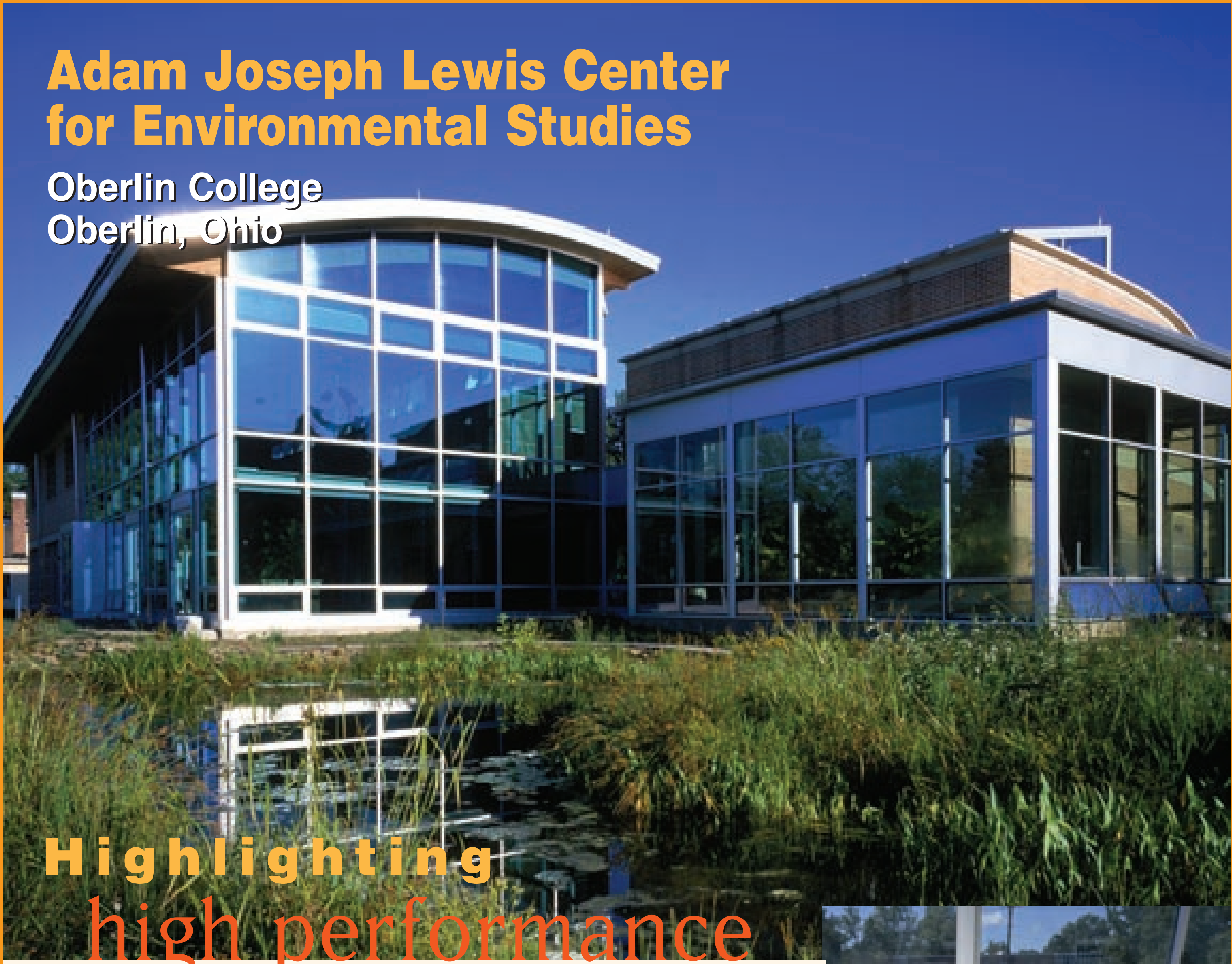
Adam Joseph Lewis Center for Environmental Studies

Oberlin College
Oberlin, Ohio



Highlighting high performance

Concerned about the environmental debt inherent in creating and maintaining most buildings, Ohio's Oberlin College designed the Adam Joseph Lewis Center for Environmental Studies with a focus on sustainability. Designers were conscious of the ecological impact of their choices, from energy sources to landscaping, and created a building that will adapt and change as more sustainable solutions unfold. They also established a building that is a laboratory in itself, trying new strategies to save energy—even if they are not cost-effective by today's standards. The net result is a building with a measured energy savings of 63% as compared to a base case building.

