Lawrence Technological University -A. Alfred Taubman Student Center

Southfield, Michigan

Case Study

Private University Goes for the Silver

Established in 1932, Lawrence Technological University is a private accredited university situated on 125 acres in Southfield, Michigan, with nearly 5,000 students. Dedicated to education through cutting-edge technology, the university embarked on a project to build an environmentally conscious student center at the heart of campus. The project was entirely supported by the philanthropic Campaign for Lawrence Tech. The campaign raised over 46 million for projects such as the Urban Forest Initiative to foster Champion Trees on campus and the A. Alfred Taubman Student Center. For both projects, the University worked closely with architects and engineers from the Southfield, Michigan firm, Harley Ellis Devereaux.

The University opened and dedicated the 42,000 square foot student center in April, 2006. Built to United States Green Building Council's Leadership in Energy and Environmental Design (LEED) specifications, the Taubman Student Services Center addresses the criteria of sustainable site development and construction, water and energy efficiency, recycled materials selection, and indoor environmental quality. The goal is that the facility will be a "living laboratory" through which students and teachers learn from the unique environmentally friendly features.

Site Management

The bordering quadrangle is designated to become an "urban forest" of cloned poplars and other indigenous species. The poplars are native to Michigan and have been recognized as "Champion Trees" due to their giant stature. The shrinking habitat of the species led to their dwindling number. The Urban Forest Initiative is an effort to clone the historic trees and promote the saplings' growth to reforest designated urban areas preserving the Michigan native species.

The green roof atop the three-story student center minimizes heat island effect. In addition to insulating the building, the vegetation prevents the roof from storing and radiating heat during the summer months. The drought-resistant sedum used on the roof attracts local bird species as well. Alternative transportation access was integrated

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into the site plan, along with bicycle storage and changing rooms. Bus service is also available within a quarter mile of the center. These features allow visitors and students to conveniently make use of public and alternative transport, reducing fossil fuel use.

Waste Minimization
At least 75% of construction waste was diverted from the landfill. The building includes recycling collection and storage facilities.

Raw Resources
The architects ensured that at least 20% of the building materials were manufactured locally, and 50% of those were also harvested locally. Lyptus wood, a renewable resource known for its rapid growth was used throughout the facility. Lyptus wood grows rapidly to harvest and can be harvest multiple times. The flooring is elevated 18 inches off the poured concrete floors to accommodate wiring and piping which are easily accessible under removable modular floor panels. If one floor panel is damaged, then only one needs to be replaced. The ceilings were constructed out of Bamboo, also considered a rapidly renewable resource. Low volatile organic compound (VOC) emitting carpets, paints, sealants, adhesives and composite wood were used for interiors. Conventional materials result in levels of volatile organic compounds indoors up to ten times those outdoors. They are known to cause a wide variety of adverse health effects some of which are carcinogenic.

Low-e glass is installed with ceramic fitting, and the siding is corrugated metal. Raised sealed concrete floor panels are used in areas of heavy circulation, and carpet tiles are used in offices and lounges.

Water Conservation and Management
The green roof and bioswales compose the onsite bioretention system. To prevent excess stormwater runoff due to the site's impervious rooftop surface, the design team chose to install a green roof. Sixty percent of precipitation on the 13,000 square foot roof is absorbed by 10,000 square feet of vegetated surface. The green roof is composed of layers of insulation, roof membrane, drainage fabric and four inches of semi organic soil to sustain nine varieties of drought-resistant sedum. The remaining 40% of the precipitation that falls onto the green roof runs off into a 12,500-gallon subterranean cistern. Prior to entering the tank, the water flows though a 12 inch simplex basket strainer to collect debris and pollutants commonly found in snow and rain. Within the tank, particles larger than 50 microns are separated from the water. This water is then used to irrigate the quadrangle and flush toilets

in the building. Low flow fixtures were installed throughout the facility along with waterless urinals to conserve potable water.
Bioswales were constructed along the length of the glass facade which borders the central quadrangle to absorb and purify runoff into the communal area. Weirs and tile fields are situated along campus boundaries to prevent approximately two thirds of rainfall on the site from draining into the Rouge River. The mechanism is accompanied by a bioswale with long rooted grasses and trees to naturally filter out lead, cadmium and chromium from automotive residue and phosphates and nitrates found in fertilizer which would lead to pollution and eutrophication in the Rouge River watershed. The system is projected to eliminate 40% of Total Phosphorous (TP) and 80% of post-developmental Total Suspended Solids (TSS) in site runoff annually. The university will conduct a long-term analysis of the stormwater quality onsite which will include closely monitoring levels of TP and TSS. Water efficient landscaping reduced irrigation needs by at least 50%.

