

## MIDDLEBURY COLLEGE

*Bicentennial Hall Celebrates the Past and Future*

## PROJECT SNAPSHOT

## PROJECT

Bicentennial Hall

## TECHNOLOGIES

Green certified wood, R-30 insulated roof, Triple-glazed windows, Recycled plastic "lumber," Glycol heat exchangers, Process cooling systems, Recycling of construction waste

PROJECTED CO<sub>2</sub> EMISSION REDUCTIONS

330 tons annually

## INVESTMENT

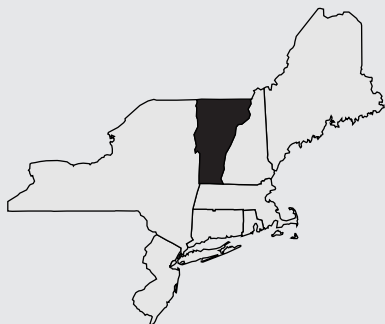
\$47 million

## LESSONS LEARNED

- It is feasible to build with (locally-sourced) certified wood.
- A coordinated planning process can keep the environmental impacts of new building construction to a minimum.

## FUNDING SOURCES

Gifts, low-interest bonds and depreciation funds



## INTRODUCTION

Sometimes a period of expansion is a good time to think about savings. "Founded in 1800, Middlebury College is embarking on a 10-year plan that will see student enrollment increase by 18 percent (to 2,350, in fact, by 2004) the addition of 30 new faculty, and \$200 million in new construction or renovation." After concluding that this era of campus growth presents an ideal opportunity to create buildings and landscapes that honor the environment while saving money, the President and Trustees of the College asked the institution to establish a new benchmark for environmentally friendly design – a benchmark that will serve as inspiration for all of the construction yet to come. Bicentennial Hall, finished in 1999, is the result of this challenge.

## THE PROJECT

Stemming from a directive issued by college President John M. McCardell Jr., the design of Bicentennial Hall was intended to set the new standard for Middlebury facilities. The Trustees of the college instructed the architects to design a functional and efficient building that would have minimal environmental impact on the campus and community. The 220,000-square-foot Bicentennial Hall was completed in autumn 1999 to commemorate Middlebury's 200th anniversary. The building houses the chemistry, biology, physics, psychology, geology and geography departments; a science library; and shared classrooms and teaching space. The hall is the largest academic structure in the nation to use "green certified" wood – timber that has been harvested and processed in an ecologically sensitive manner.<sup>1</sup> (The wood represents six tree species, and 70 percent of it was locally harvested through Vermont Family Forests.) The building also is a symbol of the college's commitment to demonstrate environmental awareness in all aspects of its operations and, in particular, all new buildings and other campus construction. In addition to certified wood, some of its notable features include a 16-inch thick

roof that incorporates R-30 insulation;<sup>2</sup> triple-glazed windows with two to three times the insulation value of typical thermal panes; recycled plastic "lumber," which is used on the roof, substituting in some places for up to half of the wood; glycol heat exchangers in laboratory venting, which substantially reduce heating and cooling losses; process cooling systems in the laboratories, which replace once-through water cooling; and the recycling of construction waste from the site itself. The architects for the project were Payette Associates.

Bicentennial Hall, in fact, is the physical manifestation of a much broader institutional process of reorganization and self-examination. That process began with the adoption of a set of environmental principles – the Guiding Principles – by the Buildings and Grounds Committee of the college's Board of Trustees. These principles outline the college's environmental goals for construction, renovation, of campus facilities. Furthermore, a process has been developed to help carry out the Guiding Principles, as well as their subsidiary policies and procedures. This process is known as the Framework for Implementation. The Framework focuses on four areas – human welfare, ecology, energy and esthetics, and it sets specific standards for environmental improvement. Those standards address waste minimization and recycling, potential use of gray water, and selection of materials based upon life-cycle analysis. One of the more noteworthy features is the requirement that buildings exceed ASHRAE Standard 90.1-1989 by 30 percent, and that energy-saving scenarios be evaluated from a number of perspectives, including energy consumption, up-front investment, architectural aesthetics, space utilization and other human impacts.<sup>3</sup>

A Project Review Committee has been charged with the task of developing a more responsible path for new building construction, utilizing the Guiding Principles and the Framework. Its members include administrators, engineers, faculty, facilities managers, architects and other building consultants.

## THE RESULTS

Bicentennial Hall's environmental enhancements will pay for themselves over a longer time frame than usual, 10 to 12 years rather than five. Although most of the enhancements were competitive with or less expensive than conventional technologies and materials, some did cost a bit more. The difference, however, was at most two to three percent. Facility managers currently are tracking energy performance. Although comprehensive data are not yet available, preliminary figures indicate that Middlebury will save \$25,000 a year from the new building's sophisticated heat recovery system. This is based on a 8,449 mmBtu reduction in steam consumption, resulting in savings of \$50,000, and use of 194,386 kWh of electricity, projected to cost \$25,000, to operate the system. In addition, the simple act of implementing night turn-back on the air handlers saves another \$60,000 a year, or so.

Based on these preliminary results, the heat recovery system alone has reduced CO<sub>2</sub> emissions associated with steam usage by a net 330 tons – using as a baseline a similar 200,000-square-foot academic science building that conforms to prevailing State of Vermont building codes. This is equivalent to the CO<sub>2</sub> emissions associated with taking 46 typical passenger cars off the road annually, or avoiding the use of approximately 1.7 barrels of oil a day. The additional CO<sub>2</sub>-reduction benefits of Bicentennial Hall's other energy-saving features are likely to be greater than this, but have not yet been quantified due to insufficient data. Middlebury College currently is instituting monitoring and tracking procedures to measure more accurately the building performance, and the amount of CO<sub>2</sub> emitted from steam and electricity use.

