces including the existing gym and new multi-activity center. With the cooperation of the manufacturer, the air handler control system was replaced with the campus's standard energy management system to facilitate maintenance, monitoring, and control activities to be performed by university engineers. Finally, additional instrumentation will be provided for one highly utilized air handler to enable detailed performance monitoring.

The project team collaborated closely to integrate the overall design and minimize the size of the HVAC system. Focusing on the building envelope, the team specified high levels of roof insulation and Solarban 60

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Additional Awards

Targeting LEED-NC Silver

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Contractor: Sundt

More Information

www.asi.calpoly.edu/rec_center_project

http://tinyurl.com/3h392pn

glass. High-efficiency lighting, daylighting, and occupancy controls will further reduce internal heat gain.

The IDEC system is designed to meet the center's peak cooling demand of 380 tons. During extremely hot weather, the campus's central plant chilled water system can provide up to 50 tons of supplemental cooling. The design team estimates that backup from the central plant will be needed less than 20 percent of the year.

Life cycle cost analysis performed by the design team shows a payback for the IDEC system of less than ten years.

Ten variable air volume (VAV) air handling units will serve the facility. These units provide only the supply air required, using variable frequency drives. This can produce significant energy savings by minimizing fan power during times when ventilation requirements are low. The HVAC system will provide 100 percent outside air during cooling mode, and due to heat-exchange capabilities, higher ventilation rates in heating mode than a typical VAV system. This is very advantageous for a sports facility where high occupant density and intensive exercise activities require a continuous supply of outside air to effectively remove indoor pollutants.

Two of the air handlers serving spaces containing the highest occupant loads will be equipped with direct expansion heat recovery, which preheats outside air before it enters the building and assists with dewpoint control. The remaining air handlers have return air recirculation to preheat supply air during cooler conditions. High-efficiency boilers at the central plant will provide building heating through the center's VAV boxes.

The eight air handlers with return air recirculation are also equipped with 50 percent bypass capability. This feature allows up to 50 percent of outside airflow to bypass the two-stage evaporative cooling process during favorable conditions, thereby reducing parasitic fan energy losses. The center will exceed 2007 Title 24 by 24 percent, surpassing CSU's minimum requirement of 15 percent, in large part due to its HVAC design.

Rendering of center entry. Image: Cannon Design.

Students have been actively involved in the project since its inception. It was funded through a self-assessed increase to student fees, and students advocated strongly for LEED certification to ensure that the facility meets high standards for sustainability. A senior level architecture class is assisting with LEED documentation to support the project's goal of attaining Silver level certification. Additionally, the ASHRAE student club is working with the commissioning agent to develop a commissioning training module, and is assisting with the commissioning process as well.

LESSONS LEARNED

Project design engineer Monica Amalfitano notes that properly assessing IDEC technology requires that project teams perform an energy analysis using a full year's worth of bin weather data. To make a well-informed decision, project teams must review utility costs and estimate payback based on the performance of the IDEC system within the applicable outside air conditions. Using this approach, the Cal Poly team completed a life cycle cost analysis and found that the recreation center's IDEC system will have a payback of less than ten years.

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.