Energy Management

The alternative and sustainable energy purchased and constructed for the student center allows the building to use 66% less energy than the average building of its size. Light pollution reduction was also taken into account. Oriented to promote natural lighting for the expanse of the building's southern exposure and take advantage of site elements, the Taubman Center's low-e glass is designed to reduce heat loss and maximize daylight without excessive solar heat gain. At least 75% of the interior spaces profit from natural daylight. To limit unnecessary use of artificial lighting, astrologically-synchronized timers and sensors in the Taubman Center adjust lighting levels throughout the day. A York Direct Digital Control system monitors 1,700 points within the building, continuously controlling the dampers and valves of the heating and cooling system to respond to demand. The system conserves energy by preventing unnecessary climate control of unoccupied spaces. The green roof provides additional insulation for the roof, limiting heat gain and loss and conserves energy.

The building's indoor climate is controlled by a most complex and sustainable field of 88 geothermal wells 300 feet deep under the campus quad. This geothermal system is used to heat a water mixture during the winter and cool a water mixture during the summer. In the wells, water flows underground through five geological layers, and continues through the building via a closed loop of polyethylene tubing, fans and pumps. During winter, the cold water runs out from the building, into the underground loops where it absorbs heat stored in the earth and flows back into the building. During summer, valves switch the hot and cold sides of the system, allowing water from the building to be cooled underground before flowing back inside. Due to the geothermal pumps, the building's heating, ventilation, air-conditioning (HVAC) system has no furnace or boiler, and also does not use any CFC, HCFC or Halon containing refrigerants. No natural gas is used or needed by the facility.

The university also installed a 10 kilo-watt system of photovoltaic (PV) panels funded by a 2004 grant from Energy Office of Michigan's Department of Labor & Economic Growth. The project was carried out by 43 LTU students, 4 faculty members and 5 staff. The six strings of 63 Shell 165 Watt monocrystalline silicon PV panels sit atop the Engineering Building. The electricity is fed directly into the engineering facilities. In the campus quad, a low-voltage "garden of light" arranged to symbolize the geothermal wells beneath also operates on energy from photovoltaic panels.

Economics and Society

The energy use of the building, green roof and bio-swale will be monitored and evaluated by students as part of a community education project. The aim is to use the building as an interactive educational tool for both graduate, undergraduate, architecture and engineering students for alternative green design. For this reason, 50 square feet of the green roof are set aside to test different plants for drought resistance and performance in the rooftop environment. The windows in mechanical rooms

and glass panels in the modular flooring system allow visitors, students and teachers to observe the mechanical distribution system.

Sustainability

The efforts of the university and design team in energy conservation, building materials, and land and water management have set the student center apart from university architecture of its scale. The university has incorporated sustainability into their curriculum as well as administration. Lawrence Tech is an active participant and member of the United States Green Building Council (USGBC), Great Lakes Renewable Energy Association (GLREA), Southeast Michigan Sustainable Business Forum (SMSBF) and the Detroit Chapter of American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). The student center is anticipated to qualify for a Silver Leadership in Energy and Environmental Design (LEED) by accumulating points for achievement in the categories of sustainable sites, energy and atmosphere, materials and resources, indoor environmental quality, and water efficiency.

As part of Lawrence Tech's commitment to the pursuit and demonstration of environmental stewardship, alternative energy, energy efficiency and sustainability, the university has: organized a campus recycling program; established an interdisciplinary Center for Sustainability led by Lawrence Tech alumnus and current University Architect and Associate Dean, College of Architecture; updated a campus master plan inclusive of sustainability and storm water mitigation; installed a 10kW photovoltaic solar system on the roof of the Engineering building; created an alternative energy technology curriculum; formed an alternative energy student group to promote alternative energy usage, sustainable construction, and energy for developing nations; and completes in national and international competition for sustainable design.

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