

## CAMPUSES BUILDING GREEN

Sustainable design and management of facilities and physical plants presents a valuable opportunity for institutional transformation on campus. Buildings are huge resource consumers and producers of waste. For example, buildings account for 40% of all energy and 25% of wood products in the U.S. The planning, design and implementation process can bring stakeholders from across the campus community into a conversation, striving towards common goals and tangible results. Colleges and universities construct buildings, maintain sanitation systems and facilities, provide heat and power, employ and house people, and contract with government and private institutions. These activities provide unparalleled teaching and learning opportunities for faculty, staff, students, administrators and members of the extended community. A growing number of American universities are making sustainable principles a fundamental part of their campus design. In both new construction and renovation projects, campuses are focusing on highly efficient buildings that reduce waste and minimize their impact while improving quality of life and educating the users. There is growing recognition that environmental considerations make good economic sense as well as good design sense. The following is a partial list of some of the green buildings to be in design or already in operation at colleges and universities around the country.

### **Colby College: Schair-Swenson-Watson Alumni Center**

<http://www.colby.edu/alumni/building/>

Architect: Ann Beha

Cost: \$7.5-million

Area:

Completed: under construction

This building, which will use three geothermal wells for heating and cooling, each 1,500 feet deep, has a long list of environmentally-friendly features, and was the first academic building in Maine proposed for certification through the LEED program. Also in the works are a social sciences and interdisciplinary studies building, also proposed to be a LEED-certified green building. This fall Colby became a Green Power Partner with the U.S. Environmental Protection Agency for its commitment to cleaner, renewable and reliable alternatives to conventional electricity generation.

### **Emory University: Whitehead Biomedical Research Building**

<http://www.hoksustainabledesign.com/september01/pdfs/EmoryGreeprints1.pdf>

Architect: Hellmuth, Obata + Kassabaum, Inc. (HOK)

Cost: \$66 million

Area: 325,000-sf

Completed: November, 2001

The first building in the Southeast to receive LEED certification this building opened in. The project, which came in below budget and ahead of schedule, has become a standard for all new Emory facilities. The total cost of the LEED initiatives -- about \$990,000 -- represents about 1.5 percent of the building's total construction cost. Emory's savings in energy costs alone over the next decade will easily cover that \$990,000. Special heat-recovery wheels on the roof are expected to recoup \$100,000 in energy costs a year, while water-recovery units should save 2.5 million gallons of water annually. Rainwater is collected

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and used for irrigation. And ninety percent of the building's occupants can work by sunlight. The university is seeking certification for two other major academic, research and medical buildings—the Mathematics and Science Center, which opened in summer of 2002, and the Winship Cancer Institute, completed in fall 2003. Emory currently has about 10 projects that will be submitted for LEED certification, or that are being designed, renovated or constructed according to LEED principles, for a total of about 1.1 million square feet—or 25 acres.

#### **Furman University: Herman N. Hipp Hall**

<http://www.johnsoncontrols.com/cg-cases/CSST-HE04-015.pdf>

Architect: Craig Gaulden Davis

Cost: \$42 million

Area: 38,000-sf

Completed: August 2002

This was the first building in South Carolina to receive the LEED certification. It houses offices and classrooms for 3 academic and 2 administrative departments. Sensors monitor overhead lighting, temperature, and air quality and flow, and adjust according to room occupancy. Large solar-green-glazed windows admit abundant natural light, block ultraviolet heat buildup, and reduce glare. Materials chosen for their recycled content, stringent construction waste management, and energy-efficient systems reduce construction and operating costs. Electric automobile recharging stations, secure bicycle storage, and showers and changing rooms encourage use of energy-efficient transportation. Fly ash concrete, a recycled byproduct of coal-burning, strengthens the foundation. Radiant energy barriers conserve energy by improving the performance of roof and wall insulation. Low-emission adhesives, sealants, carpet and paint preserve indoor air quality. External down lighting conserves energy and reduces light pollution.

#### **Georgia Tech: Management Building**

<http://leedcasestudies.usgbc.org/overview.cfm?ProjectID=227>

Architect: The Epstein Group

Cost: \$40 million

Area: 248,000-sf

Completed: August 2003

The project uses the latest in water conservation and energy efficiency as well. The use of a water efficient drip irrigation system and drought resistant native plants reduces watering requirements by 50 percent. Bathroom fixtures use only 25 to 50 percent of the water consumed by typical bathroom fixtures. The building sports a high-performance building envelope and other features such as the highly reflective white roof, efficient heating and cooling systems, and energy saving light fixtures make the building 16.5 percent more energy efficient than the national ASHRAE standard. In addition the cooling systems use no ozone-depleting refrigerants.

