

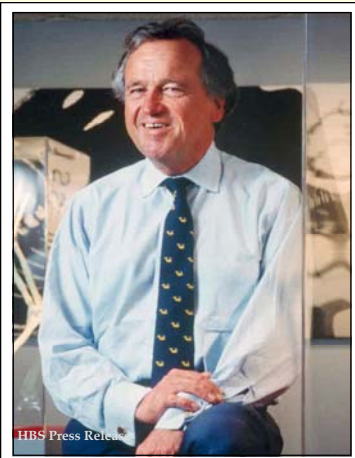


Harvard | Business | School Wyss Hall Renovation



Photo by: Nathan Gauthier

Wyss Hall (formerly Sherman Hall) is a 5,000 square foot office renovation completed in August 2006. The building is home to the Harvard Business School's doctoral research programs. The renovation of the 75 year old location was made possible through a generous donation by Hansjeorg Wyss (MBA '65), who has, among many other endeavors, facilitated the development of environmental management cases for the MBA program. Wyss is particularly committed to conservation and other environmental concerns and is a member of several environmental organizations, including the Southern Utah Wilderness Alliance, the Wilderness Society, and the Grand Canyon Trust. The school felt it especially appropriate that they honor Hansjeorg's gift by making Wyss Hall an example of environmentally responsible design and construction.



The renovation of the former Sherman Hall was made possible by a generous gift from Hansjeorg Wyss (MBA '65)

Boston architectural firm Baker Design Group, Inc. was selected to lead the design team. BLW Engineers, Inc. was the MEP engineers and Richard White Sons the construction manager. All three groups had worked on previous HBS projects. BLW and Richard White Sons were selected based in part on their performance during the renovation of Hamilton Hall, a LEED Gold Residence Hall. Baker Design was simultaneously involved in the renovations of Aldrich Hall, a soon-to-be LEED Certified classroom building. Since sustainability was a priority from the beginning, the school contracted Harvard Green Campus Initiative to facilitate green building design

and administer the LEED documentation process and the Institution Recycling Network for construction and demolition waste management.

The goal of the renovation was to providing a more attractive, comfortable, productive, healthy and environmentally friendly space for doctoral research. An additional goal was for Wyss Hall to become the second building at the Harvard Business School to achieve the US Green Building Council's LEED Gold certification. The project used the LEED New Construction version 2.1 Rating System and was the first at Harvard to use LEED Online.

Project Team

Owner

Harvard Business School

Architect

Baker Design Group, Inc.

Interior Design

Lucas Stefura Interiors

HVAC Engineer

BLW Engineering

Electrical Engineer

BLW Engineering

Landscape Architect

Halvorson Company

Contractor

Richard White Sons

Commissioning Agent

MAW Consulting, Inc.

C&D Waste Consultant

Institution Recycling Network

Green Building Consultant

Harvard Green Campus Initiative



SUSTAINABLE FEATURES

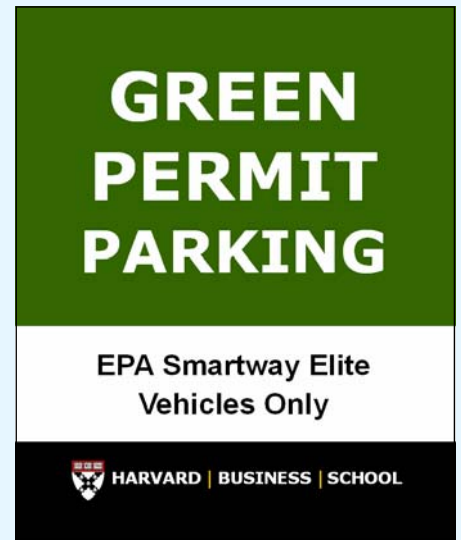


The renovation of Wyss Hall focused on green building design from very early in the design process. The LEED NC v2.1 Rating System was used to help evaluate green strategies. Often, preliminary designs were altered when decisions were reviewed in terms of environmental impact, occupant health and comfort, or long-term building operation. The following is an abbreviated list of sustainable features incorporated into the project.

Project Site

Alternative Transportation

Like all HBS properties, Wyss Hall is in close proximity to MBTA and Harvard bus routes, an MBTA subway station and bicycle racks and shower facilities. In addition, the campus has a contract with Zipcar for hybrid shared vehicles to be parked on campus and all Harvard affiliates memberships are subsidized by the university. The Business School also offers preferred parking to EPA SmartWay Elite low-emitting and fuel-efficient vehicles. All Harvard affiliates are offered 50% discounted parking permits for 2 person carpools and a 75% discount



for 3 person carpools. The university subsidizes public transportation passes, identifies preferred bike routes, offers a guaranteed ride home to carpool participants, reserves carpool parking spaces, offers free campus-wide shuttles, and more to further reduce the use of single occupant vehicles. The program has been so successful that the percentage of drive alone trips has been reduced by over 37% since 1998.

