BEST PRACTICES 2014

Award Category

Overall Sustainable Design

Green Features

Zero-net energy performance

Super-insulated building shell

Fan-assisted nighttime cooling with displacement ventilation

Reduced carbon concrete materials

Rooftop water collection

Built-in infrastructure for future loads

Annual Energy and Cost Savings

Meeting net zero energy in first year of operation

$23,121 (estimated)

Size

8500 ft^2

Cost

$3.5 million

Savings by Design incentives of $15,000

Completion Date

June 2013

UC Davis Jess S. Jackson Sustainable Winery Building

This latest addition to UC Davis' viticulture teaching and research complex reaches new levels for sustainability with innovative passive design, on-site water capture and reuse. The project is expected to achieve zero-net energy certification through the Living Building Challenge.

By using a design-build project delivery method, UC Davis was able to drive innovation in sustainable design, while controlling costs in the development of the Jess J. Jackson Sustainable Winery Building. The design and development team won the contract by exceeding project goals, offering zero-net energy (ZNE) performance, and meeting cost limitations by adapting off-the-shelf products commonly used in industrial buildings.

The building is the fifth completed in the campus's extensive wine and food science complex, and it compliments a LEED-Platinum teaching and research winery, with a lab dedicated to brewing and food science, that was completed in 2010. One of the primary uses of the new building will be to investigate technologies and methods to reduce and sequester the carbon emissions produced in winemaking.

The building consists of a single divisible space that will house winemaking tanks and equipment, with sufficient systems and infrastructure to accommodate a wide range of possible of research activities in the future. Since the building will not be consistently occupied, and thus ineligible for LEED certification, the design team opted instead to pursue Net Zero Energy Building Certification from the International Living Future Institute.

With many climate-responsive passive design strategies, a tiny PV array is sufficient to meet zero-net energy performance.

A key first step in designing the facility was to design a super-insulated building shell, with adequate thermal mass to take advantage of diurnal temperature swings, and well-shaded windows appropriately sized for Davis' arid climate. The walls and roof are constructed of composite structural panels generally used for refrigerated buildings, with sheet metal enclosing rigid insulation. The panels form the exterior wall and roof finishes, and were installed over one-inch rigid insulation caps or insulated tape to prevent thermal bridging at the connections to the steel frame. Additional batt insulation on the interior brings the effective assemblies to R-56 for the walls and R-70 for the roof. The project team selected a pre-engineered metal structural system to reduce costs and expedite construction.

Exterior with window shading, water storage tanks, and overhangs on east and west exposures. Photo: Jasper Sanidad.

Energy simulations showed that a standard floor slab would not provide sufficient thermal mass, so the design team increased the slab thickness, added continuous R-7 insulation below, and added a partial-height concrete block (CMU) wall inside of the enclosing walls. Because concrete production is a significant contributor to greenhouse gas emissions, the design team was one of the first specifiers of a new low-carbon CMU product with reduced cement content, and a patented system from CarbonCure Technologies to sequester carbon within the blocks. In addition, the foundation and slab used a concrete mixture with cement content reduced by 50 percent. The products were manufactured locally to reduce the "embodied energy" resulting from shipping.

2014

BEST PRACTICES

Additional Awards

Small Projects Award of Merit, *Engineering News Record*

Energy + Sustainability Merit Award, AIA San Francisco

Expecting Zero-Net Certification from Living Futures Institute

Contacts

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Project Team

Architect:
Siegel & Strain Architects

MEP Engineer:
Guttmann & Blaevoet Consulting Engineers

General Contractor:
Pankow Builders

Structural:
Ingraham/DeJesse Associates

Civil and Landscape:
Cunningham Engineers

More Information

http://news.ucdavis.edu/search/news_detail.lasso?id=10608

http://www.siegel-strain.com/projects/jessjackson-winery/

http://www.pankow.com/Libraries/Documents/UC_Davis_Jess_S_Jackson_Sustainable_Winery_Building_Press_Kit-4.sflb.ashx

This attention to the envelope design reduces the space conditioning loads so that passive approaches are generally sufficient to maintain indoor temperatures, taking advantage of the daily temperature swings that can be as much as 60°F. A night-time cooling strategy is used to precool the space and the building's thermal mass, using low level displacement ventilation that supplies cool night supply air in close proximity to the floor slab and

View of interior shows displacement diffusers inside the partial height CMU wall. Photo: Jasper Sanidad.

the perimeter CMU walls. The project has no compressor-based cooling, and uses only an efficient in-line fan to provide the nighttime cooling, which is assisted using the natural buoyancy of warm air that is allowed to escape through high-level operable windows that are automatically controlled. A simple building control system uses a combination of scheduling, and inside and outdoor temperatures, to manage the nighttime cooling cycle, which usually starts at 10:00 p.m.

Unlike many ZNE buildings that require large and expensive photovoltaic (PV) arrays, the winery's passive strategies have greatly reduced electrical loads, and these may be met with a small PV array, described by the project mechanical engineer Abdel Darwiche as a "postage stamp" on the roof. To accommodate loads that may be generated by future research activities, the building includes in-slab tubing for radiant cooling, and ducting to connect to a future underground rock-bed that could provide additional thermal mass. Additional PVs could be added to power future research plug loads, or an efficient heat pump.

The building is integrated with adjacent buildings and provides easy access to the campus vineyards.

The project includes several site water collection and conservation features. Water collection from the new winery's roof and landscape serves the larger adjacent building having excess water storage, and the new winery water storage tanks are filled by the adjacent building's larger roof. Nancy Malone, principal with Siegel & Strain Architects, notes that such integration opportunities are unique to campus settings, and rarely exist in adjacent city lots. The project also includes paving from Nature Pave, which is cited as having reduced toxic ingredients and carbon content, yet still meets fire department loading requirements.

LESSONS LEARNED

The project has exceeded its ZNE goals in its first six months of operation, with PV generation exceeding usage by over 40%, an overage expected to increase through the summer months. The project has also met the design criteria of not exceeding interior temperatures of 80°F, even during a summer "heat storm" in which high temperatures well over 100°F persisted for many days. Julianne Nola, the Assistant Director for UC Davis' Design and Construction Management, notes that one challenge was working with the manufacturers of pre-engineered systems, such as the building structure. As the suppliers are not adept at customizing their products, special attention on the part of the team was needed to ensure that the design intent was met. However she notes that the final solution has been successful, and that the use of a highly insulated building shell is already being considered for other campus projects.

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.