The 13,600-square-foot building relies heavily on the sun for daylight, passive heating, and power—an expansive photovoltaic system supplies more than half of the center's electricity. A closed-loop groundwater heat pump system provides cooling and some of the heating. Designers incorporated energy-efficient components, and materials are local, non-toxic, and durable.

The center is both a venue for classes and a focus of study for a variety of disciplines, and it has encouraged relationships between such fields as the arts and sciences. Thousands of visitors have toured and learned about the building, and it has become a center for many local community events. The building emphasizes the values and knowledge the center provides, helping the college maintain its commitment to the future—its students.

Biology professor David Benzing stands with a wastewater treatment system that is modeled after natural wetland ecosystems.

Sustainable Design at the Adam Joseph Lewis Center for Environmental Studies

Materials

Designers emphasized sustainability and low environmental impact when choosing materials. Among their priorities were durable, low-maintenance products, such as concrete masonry units for interior walls, brick exterior walls, and recycled steel frames. Other recycled or reused products include aluminum for the roof, windows and curtainwall frames, ceramic tiles in the restrooms, and toilet partitions.

Designers also looked for **products of service**—products that are leased rather than purchased—and leased carpeting for the building. Carpeting is laid in squares that can be replaced as they are worn. The leasing company can reuse or recycle the used carpet that it removes from the building.

Wood throughout the building came from certified sustainably managed forests in northern Pennsylvania.