Other benefits of the project and the college's approach include worker and student comfort, local and statewide economic gains, improved safety, favorable public relations and the educational advantages provided by a living example of a green building on campus – not to mention the addition of a new, fully-functional science building on the Middlebury

campus. Just the use of the green-certified wood is responsible for employing more than 30 foresters, loggers, timber truckers, and sawmill and kiln operators in Vermont. Moreover, by promoting sustained-yield forestry, it supports the long-term security of the forests from which the raw lumber was harvested, and contributes to healthy biosystems and watershed stability.

Bicentennial Hall was named "Lab of the Year 2000" by R&D Magazine. The award recognized "the best new and renovated laboratories that combine all aspects of the building into a superior working environment" – including "an appealing architecture, ... a functional arrangement that encourages innovation and communication, ... and the efficient use of energy...."

## LESSONS LEARNED

When planning Bicentennial Hall, Middlebury College insisted that an "outside of the box" approach be taken that emphasized the importance of keeping the building's environmental impacts to a minimum. The college found itself out in front of what typical consultants were prepared to recommend. To bridge the gap, the Environmental Council recommended the establishment of the multi-disciplinary Project Review Committee, consisting of administrators, engineers, faculty, and architects, among others. The Committee provided insight early on in the process into everything from environmentally sensitive building products, to energy-efficient design and other technologies to minimize the building's environmental impact. In its advisory role, the Committee facilitates projects by providing up-front guidance to reduce potential negative impacts, achieve environmental quality, comply with regulations, improve public relations, and advance the objectives of the Middlebury College Master Plan. Overall, one of the most important lessons to emerge from the process is that the administration's support for and employee interest in environmental affairs on campus directly led to the success of Bicentennial Hall and, ultimately, of the Project Review Committee itself.

## FUTURE COMMITMENTS

Middlebury College has a long history of environmental awareness and responsibility that began with the formation of the college's Energy Council in the 1970's. With an expanded agenda and a new name – the Environmental Council – the organization performed a number of long-range planning studies to promote on-campus environmental action, and it has encouraged research by faculty, staff and students. Members of the Council are working on a State of the Environment Report, which will examine the college's greenhouse gas emissions, among other things. The Council is reviewing plans to perform an inventory of greenhouse emissions, and may draw up a climate change action plan later in 2001. The college is developing a policy to reduce the number of days on which air conditioning is operated, and also is looking at the environmental impacts of transportation. Finally, the college has a seat on the Steering Committee of the Vermont Clean Cities Initiative, which is seeking to replace fleet vehicles with alternative fuel vehicles.

Ross Commons, a new dormitory and dining hall scheduled for completion in January 2002, will also feature a variety of advanced environmental design elements, including green-certified wood, locally purchased stone, energy-efficient kitchen hoods, and low-glare but effective outdoor lighting.

## STUDENT AND PUBLIC OUTREACH

Middlebury's Framework for Implementation promotes teaching opportunities by recommending the following:

- Educating building users and visitors about sustainable strategies incorporated into building design, improved construction quality and building site ecology.
- Implementing a resource awareness program to educate faculty, staff and students about their own resource consumption.
- Involving students in projects to examine future environmental opportunities.

The college also has delivered presentations on Bicentennial Hall and the Project Review Committee's Sustainable Design Process at state and national conferences. Several articles about the project have been published, and tours of the hall are offered.

### INSTITUTIONAL PROFILE

Middlebury College is a private liberal arts college situated in northwestern Vermont in the Lake Champlain Basin. The site is rural, located at the western edge of the Green Mountains. The college has about 1,200 employees and 2,000 students. The main campus houses 85 buildings on 350 acres, with 1,800 additional acres at the nearby Bread Loaf campus. The college is Vermont's ninth-largest employer.

### CONTACTS

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**Natural Forest Products**  
[www.forestworld.com/](http://www.forestworld.com/)

**Rainforest Alliance  
SmartWood Program**  
[www.smartwood.org/](http://www.smartwood.org/)

**Vermont Family Forests**  
[www.familyforests.org/](http://www.familyforests.org/)

<sup>1</sup> Certified wood is evaluated against more than 60 criteria to ensure that it is harvested from forests that are under environmentally sound management. The wood is certified through the SmartWood program of the New York-based Rainforest Alliance. The Forest Stewardship Council, an internationally recognized monitoring organization for forest product certification, accredits SmartWood.

<sup>2</sup> This is about 20 percent better insulated than a typical (R-24) roof. The entire building shell also is rated at R-30.

<sup>3</sup> This sets minimum standards for the energy-efficient design of new buildings. It requires that buildings be constructed, operated and maintained in a manner that minimizes the use of energy, without constraining their function, or the comfort or productivity of their occupants.

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### CLEAN AIR-COOL PLANET CASE STUDY RATING

*This case study reduces CO<sub>2</sub> emissions equivalent to the following:*

Avoiding the consumption of 604 barrels of oil per day. (1 barrel = 50 barrels of oil)



OR Taking 46 vehicles off the road per year. (1 car = 10 vehicles)




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Assumptions: 1,093 lbs of CO<sub>2</sub> per barrel of oil. Vehicles are average passenger cars (approximately 20 lbs CO<sub>2</sub> per gallon of gasoline - 22.5 miles per gallon, averaging 16,000 miles per year)