

# Designing EcoHouse

A cross-disciplinary design course at Carleton College  
examines global issues in a campus context  
BY HEATHER BEAL

What happens when you gather college students from a broad array of academic disciplines; equip them with pencils, sketchpads, reference materials, computers, and a building laboratory; then ask them to design a beautiful, comfortable campus residence that “pushes the paradigm of eco-efficient living,” all in 10 weeks?

Ask Richard Strong, facilities director at Carleton College in Northfield, Minnesota, and Gary Wagenbach, director of Carleton’s Environmental

Technology Studies program, who co-teach a cross-disciplinary class for liberal-arts students that fits this description. Titled “Design and Construction of EcoHouse,” the course attempts to bring high-level, theoretical discussions on topics such as global warming and energy policy down to a personal level, where students can relate their individual life choices to broader environmental issues.



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Above left: Instructors Richard Strong (shown) and Gary Wagenbach mix conventional classroom lectures with open and animated discussions to address issues that have “few prescribed solutions.” Above right: Students use “overlaying” to combine their individual research results and narrow site options for EcoHouse. Opposite: Noted green architect William McDonough, FAIA, joined EcoHouse students for an informal discussion over breakfast in April 2004.

Carleton officials first considered constructing an ecologically efficient student residence in 2002 after the college received a capital donation for this purpose. A short time later, a group of students completed an independent-study project that examined sustainable campus living. “Their project raised new questions,” Strong says. “Would college students want to live in an ecologically efficient house? What does *sustainable* mean? To find answers to these questions, we thought, ‘Why not design this house ourselves?’”

After writing a preliminary course description, Strong invited other faculty members to consider collaborating with him. Wagenbach needed no cajoling. It made perfect sense for an architect (Strong) and a biologist (Wagenbach) to co-teach a course aimed at integrating the built and natural environments. However, as they soon learned, completing detailed plans for the EcoHouse class, which they envisioned teaching for up to five consecutive spring quarters, presented a number of challenges.

## A Tin-Foil Blanket

At first students resist the idea of sustainable living,” Strong says. “Some think they’ll have to live in a cave with a candle. Others think they’ll have to shrink the size of their living space.” Strong and Wagenbach address these concerns by encouraging students to first think about how much space, daylight, heating, cooling, power, and other amenities they would need to make a home comfortable; then they ask the students to focus on achieving these goals sustainably. “Beauty and abundance are found in nature,” Strong assures them, “and thus are guiding principles for the design of EcoHouse.”

Different teaching styles posed another challenge for the two instructors, who had never before collaborated. Wagenbach uses an empirical method, while Strong relies heavily on intuition. With a laugh, Strong recalls how Wagenbach once “wrapped a student in tin foil”—at least that’s what it looked like—to explore the concept of heat

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*Above: EcoHouse will likely be constructed in the open area of a thickly foliated site (upper-right quarter of photo), providing residents with a wide-open view of a campus lake and island to the south. Opposite: Jeff Lin (left), who portrayed an indentured servant in the PBS series Colonial House, spoke to students about his sustainable-living experience and later helped construct a cordwood wall in the building lab.*

exchange. In actuality, Wagenbach bundled the student in a space blanket, taped down the edges, then asked for periodic reports on how the young man was feeling.

"He warmed up very quickly," Strong says. "Yet intuitively this made no sense because the thin space blanket doesn't provide much insulation value." Wagenbach explained that the blanket was reflecting long-wave energy created by the student's body. The class also observed that the heat-production cycle escalated because the student couldn't cool himself. "If we had let this go on too long, we would have had to douse his mitochondria with cyanide to stop the heat production," Wagenbach jokes. "Of course, that would have been fatal."

"Luckily, we didn't have to go that far," adds Strong, wryly.

Through experimentation, an essential element in both the scientific and artistic processes, the instructors have grown comfortable learning from each other and from their students. "Gary and I noticed that we dialogued more in class during the second year," Strong says. This classroom dynamic instills a sense that "there are few prescribed solutions" for designing sustainably; as a result, students are more willing to voice their ideas and opinions.

During a lecture about wind roses (diagrams illustrating wind patterns across a site), for example, a student asked, "What makes the wind blow?" Strong answered that variations in low- and high-pressure gradients cause air to flow between them. A geology major then spoke up, explaining how the combination of the earth's rotation and topographical features such as plateaus and mountains generates wind.

“Since the class is open to freshmen through seniors from all disciplines,” Wagenbach says, “we have to respond to the mix of students who walk through the door.”

### Charting a New Course

While the diversity of students enriches the creative experience, it also complicates the planning process for a course taught incrementally over several years. “Since the class is open to freshmen through seniors from all disciplines,” Wagenbach says, “we have to respond to the mix of students who walk through the door.” Thus the instructors have tried to achieve a “structured openness” by blending conventional classroom lectures with guest-speaker presentations, field trips, computer exercises, and hands-on construction activities.