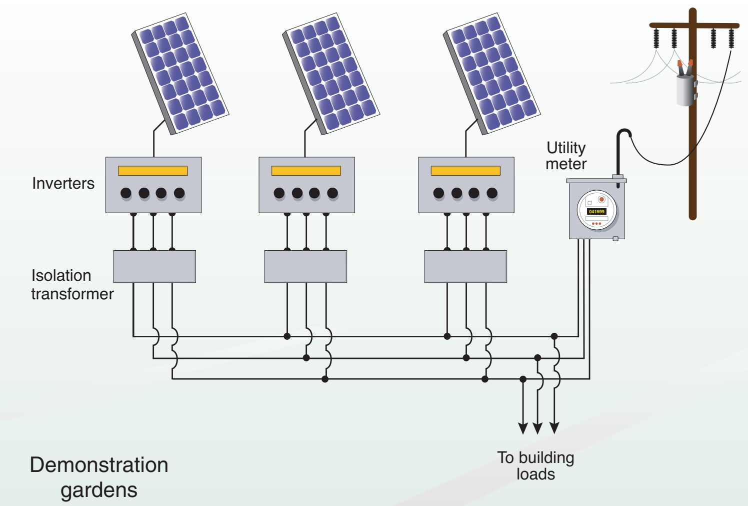
Energy

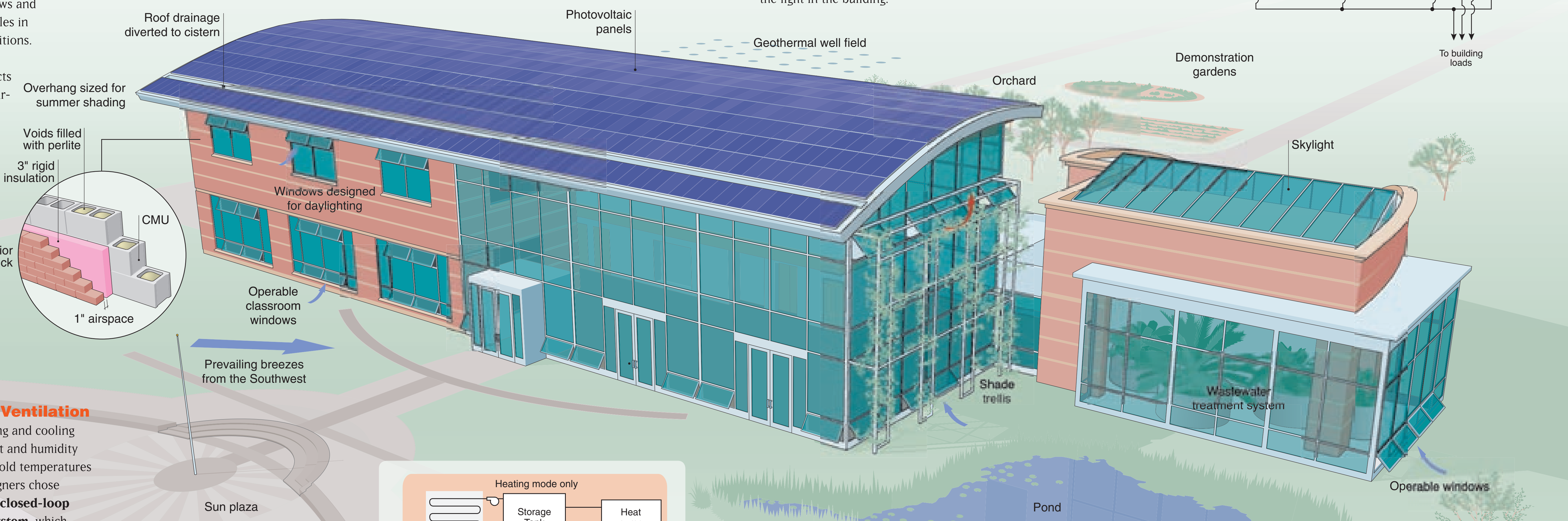
More than 4,000 square feet of **photovoltaic (PV) panels** cover the roof, supplying up to 45 kilowatts of electrical energy for the building. The PV system is grid-interconnected: the building exports energy back to the grid when the PV system produces more than the building uses, and it imports energy when the PV system does not produce enough to meet the building's needs. Integrated building controls manage mechanical, security, fire, and water treatment systems, optimizing energy efficiency.

Lighting

The building's expansive south-facing windows provide **daylight** for the atrium and classrooms. Where electrical lighting is needed, efficient fixtures, dimmers, and sensors all reduce the amount of energy used. Dimming systems allow occupants to control the lighting levels, saving energy by reducing the use of full-strength lighting. Classrooms, offices, corridors, and restrooms have motion-sensitive lighting, turning on when the rooms are occupied. Hallway lights are also connected to photo sensors, which override the occupancy sensors if there is enough daylight. Light-colored surfaces and interior windows make the most of the light in the building.

PV Arrays





Heating, Cooling & Ventilation

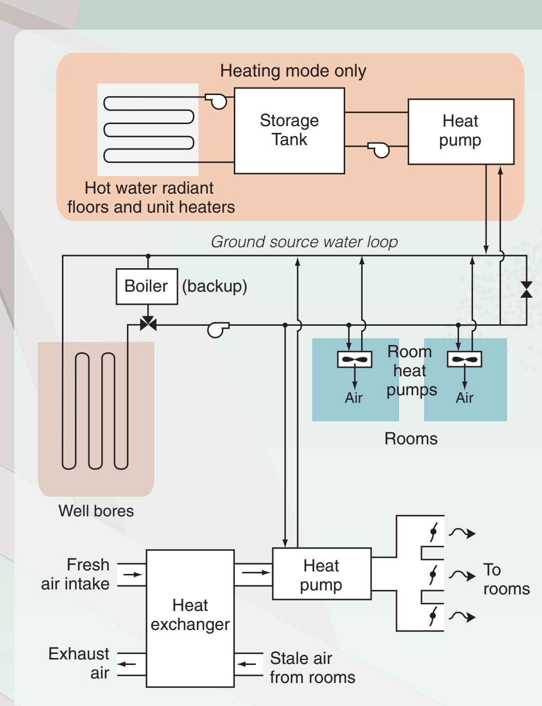
Ohio's climate has both heating and cooling extremes. In the summer, heat and humidity are prevalent; winter brings cold temperatures with lots of cloud cover. Designers chose to temper the building with a **closed-loop groundwater heat pump system**, which uses the constant temperature of the Earth underground to heat and cool the building, and through passive techniques.

