



Green Renovation

By Trisha Swindle

The main goal behind building green is to reduce the potential strain a structure bears on the environment. However, the very act of creating a building takes its toll on the environment. Good property is limited; therefore, existing structures may need to be demolished to make room for the manufacture of the new green building. This makes mountains of waste that must be hauled off to a landfill, adding to the burden of trash our planet endures. An alternative is to restore a historic building. The goal of green building is not in the short term. The added cost of restoration, much like the initial cost of a ground source heat pump (GSHP), will pay for itself through the reduced impact on the environment and in the integrity of the structure.

The city of Cambridge, Mass., took this to heart. In 2004, they began the restoration of the Harvard Grammar School circa 1871 for this purpose. Through their use of an existing structure, the city of Cambridge helped breathe life into a beautiful historic building while protecting the environment by reducing the amount of building materials. Cambridge is proud to be home to the oldest building to receive a Leadership in Energy and Environmental Design (LEED) Gold Certification from the U.S. Green Building Council (USGBC). This award-winning showcase of the historic and advanced technology houses the best of both ideals—the beauty of

the past protecting the environment of our future through the use of technologies such as GSHPs.

Combining Historical Architecture with Technology

New England towns are peppered with stunning historic buildings that are frequently in need of some repair and function. Municipalities putting such buildings to use serve the community by restoring an important piece of local heritage while protecting the environment around them. Bill Hammer of HKT Architects and David Perry Architects Inc., took on the challenge of this extensive renovation. Retrofitting any structure for green technology can be difficult but the historic features of this building needed to be preserved or restored as well.

The restoration cost of the 33,216 square-foot-building was \$7.1 million. Each phase of this plan had to be approved by the Cambridge Neighborhood Historic District Commission. Old photographs from the 1950s guided the architects to restore the unique historic features of this design such as the brick parapets or mansard roof. Finally, the building had to be brought up to current American with Disabilities Act standards through the installation of a new main entry with a two-story entry lobby and elevator access to every floor.

Limiting Waste Materials

Reusing an existing structure automatically reduces the amount of waste material produced during construction. Contractor Consigli Construction is a leader in the field of reducing waste on building projects. According to their Web site, the Annex "is one of five pilot projects in Consigli's waste reduction analysis program, being run in cooperation with the Massachusetts Department of Environmental Protection." Through either on-site separation or reuse, 86 percent of construction debris was recycled. For example, the old brick and concrete were used as paving material, while the wood was chipped for use as fuel in biomass power plants to produce electricity.

Keeping it Cool (or Warm)

Chris Schaffner, Arup engineer, designed and supervised the installation of the GSHP system for the Annex. Carl Orio from Water Energy Distributors, Inc. served as consultant on this project and provided information that led to the choice of an open water-to-water GSHP design. Schaffner said the selected design was the most affordable option as well as being the most energy-efficient choice for this building. Drilling to 1,500 feet, three open-injection wells were installed. These wells required 1,200 feet of four-inch PVC pipe.

Outdoor temperature plays a large role in design choices. A simple answer to this was to install an automatic fixture to monitor the water temperature in the loops. The extreme New England winters will trigger the gauge to flush water in the loops to prevent them from freezing. The eight, 10-ton ClimateMaster heat pumps can be found on the first floor of the building.

GSHPs Working with Solar Energy

Solar photovoltaic (PV) systems are becoming a natural complement to some GSHPs. In this particular



The GSHP system for Harvard Grammar School's renovation is run on electricity generated by a solar photovoltaic system.

system, the electricity generated from the solar panels can be used to run the GSHP thus totally eliminating any outside electricity needs for heating and cooling this building. Jeff Wolfe, CEO of Global Resource Options, designed the 26.5-kilowatt solar PV system. Wolfe along with Dan Kinney, Andy Olson and Howie Michealson installed this project that will supply about 10 percent of the building's electricity. According to Sylvan Groth, marketing assistant at GRO, the system was chosen for the Annex to "maximize the amount of photovoltaic panels to fit on the roof, thereby maximizing the amount of clean, solar electricity the system could produce." As with a GSHP, the design was also chosen due to its ability to be hidden from public view. The panels are set on the roof in such a way as to minimize public view much like the less bulky GSHPs can be tucked away in a utility room instead of outside of the building.

The Massachusetts Technology Collaborative, which administers the Commonwealth's Renewable Energy Trust, helped fund the solar PV system installation through a \$337,500 grant. According to the Annex Web site, "Since August 2004, the PV system has produced 19,415 kilowatt-hours which is valued at \$2,106 and reduces carbon dioxide emission by 17,417 pounds."