#### **Juniata College: Shuster Hall at Raystown Field Station**

<http://www.schoolsdesigns.com/ResultsDetail.asp?id=2085>

Architect: Hoffman & Popovich Architects

Cost: \$1.3 million

Area: 6,000-sf

Completed: June 2003

Shuster Hall is the first LEED-certified building at Juniata College's Raystown Field Station (RFS), providing state-of-the-art field facilities within a unique "green" campus. Juniata College established the RFS to provide special opportunities for environmental research and education inside a living laboratory encompassing 36,000 acres of land and lake.

"A top priority for Juniata's new research station is to ensure that our presence on Raystown Lake has a minimal environmental impact on the ecosystem," says Juniata College president, Thomas Kepple. "Our status as a 'green' building gives us a rare opportunity to use the building itself as a teaching tool for students, while also setting an example for other institutions who are interested in environmentally designed buildings." Shuster Hall maximizes views of the lake to the east and north, and situates support spaces to the south and west, minimizing solar impact.

### **Middlebury College : McCardell Bicentennial Hall**

<http://www.familyforests.org/research/bicentennial.shtml>

Architect: Payette Associates

Cost: \$47 million

Area: 220,000-sf

Completed: 2000

This structure features triple glazing in windows to add more insulation, a ventilated "cold roof" design for energy efficiency, a six-inch air/insulation space between the shell and structural exterior walls for effective drainage, solar-powered lights, porous paving to filter runoff and return water for aquifer recharge, and local green-certified wood used for paneling. 70% of the wood used in the building was provided by Vermont Family Forests, a Vt.-based organization committed to ecological sustainable forestry. Middlebury consciously opted not to go for LEED certification, preferring to spend that money on hiring energy and environmental consultants who can help us build good buildings. However, in some cases their sustainable design exceeds LEED standards.

### **Northland College: McLean Environmental Living and Learning Center**

<http://www.northland.edu/info/tour/wmmellc.html>

Architect: Hammel Green Abrahamson, Inc. and LHB Engineers & Architects

Cost: \$3.6 million

Area: 40,000-sf

Completed: 1998

This co-ed facility houses 111 students and includes such sustainable features as passive solar heating, a wind tower, and two greenhouses. Recycled brownstone, salvaged from Ashland's old high school, was used in the exterior walls, along with locally grown cedar. The flooring is organic-based linoleum, and the furniture is made from milk jugs and steel, both recycled. Even the attic insulation was made from recycled paper cellulose. Residents monitor energy consumption and tend to the greenhouse plants to demonstrate the importance of alternative energy systems. They have achieved a 50% greater level of energy efficiency.

### **Oberlin College: Adam Joseph Lewis Center for Environmental Studies**

[http://web.sbu.edu/fcsc/adam\\_joseph\\_lewis\\_center\\_for\\_env.htm](http://web.sbu.edu/fcsc/adam_joseph_lewis_center_for_env.htm)

Architect: William McDonough + Partners

Cost:

Area: 13,600-sf

Completed: January 2000

This building houses classroom and office space, an auditorium, a small environmental studies library and resource center, a wastewater-purification system in a greenhouse, and an open atrium. The Center provides a "living classroom" for students of environmental design. Passive solar heating and lighting were optimized. A 3,700 square-foot solar electric system on the main south-facing curved roof provides electrical energy for the building. Recycled and reused products were used in its construction, including the steel framing, ceramic tiles in the restrooms, and carpeting. The heating and cooling is supplemented by closed-loop geothermal wells, where water circulates through closed-loop pipes to water source heat pumps located in each space throughout the building. An energy management system monitors the building's energy use and key environmental variables throughout the building and landscape. A natural waste-water treatment system uses microbes, plants, snails, and insects, and is designed to treat up to 2,500 gallons of the building's wastewater daily.

### **Pima Community College: Plaza Building, Desert Vista Campus**

[http://dco-proxima.dco.pima.edu/fclplan/pdf/best\\_of\\_tucson.pdf](http://dco-proxima.dco.pima.edu/fclplan/pdf/best_of_tucson.pdf)

Architect: Burns, Wald-Hopkins Architects

Cost: \$8.4 million

Area:

Completed: 2000

This is the first structure in Arizona to receive a rating from USGBC. The Plaza Building uses water-conserving fixtures reduce municipal water use by over 20%, and building commissioning and

monitoring contribute to a 20% improvement over the ASHRAE standard for energy efficiency. The energy model for this building shows that it will use 21% less energy than a standard building. The College added \$225,750 or 2.7% to the budget to achieve this goal. The energy savings will pay back the cost in the first 10 years.