The required-reading list includes books and web sites on topics ranging from biomimicry, permaculture, and regenerative design to the history of the American home, current housing and lifestyle trends, and the values and practices of indigenous peoples. Guest speakers have included architects and engineers specializing in sustainable design, such as Rick Carter, AIA, of LHB; John Carmody, director of the University of Minnesota’s Center for Sustainable Building Research; and David Eijadi, AIA, and Jay Johnson, AIA, from The Weidt Group; as well as people with sustainable-living experience, such as Jeff Lin, who lived off the land while portraying an indentured servant in the PBS series *Colonial House*, and Allan Stanowitz, who built his own cordwood house in La Crescent, Minnesota. In 2004, the students had breakfast with William McDonough, FAIA, noted green architect and coauthor of *Cradle to Cradle: Remaking the Way We Make Things* (2002).

While each segment of the EcoHouse course addresses aesthetics, energy use, life-cycle costs, and the relationship between a building and its site, community, and culture, the course “themes” and two-thirds of the course content vary from year to year. The inaugural class (2004) focused on answering the question: “What is natural for Northfield, Minnesota?” Students researched the history of the

region and reviewed case studies on housing types “native” to North America. Then they experimented with indigenous materials and construction techniques by building and testing three types of natural wall systems: straw bale, rammed earth, and cordwood. They concluded that the straw-bale system was best because it offered the highest insulation value for the lowest energy costs.

The students also used the overlaying approach detailed in Ian McHarg’s *Design with Nature* (1969)—transparencies, each addressing a specific parameter, are placed on the site plan so that unsuitable building locations are obscured and the most desirable is highlighted—to systematically analyze seven possible sites for EcoHouse. Four were subsequently recommended. As the first term progressed, however, the instructors became “subliminally aware” that, even after completing rigorous site analyses, the students seemed “disconnected from the land.”



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GARY WAGENBACH



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## Year Two

In 2005, the instructors narrowed the focus of the course by selecting one site from the four finalists and prescribing straw-bale walls for three sides of a student-built test structure. “We hoped this approach would enable students to gather greater detail about the unique characteristics of a single site and, in turn, design a home that captured and employed the site’s natural energy flows,” says Strong.

To catalyze a debate on the relationship between the built and natural environments, the instructors showed the 2005 class a photo of a five-bedroom house that had recently been constructed near Northfield. The house sat on a five-acre lawn and most of its windows faced north. “We asked if there were any environmental issues we should be concerned about with this house,” Strong says. The two assumed that students would identify at least a few of the issues—for example, the lack of solar orientation—but the students didn’t think anything needed to be changed.

“We were shocked,” Wagenbach says. Notes Strong: “We found that the students could relate to a structure and its characteristics but not its connection to the land,” adding that, on further reflection, he and Wagenbach shouldn’t have been surprised by the students’ response, since “most people in Western countries view achievement of human comfort as disconnected from their surroundings.”

To deepen the students’ understanding of environmental issues, the instructors divided the class into four teams and had the teams research renewable energy sources and technologies while documenting in greater detail the natural characteristics of the EcoHouse site. The students then used this combined information to design a south wall for the test structure that optimizes solar gain and achieves a desired level of natural lighting. While all four teams were required to use translucent polycarbonate and insulated foam panels on the south wall,

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they were free to incorporate thermal massing, light shelves, sun shading, and other eco-efficient strategies into their final designs. In the end, the students concluded that passive-solar design strategies would need to be supplemented by an additional heat source to maintain year-round interior comfort.

## A Positive Influence

In spring 2006, students will design a “living machine” and explore ways to minimize waste that flows into, through, and out of EcoHouse while dealing with any waste created in a sustainable manner. Although the instructors may still be pondering how best to attune students to nature, there is little doubt that the EcoHouse endeavor is taking hold. For example, research leading up to and resulting from the course is now spilling into future Carleton building projects, such as a 40-unit student residence designed by LHB that will break ground in fall 2006. “We’ve proposed incorporating some living-machine ideas into this building’s design, such as separating gray and black water from storm-water drainage systems,” Strong says.

The course has also spawned related classes, including one taught by Wagenbach that explored how to feed the future residents of EcoHouse in a sustainable manner, and independent-study projects, such as the construction of a small section of green roof atop a campus science building and an economic analysis of investing in wind power. “You can only learn so much by thinking about a project,” says Jason Lord, one of two former EcoHouse students who led the green-roof project. “The real education takes place when you actually build it and have to solve problems.”

Strong and Wagenbach attribute the high level of interest in EcoHouse to the fact that designing a home is an ideal way to engage students in the discourse about sustainability. Sociology major Josh Tolkman, who took the 2004 course and served as a teaching assistant the following spring, concurs: “The class provides a practical way to take environmental action, because it aims to improve the quality and efficiency of life.”

“Of course,” Wagenbach adds, “building a tepee and leaving it in a prominent campus location as part of our exploration of indigenous dwellings has helped raise awareness, too. Whenever there’s a teachable moment, we take it.”



JASON LORD AND DAVE HOLMAN



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*Opposite: 2005 EcoHouse students used translucent polycarbonate and insulated foam panels to construct the south wall of a test structure. This page, top: Students from the 2004 class later designed and installed a green roof on a canopy overlooking the loading dock of a campus building. The students first tested plant materials by growing them in wooden boxes (bottom).*