Sunlight—Friend or Foe

Solar PV systems harness the sun's power to produce electricity. Although an abundant resource, the sun can present dilemmas that need to be remedied in a green building. To reduce the reliance on indoor lighting, 90 percent of all office space has outdoor views. For additional lighting the Annex Web site states, "skylights were restored and a light well has been created between the third and fourth floors." Functional low-e, double-glazed windowpanes were installed to reduce heat loss/gain and protect the Annex occupants from ultraviolet radiation.

Schaffner designed an "intelligent" lighting system for the building. Each room is equipped with a sensor that automatically adjusts the artificial lighting by how much sunlight is available. These sensors also automatically shut the lights off when the room is unused. Schaffner took this lighting system one step further; each room can be uniquely adjusted to meet the needs of the individual employees. Attaining the balance between too much solar gain while still benefiting from natural sunlight can be a challenge. Using "intelligent" light-

ing and other green choices lead to achieving this state of equilibrium.

The Rest of the Story

Great care was taken in the design of each aspect of this building. Cambridge wanted to ensure this design served as an example to the community of what is possible when history and state-of-the-art technology meet. Green technology does not just stop with the structure; the landscape that borders the Annex was created with care for the environment as well. Hammer Design, a landscape architecture firm put together a plan that would reduce water usage by 50 percent while still providing a beautiful, lush area outside the building. Recycled materials can be found throughout the building, such as carpet, ceiling materials and steel framing. According to the city, the carpet will be returned to the manufacturer to be recycled when replaced. Over 50 percent of the wood used came from forests certified by the Forest Stewardship Council as practicing sustainable forestry. An Energy Star rated roof coated with a highly reflective/low emissive material was put in place to minimize heat absorption.



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Healthy Employees

The Cambridge City Hall Annex has design features that ensure the health of its employees as well as the environment. Sensors were installed to monitor the carbon dioxide levels in the building. All paints, adhesives, carpets and wood products contain only low volatile organic compounds. Water-based products were used whenever possible.

To encourage employees to seek alternative transportation, the Annex subsidizes mass transit passes and employs an on-site transportation coordinator. Two bicycles are also available for employees to ride during the day or if an employee rides their bike to work, an indoor storage room is available as well as shower facilities. Visitors can park their bikes at the outdoor bike racks. Employees making use of the Internet-based carpool matching service or carpooling on their own have the added bonus of two reserved parking spaces. Finally, the Community Development Department staff can use ZipCar-sharing for work travel.

Civic-Minded Art

The Cambridge Arts Council hired Mike Glier to develop art inside the Annex that describes the different departments. The artist's aim was to use large-scale paintings to "transform the two-story space into an indoor 'garden' and evoke the relationships between civic goals, 'green' design, historic preservation and public transportation" states the Annex brochure. Glier began his research for this project in 2002 by consulting with the five departments that would occupy the Annex. The departments he represented in his acrylic and charcoal paintings are Community Development, Traffic, Parking and Transportation, Cambridge Arts Council, the Animal Commission and the Conservation Commission.

Award Winning

The city of Cambridge chose to renovate one of its historic buildings to help show the community that it is possible to build green and still be cost effective. The time and care spent renovating the historic Harvard School building paid off. The honors awarded to the Annex restoration are as follows:

1. Massachusetts Historical Commission Preservation Award 2005
2. Environmental Design and Construction Magazine, Excellence in Design Award 2005
3. Build New England Award, Associated General Contractors 2005
4. Massachusetts Municipal Association Innovation Award 2004
5. Cambridge Historical Commission Preservation Award 2004
6. Building Design and Construction Magazine, Reconstruction and Renovation Award 2004

Applying and winning such awards helps further educate the public on the benefits and affordability of technology such as GSHPs or solar PV systems. Restoring historic buildings with green practices preserves a piece of our past while helping ensure the environment of our future.

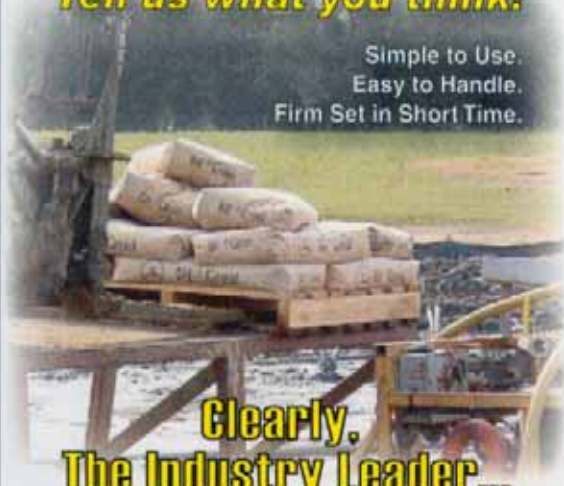


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