### **Santa Clara University (Mission Campus): Kennedy Commons building**

<http://www.energyvortex.com/pages/headlinedetails.cfm?id=1727>

Architect: Kaplan McLaughlin Diaz (KMD)

Cost:

Area: 7,500-sf

Completed: breaking ground in spring 2005

This building will feature straw bale walls, photovoltaic cells, recycled textiles, and furniture featuring locally harvested wood are some features that will be a part of the new facility. In an effort to reduce the impact on the environment, they will be incorporating recycled materials in the construction phase, choosing materials to minimize polluting emissions, and incorporating technologies that increase energy efficiency. The building will accommodate smart classrooms with the latest technology, but will also be designed with movable walls to create flexibility and a variety of experiences. Santa Clara University is amending their design guidelines to incorporate sustainable architecture in future campus renovations and freestanding buildings.

### **Stetson University: Lynn Business Center**

<http://www.stetson.edu/marcom/currentmag/utc.htm>

Architect: SchenkelShultz Architects

Cost: : \$12.6 million

Area: 73096-sf

Completed: September 2002

The first building in Florida to be LEED certified, this project was a renovation of a run-down, six-story bank building. Synthetic stucco and high-performance glass clad the building's exterior. The building uses low-VOC emitting materials, furniture made of recycled content, low emissivity glazing, reduces water and energy consumption.

### **UC Berkeley: Residence Halls Units 1 & 2 Infill Student Housing**

[http://www.housing.berkeley.edu/construction/projects\\_units.html](http://www.housing.berkeley.edu/construction/projects_units.html)

Architect: EHDD

Cost:

Area: \$267,500-sf

Completed: under construction

These are the first buildings on the Berkeley campus to be designed and constructed to LEED Silver standards. The project consists of 884 beds, and 4 buildings. As a dense infill project close to the center of campus, it emphasizes pedestrian and bicycle transportation, with no dedicated parking, and qualifies for a number of LEED site credits. The concrete mat slabs incorporated high volume flyash concrete, significantly reducing carbon dioxide emissions while yielding a superior concrete quality. All the residential rooms are fully daylit and were designed to take advantage of views, including many expansive views of the San Francisco Bay. The project was designed without air-conditioning to significantly reduce energy use. Passive cooling strategies included the use of spectrally selective glazing and large areas of thermal mass exposed to the building interior. Recycling of both demolition and construction waste was given high importance on this project. In addition, 25% of the projects building materials contain a minimum of 20% post-consumer recycled material.

### **UC Santa Barbara: Donald Bren School of Environmental Science and Management**

[http://www.zgf.com/press\\_IIDA.htm](http://www.zgf.com/press_IIDA.htm)

Architect: Zimmer, Gunsul, Frasca Partnership

Cost:

Area: 84,672-sf

Completed: 2002

This development is a living laboratory and environmental showcase facility to demonstrate cost-effective, energy-efficient technologies and operations. A separate reclaimed water system was installed to furnish greywater to flush toilets and irrigate the landscape. Waterless urinals were also installed and it is estimated that each waterless urinal will save approximately 45,000 gallons of water per year. Design includes a 40 KW rooftop photovoltaic system, natural ventilation linked with a window interlock system for heating, daylighting controls, energy-efficient lighting, high efficiency boiler, and chiller integrated into a virtual chilled water loop. These energy efficiency measures assisted the building to exceed Title 24 (1998 Standards) by 31%. 93% of the construction waste generated onsite was diverted from the landfill. Recycled-content products include 12-20% flyash in the concrete, glass tiles and countertops, 100% postconsumer recycled content carpet, and tire-derived rubber flooring. Other environmentally preferable products for the interior surface materials included linoleum and natural cork flooring, bamboo cabinetry, and stained concrete flooring.

### **University of Denver: The College of Law**

<http://www.universitybusiness.com/page.cfm?id=288>

Architect: Shepley Bulfinch Richardson and Abbott

Cost:

Area:

Completed: scheduled for August 2005

This state-of-the-art facility project includes proactive design for indoor air quality through superior ventilation; a smoking ban; a carbon monoxide monitoring system; low-emitting paints, carpets, and composite wood products; and indoor chemical and pollutant controls. When DU realized it had the opportunity to build a new law school on its main campus, the administration quickly asked, "Why not an environmentally responsible structure?" After all, the DU law school houses a prominent environmental law practice, and is headquarters to Earthlaw, a nonprofit environmental law organization ([www.earthlaw.org](http://www.earthlaw.org)).

