The Science and Engineering Building, completed in August 2006, is a 175,000 square-foot research and teaching facility housing laboratories, laboratory support space, teaching laboratories, and offices for the Natural Sciences and Engineering Colleges. The building consists of three stories and a basement housing the campus vivarium.

The design team used UC Merced’s master plan, developed by SOM, and architectural design guidelines, developed by SOM with Fernau & Hartman and EHDD Architecture, as a framework to design the building. The master plan orients an underlying grid 30 degrees off of the north-south axis to allow buildings to minimize solar gain while allowing for natural daylight. The master plan grid also runs parallel to prevailing winds coming off nearby Lake Yosemite to maximize potential for natural ventilation.

The building serves as an integral piece of Founding Chancellor Carol Tomlinson-Keasey’s vision of UC Merced as a new sustainable research university for the 21st century.

The Science and Engineering Building’s energy saving strategies were facilitated by LEED compliance and driven by a rigorous series of energy targets developed by UC Merced, in collaboration with Karl Brown of the UC Office of the President (UCOP) and the California Institute for Energy and Environment (CIEE). All new buildings to be built at UC Merced, which are planned in four phases over the next 30 years, are now required to meet a minimum of LEED-NC Gold, be 50% more energy efficient than the 1999 UC/CSU Benchmarks (the energy consumption and peak demand of existing laboratory building stock in the UC and CSU systems), and exceed Title 24 by 30%. The Science and Engineering Building has exceeded the 1999 UC/CSU Benchmark by 64% based on actual energy performance measurements.

The Science and Engineering Building design team, led by Chuck Davis, FAIA, of EHDD Architecture, also carried out collaborative meetings with the design teams of the other two new buildings on campus: the Classroom Building designed by Portland-based Thomas Hacker Architects, and the Library and Information Technology Center designed by SOM, and Fernau & Hartman. All three buildings are three or four stories in height, have architecturally significant exterior shading devices, shaded clear glazing and exterior circulation.

The L-shaped building defines two sides of the Campus Green. Photo: Tim Griffith
arcades, and flexible outdoor spaces. As the largest consumer of energy on campus, the Science and Engineering building allows for load shifting through its connection to the campus chilled water plant. Chilled water is produced at the central plant during off-peak hours and stored in a two-million-gallon stratified chilled water storage tank for use during the day. This load-shifting strategy saves energy, reduces the campus peak load, and minimizes costs by running chillers during cooler nighttime hours, taking advantage of time-of-use rates.

The Science and Engineering Building was designed for flexible programming and interaction between different disciplines. Educational laboratories and support spaces are all located on the ground floor. The second and third floors contain the research laboratories organized in “neighborhoods” with shared meeting spaces, as well as faculty and administrative offices adjacent to the research labs.

**The design team carefully considered all building materials in terms of a full life-cycle analysis.**

The building’s structure has been designed with a steel frame and concrete structure. The thermal mass of the building’s concrete structure delays heat transfer from the exterior to the interior on summer days, saving energy by decreasing the need for cooling. The roof and walls are also highly insulated and efficient in retaining heat. The entire building is conceptually a “shaded box”, with extensive glass sunshades and overhangs to decrease solar gains and cooling requirements. The building also has high performance glazing that is spectrally selective to also reduce heat gain while being visually clear to maximize views and daylight. Over 90 percent of the wood in the building is from sources certified as being from responsibly-managed forests. Materials in the building contain 48 percent overall recycled content, and 43 percent of materials were manufactured regionally. Carpets contain 100 percent recycled content, with 37 percent of the material from soda bottles and 77 percent from newspapers. Of the total construction waste, 70 percent was recycled or diverted from local landfills. Wood was chipped for use in other products or composted, and concrete was used as a road base locally. The HVAC design, carried out by global engineering firm Arup, integrates approximately 100 laboratory exhaust hoods with variable air volume (VAV) controls, adjusting to loads and minimizing air changes. HVAC equipment was carefully sized based on expected internal loads. Heating energy use is minimized through zone cooling, reacting to internal loads and reducing the need to reheat. Office spaces are largely naturally ventilated with operable windows. Daylighting is maximized with floor-to-ceiling windows and narrow floor-plates of occupied space, while electrical lighting use is managed by dual mode (IR and motion) occupancy sensor controls. Permanent energy monitoring equipment was also installed to accurately assess post-occupancy building performance.

Typical laboratory buildings have high energy and water intensities due to high ventilation requirements and other health and safety concerns. This project uses 44 percent less water than a comparable building through the use of automated faucets, low flow laboratory fixtures, low flow toilets and waterless urinals.
LESSONS LEARNED

David Hurley, Architect at EHDD, states “UC Merced’s clear vision of a sustainable campus, as outlined in the master plan and campus goals, helped reinforce the importance of architectural elements and integrated well planned design moves that support both functional and design objectives.” Mark Maxwell, UC Merced LEED Coordinator, states that the university also established clear LEED goals for the design team and that LEED served as a suitable framework for keeping a project on track while identifying cost-effective sustainable strategies. “The better a university defines goals from the start, the easier it is for a project to meet those goals and create a project that approaches sustainability holistically,” he explains. The Science and Engineering Building serves as a core addition to UC Merced’s ambitious sustainable campus goals and as a key starting point for the university’s “triple-zero commitment” to reach zero net energy use, produce zero landfill waste, and reach zero net greenhouse gas emissions by 2020.

Best Practices is written and produced 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.