In this system, water circulates through the building from 24 geothermal wells, each 240 feet deep. Heat pumps transfer the heat from the pipes into the building. Individual water-to-air pump units heat and cool the classrooms, offices, auditorium, and conference room. During winter, a water-to-water heat pump warms the atrium through **radiant floor heating**—circulating heated water through pipes embedded in the floor.

The building is elongated along the east-west axis to provide some **passive solar heating** during winter months. The lower winter sun reaches **thermal mass** in concrete floors and exposed interior masonry, which retain and re-radiate heat to temper the space. The glass panes are treated with a **low-emissivity coating** to reduce the amount of heat loss.

In the summertime, overhanging eaves shade south windows from the high sun, and a trellis is designed to shade the atrium from the sun on the east side, reducing solar gain. Operable windows allow for **natural ventilation**, particularly in the atrium.

When the building is actively heated or cooled, an energy recovery ventilator exchanges heat between outgoing and incoming air. Programmed and individual controls balance energy efficiency and occupant comfort.



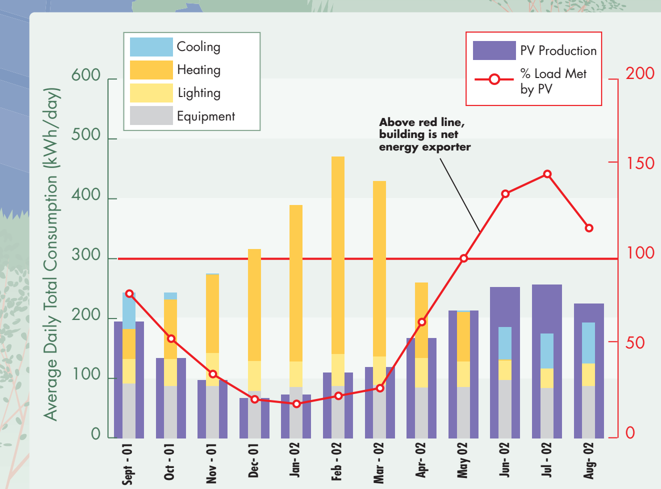
Heating, Ventilation & Air Conditioning

Landscape

The surroundings of the building are an integral part of the Adam Joseph Lewis Center. The landscaping includes a sampling of ecosystems, including microcosms of hardwood forest and once-common wetlands native to Ohio.

An orchard of 50 pear and apple trees and a permaculture garden demonstrate urban agriculture, and a terraced berm reduces erosion and insulates the north side of the building. A cistern, extensive drains, and the wetlands prevent precipitation at the center from overloading the city's storm water collection system during heavy rains.

Paths, stone benches, and a rock garden make up part of the building's "social" landscape, the hub of which is a sun plaza—a tribute to the heat, light, and energy that the sun provides the center.



Average Energy Performance
September 2001 – August 2002

Real-time data on the building's performance is available at www.oberlin.edu/envs/ajlc/.