### **University of Florida in Gainesville: Rinker Hall**

[http://www.architectureweek.com/2005/0316/environment\\_1-1.html](http://www.architectureweek.com/2005/0316/environment_1-1.html)

Architects: Croxton Collaborative Architects and GouldEvans

Cost:

Area:

Completed: 2005

Rinker Hall has achieved a "gold" LEED rating from the USGBC. Its success has raised the bar for this university's new buildings which will now be expected to meet or exceed LEED silver standards. The client expects to recover the additional costs involved in sustainable design within six years through energy savings, Rinker Hall has become a teaching tool for architecture and building construction students. The curriculum integrates tours of the building into courses in sustainable construction. Rinker Hall performs across the board, with particularly elegant solutions to water and energy efficiency, interior daylighting, and waste reduction.

### **University of South Carolina : West Quad Green Dorm**

<http://www.housing.sc.edu/westquadgo.asp>

Architect: Boudreaux and Little End Associates

Cost: \$30.9 million

Area: 172,000-sf

Completed: November, 2004

This complex is said to be the largest green residence hall in the world. This LEED certified building includes special light shelves in the windows that deflect natural light into the rooms and reduce the heat of direct sunlight. There are interior lights with motion sensors that detect when someone enters and exits a room and turn lights on and off accordingly. In addition, a hydrogen fuel cell generates partial power for the building's 9,000-square-foot learning center, and there are low-flow plumbing fixtures, and high efficiency washers and dryers. There is even a turf roof that absorbs heat and reduces rainwater runoff. And the building houses a cafe that sells health foods and environmentally aware products. The dorm

uses 45% less energy and 20% less water than comparable traditional residence halls. To encourage students to conserve, USC has created a variety of attractive incentives. Students can see how much energy they are using via three interactive touch screen displays located in the lobby. They can also access this information on the web. And those students who use less energy than the student average are eligible for award money of \$100 to \$150. And since students have full control of the temperature in their rooms--each room has its own thermostat--they can save easily on cooling and heating.

### **University of Texas Houston: School of Nursing and Student Community Center**

<http://www.bnim.com/fmi/xsl/portfolio/index.xsl?-token.pnum=00032&-token.pid=pr10-2&-token.cat=cat-10>

Architect: Berkebile Nelson Immenschuh McDowell Architects and Lake/Flato Architects

Cost: \$57 million

Area: 195,000-sf

Completed: June 2004

This project is a model for environmentally friendly and cost-effective campus buildings. The project breaks new ground for the most comprehensive academic health science center in the Southwest. The facade of the school is making use of many recycled materials, including: flyash in place of Portland cement; aluminum panels made from 92 percent recycled material; wood siding made of sinker cypress hauled from the bottom of the Mississippi River; and red bricks reclaimed from a 19th century warehouse in San Antonio. The new building benefits from innovative use of natural daylight, new techniques in window glazing and sun control devices, an under-floor air distribution system, and individualized temperature controls were all integrated into the design. Water-recovery tanks and troughs collect rainwater from the roof and sides of the building to make the facility largely self-sufficient for the estimated 42,000 gallons it needs each month for irrigation and toilet flushing. The building is also designed to accommodate a future on-site waste treatment unit targeting zero discharge to City sewer systems, and a roof-mounted photovoltaic system for on-site power generation. This building is projected to operate 50-60 percent more efficiently than a traditional classroom building in Houston. All future campus buildings and renovation projects will follow suit in what is termed "sustainable design," which calls for numerous energy-saving and operational efficiency features, as well as the use of recycled materials and materials preservation.

### **University of Washington, Tacoma: Phase 2B**

<http://www.djc.com/special/agcawards2004/uwtacoma.html>

Architect: McGranahan Architects and Lease Crutcher Lewis

Cost: \$41 million

Area:

Completed: 2004

This is the first LEED certification granted in the UW system and the City of Tacoma. Phase 2B consists of five historic buildings that once housed a candy company, dried goods businesses, a furniture factory and a cabinetworks that have been transformed into modern learning space that will serve students from many academic disciplines. The Phase 2B project was recognized for several innovative design features and construction methods, USGBC officials said. Among these were: The re-use and restoration of 100-year-old masonry building facades; An ivy wall against the Mattress Factory building that will lower dependence on artificial air conditioning and reduce cooling costs Passive cooling strategies to offset cooling load, such as high-performance windows with solar control, shading devices and exposed thermal mass; Use of renewable or salvaged materials and environmentally responsible finishes for floors, woodwork and walls; Re-use of columns, beams and floors; Reduction of water and power usage and optimized energy performance in HVAC equipment . During construction, the project team implemented an intensive recycling program with a goal of diverting 78 percent of construction debris from landfills. In addition, the team monitored indoor air quality during construction to ensure a good work environment.

