BEST PRACTICES 2008

Sonoma State University, Darwin Hall Retrofit

Darwin Hall, as part of an extensive remodeling, was converted from constant volume fume hoods and air handlers to a variable air volume system. Ventilation rate setbacks at night are implemented when sensors identify lab space as unoccupied.

Award Category

Best HVAC Retrofit

Green Features

Variable air volume system with ventilation setbacks during unoccupied hours

Indirect/direct evaporative cooling

Annual Energy Savings

153,491 kWh and 10,275 therms

$27 thousand annual savings ($21 thousand electricity savings, $6 thousand gas savings)

53% energy use compared to Title 24 2001

Size

96,000 ft^2

Cost

$40 thousand (For ACH setback only)

Completion Date

October 2008

Darwin Hall, a 96,000 square foot lab facility, was originally built in 1965. In need of improved lab space, Sonoma State and the design team determined that renovating the building would be the most sustainable and cost effective approach to meeting the demands of 21st century research, as opposed to building a new science center. Darwin Hall was renovated from 2005 to 2006 with the majority of interior space demolished while leaving the structure and shell in place. The renovation included upgrading lab equipment, education technology, and accessibility.

The design team, with the support of Labs21 and PG & E, increased energy monitoring in the existing building prior to the renovation to analyze existing loads and to identify opportunities for substantial energy savings. The team chose to give more useable space back to the floors by consolidating existing vertical mechanical distribution shafts and grouping together the most fume intensive labs. Lab spaces were relocated to the upper floors, reducing vertical duct runs and loads on the ventilation system.

Air flow rates are setback during unoccupied hours and at nighttime. The air change rate is adjusted by fume hood sash position.

The new design also took advantage of the building's site orientation and narrow width to maximize daylighting and solar thermal opportunities. The region's mild climate also allowed the team to implement indirect/direct evaporative cooling units. Entirely new exterior windows with dual pane insulated glazing were also installed to improve thermal performance.

Based on energy monitoring data, the most cost effective method of reducing energy use was to decrease air flow rates during times when the labs were not occupied. Prior to the retrofit, the constant air volume system maintained air flow at 69,000 CFM at all times.

Darwin Hall after the renovation. Photo: Sonoma State

Based on Labs21 research, ventilation rates in labs can be reduced during unoccupied times and nighttime, while still maintaining a safe work environment. By October 2008, the ventilation system was switched from constant air volume to variable air volume. The upgrade included initiating a ventilation rate setback schedule carried out by a building energy management system. The setback schedule is supplemented by a system to identify nighttime lab occupancy. Sensors are connected to the lighting system. When the space is both empty and the lights are off, the nighttime setback rate is implemented. Airflow rates were reduced during daytime, occupied hours to 4

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Team

Architect: Chong Partners Architecture (Acquired by Stantec in 2007)

Mechanical Engineer: Flack + Kurtz

Energy Consulting: Rumsey Engineers

Additional Consulting: PG&E Savings By Design, Labs21

Contractor: Syserco

More Information

www.labs21century.gov/conf/past/2004/abstracts/e3_walker.htm

www.sonoma.edu/pubs/darwinhall/plan.shtml

Darwin Hall. Photo: Sonoma State

ACH in classrooms and 8 ACH in lab while the nighttime setback rate is 2 ACH. Airflow rates are regulated by fume hood sash position. The 2 and 4 ACH rates are when the hood sashes are closed and the 8 ACH rate is with hood sashes open. From this measure alone the projected savings total over 150,000 kWh and 10,000 therms annually and the overall retrofit decreased energy use by more than 50% compared to 2001 Title 24 requirements. The estimated $27,000 in savings from decreased energy use, combined with $18,000 dollars in savings resulted in the system paying for itself in just under a year.

LESSONS LEARNED

The Darwin Hall renovation project, a near complete remodel of a 35 year old building, was a major undertaking for Sonoma State. The design team drew on their knowledge of regional strategies as well as the success of other projects on the Sonoma State campus for guidance through the project. Extensive energy monitoring of the building as an initial step in the process led to a clear understanding of the electrical and mechanical needs of the project. By adjusting the facilities layout within the building, useable space was increased, while reducing energy consumption drastically. The design team notes the importance of adhering to a modular approach in renovation, both to work with existing structure and to provide for future upgrades, increasing the building's lifespan. Working with Labs21 and PG&E, the design team was able to develop a plan that provided both a safe and productive work environment, while at the same time decreasing energy consumption.

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