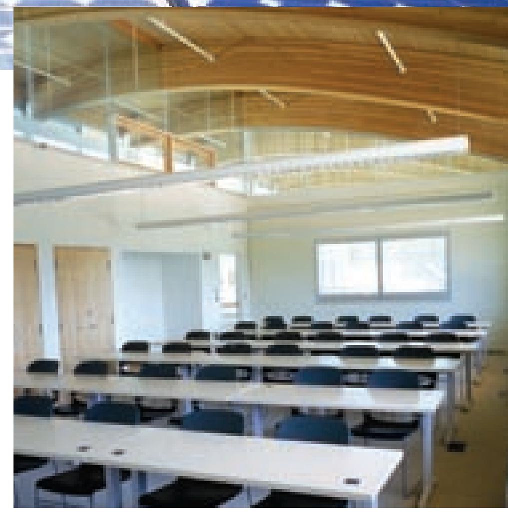
Buildings for the 21st Century

Buildings that are more energy efficient, comfortable, and affordable…that's the goal of the U.S. Department of Energy's Building Technologies Program.

To accelerate development and wide application of energy efficiency measures, the program:

- Conducts R&D on technologies and concepts for energy efficiency, working closely with the building industry and with manufacturers of materials, equipment, and appliances
- Promotes energy/money-saving opportunities to both builders and buyers of homes and commercial buildings
- Works with state and local regulatory groups to improve building codes, appliance standards, and guidelines for efficient energy use.

OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY
BUILDING TECHNOLOGIES PROGRAM
U.S. DEPARTMENT OF ENERGY



Top: The Adam Joseph Lewis Center roof is covered with more than 4,000 square feet of photovoltaic panels.

Bottom: Daylight and energy-efficient lighting minimize the lighting costs.

Hands-on Learning

The Adam Joseph Lewis Center building and its surrounding landscape offer hands-on learning opportunities for students, demonstrating many of the concepts taught through Oberlin's Environmental Studies Program.

A wastewater treatment system modeled on natural wetland ecosystems is one such learning tool. Students maintain and monitor the system, which treats 200 to 300 gallons of the building's wastewater each day. Three aerobic tanks containing a variety of tropical and local plants provide an expansive root system that bacteria, algae, microorganisms, snails, and fish live on, acting as living bio-filters to remove organic wastes, nutrients, and pathogens. The system is designed so the treated wastewater can someday be recycled through the building's toilets, helping to conserve water.

More Information

The following table shows some of the key energy-efficient and sustainable features of the building.

Key Features

Wall insulation	R-value = 19
Roof insulation	R-value = 30
Windows	double- and triple-pane, argon-filled, low-e glass with thermally broken frames
Daylighting	clerestory windows, engineered overhangs
Electric lighting	T8 and compact fluorescents controlled by photo sensors and occupancy sensors
Photovoltaics	rated maximum output 60 kW, realized maximum 45 kW, grid-tied
Cooling/Heating	closed-loop groundwaer heat pump system, radiant floor heating, passive solar heating
Heat recovery from exhaust air	50% - 60% energy recovered
Indoor air quality	100% outdoor air every four hours on average, nontoxic materials
Materials	Designers emphasized local, sustainably harvested, nontoxic building materials

Photo Credits

Robb Williamson: Cover—PIX10855; Cover inset—PIX10871; Back top—PIX10864; Back right—PIX10873

Contacts

Oberlin College
Adam Joseph Lewis Center for Environmental Studies
www.oberlin.edu/envs/ajlc/

Architects: William McDonough + Partners
434-979-1111
www.mcdonoughpartners.com

U.S. Department of Energy
Energy Efficiency and Renewable Energy Clearinghouse (EREC)
800-DOE-3732
www.eren.doe.gov

U.S. Department of Energy
Building Technologies Program
www.highperformancebuildings.gov

National Renewable Energy Laboratory
Center for Buildings and Thermal Systems
www.nrel.gov/buildings/highperformance

Produced for the U.S. Department of Energy by the National Renewable Energy Laboratory, a DOE national laboratory

DOE/GO-102002-1532
November 2002

Printed with a renewable-source ink on paper containing at least 50% wastepaper, including 20% postconsumer waste