### **Warren Wilson College: EcoDorm**

<http://www.warren-wilson.edu/currently/ecodorm/>

Architect: Jim Samsel

Cost: \$1.5 million

Area:

Completed: July 2003

The 36-bed EcoDorm features energy-efficient building designs and sustainable-resource construction. It will serve as a live-in educational facility for students while meeting the need for additional campus housing. It is built almost entirely with reusable and recycled materials, such as wooden farm fences that were turned into siding. Solar fuel cells will convert sunlight into electricity and heat. Runoff from the roof, funneled through a converted 10,000-gallon railroad tank car, will provide water to the building and grounds. The dorm will also feature composting toilets and waterless urinals. Energy savings will come from the installation of passive solar and thermal mass, high efficiency equipment, radiant floor heating, and photovoltaic and fuel cell energy. They anticipate energy savings could range from 30 to 50 percent.

### **Yavapai College - Chino Valley Campus Agribusiness and Science Technology Center –**

[http://www.dlrgroupcorporate.com/news/national/egroup/articles/article\\_22/chino.htm](http://www.dlrgroupcorporate.com/news/national/egroup/articles/article_22/chino.htm)

Architect: DRL Group

Cost: \$3.3 million

Area: 16,000-sf

Completed: January 2004

This center supports academic programs that are intimately linked to intelligent use of natural resources; therefore, the College envisioned a project that significantly minimizes environmental impact while incorporating a 'building as teacher' philosophy. The project addresses the site by restoring disturbed areas with native vegetation and collecting site storm water run-off in an engineered wetlands. The project reduces water use through xeriscape landscaping and rainwater harvesting for irrigation. Efficiency is optimized in numerous ways reducing energy use by more than 50% below ASHRAE 90.1-1999 standards. Over 70% of the materials in the project were manufactured within a 200-mile radius. All adhesives, paint and interior products such as wheatboard casework and carpet are very low- or zero-VOC emitting materials that contribute to exceptional IAQ in the building. The project achieved the 25% recycled content LEED credit for construction materials, and despite the rural location and lack of infrastructure, the project achieved a 50% construction waste recycling goal. Every regularly occupied space has daylighting as part of the lighting strategy as well as access to exterior views.

## **RESOURCES**

### **APPA: The Association of Higher Education Facilities Officers**

<http://www.appa.org/>

APPA's Association of Higher Education Facilities Officers is an international association dedicated to maintaining, protecting, and promoting the quality of educational facilities.

### **Clean Air Cool Planet**

<http://www.cleanair-coolplanet.org/>

Clean Air-Cool Planet creates partnerships in the Northeast to implement solutions to climate change and build constituencies for effective climate policies and actions.

### **Environmental Building News**

<http://www.buildinggreen.com/ecommerce/ebn.cfm>

EBN is a monthly newsletter featuring comprehensive, practical information on a wide range of topics related to sustainable building--from energy efficiency and recycled-content materials to land-use planning and indoor air quality.

### **National Association of College and University Business Officers (NACUBO)**

<http://www.nacubo.org/x7.xml>

NACUBO serves a membership of more than 2,500 colleges, universities, and higher education service providers across the country. NACUBO represents chief administrative and financial officers through a collaboration of knowledge and professional development, advocacy, and community. Our vision: to define excellence in higher education business and financial management.

**National Wildlife Federation Campus Ecology Program**

<http://www.nwf.org/campusecology/>

For more than a decade, NWF's Campus Ecology program has been helping transform the nation's college campuses into living models of an ecologically sustainable society, and training a new generation of environmental leaders.

**Society for College and University Planning**

<http://www.scup.org/index.html>

The mission of the Society for College and University Planning is to provide higher education professionals with planning knowledge, resources, and connections to achieve institutional goals.

**University Leaders for a Sustainable Future**

<http://www.ulsf.org/>

ULS supports colleges and universities in making sustainability an integral part of curriculum, research, operations, outreach, faculty and staff development, student life and institutional mission.

**U.S. Green Building Council**

<http://www.usgbc.org>

The U.S. Green Building Council is the nation's foremost coalition of leaders from across the building industry working to promote buildings that are environmentally responsible, profitable, and healthy places to live and work.