Sustainability Strategies

- Groundwater recharge drywells
- 73% reduction in irrigation water use
- 41% reduction in domestic water use
- 18% more energy efficient than standard building
- Occupancy sensors throughout building
- 96% of C&D waste diverted from landfills
- 66% of material manufactured locally
- 12% of raw materials harvested locally
- 7% of materials from recycled content
- Excellent daylighting and views throughout
- Construction IAQ Management Plan
- Low VOC-emitting materials
- Green cleaning contract
- 100% of electricity offset by Renewable Certificates

Stormwater

Harvard Business School used the Wyss Hall renovation as an opportunity to improve stormwater management. Prior to the renovation,

all rainwater falling on the building's roof was directed to the city storm drains. The project team re-directed roof run-off to a groundwater recharge tank. The addition of the drywell has reduced the imperviousness of the site by more than 35%. The project also directs rainwater that falls on its sidewalks to sheet flow across vegetated filter strips to improve water quality. Stormwater runoff quantity and quality is further improved by use of an extremely efficient, weather-station dependant irrigation system and the adoption of best management practices for fertilization.

Light Pollution

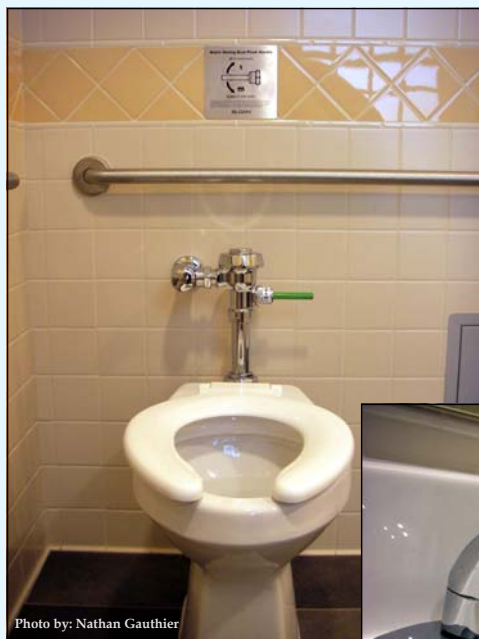
When the Wyss Hall team evaluated the existing building-mounted site lighting, it was determined that the historic fixtures common throughout the Business School campus allowed a substantial amount of up-lighting in addition to not being very energy efficient. The team sent the fixtures to Available Light to retrofit and then to ITL Testing Lab to verify lighting characteristics. The upgraded fixtures have less than 1% uplighting and utilize a significantly more efficient lamp/ballast combination. As a result of this research, HBS has adopted a campus-wide exterior lighting master plan and all exterior lighting is being reviewed in terms of safety, uplighting, horizontal light trespass, and energy efficiency.



Water Use

Efficient Irrigation System

When evaluating the Wyss Hall irrigation needs, landscape architect Halvorson Company paired with Irrigation Consulting, Inc. to ensure efficient use of potable water. The Harvard Business School uses a Rain Bird Maxicom2 Central Controller, Weather Stations, and 1800-PRS Pressure Regulating Sprinklers to achieve greater than 73% water savings compared to conventional irrigation systems. Station operating times are automatically adjusted in response to changing daily ET (evapotranspiration) values supplied by a Rain Bird Weather Station. The Pressure Regulating Sprinklers' in-stem pressure regulator maintains a constant pressure of 30-gpm at the sprinkler nozzle and eliminates misting and fogging caused by high pressure. Installation of the Rain-Bird system took advantage of a Harvard University 0% Green Campus Loan for existing buildings and the loan is paid back from the resulting operating savings.



Domestic Water Use Reduction

The project uses Sloan UpperCut dual-flush flushometer toilets and ultra low-flow Chicago Faucets kitchen and lavatory faucets. The toilets offer a 1.6 gallon "solid" flush and a 1.1 gallon "liquid" flush to reduce water consumption and have informative signage to educate occupants. The sinks distribute water at 0.5 gallons per minute, compared to the 2.5 gallon per minute standard. Combined, these features save more than 41% of potable water compared to a standard building.



Energy Use

Commissioning

Wyss Hall has employed an independent commissioning agent, MAW Commissioning, Inc., since very early in the design phase to review all mechanical, electrical and plumbing designs. In addition, HBS facilities engineers review all proposed designs at the Business School and attend the majority of design and construction meetings. The two sets of design reviews help to ensure energy efficiency opportunities are identified and operations and maintenance concerns are addressed early in the design.



Improved Energy Efficiency

BLW Engineers worked with the design team to evaluate a number of options to improve energy efficiency. The project uses Hansa Smart Panels for ventilation and induction cooling to efficiently deliver cool dry air to all spaces. Heating is provided by fin tube radiation. Both hot water and chilled water are provided from a central plant. In order to save heating, cooling and fan energy, ventilation rates in all spaces and the amount of outside air being introduced is determined by CO2 sensors. The building will also reduce its hot water consumption through reduced use of domestic hot water via low-flow sinks. Almost all light in the building is provided by efficient fluorescent lamps and controlled by occupancy sensors. Originally, the project planned to re-use existing windows but an analysis by BLW demonstrated the energy and occupant comfort benefits to be had by replacing existing windows with new windows with high performance glazing. Overall, the Wyss Hall project will save at least 18% in energy cost compared to a standard ASHRAE 90.1-1999 compliant building.



Enhanced Metering and Verification

HBS operations staff will benefit from having real-time and historic utility demand and consumption data for all major systems in Wyss Hall. Building chilled water, heating hot water and domestic hot water will all be metered for volume and temperature change. Domestic cold water will be metered for volume. The air economizer cycle shall be recorded, as will outside air enthalpy and electricity demand and consumption, which is being submetered by all major building electrical systems. All meter data will be fed to the Energy Management System and recorded and trended for comparison to historic data and the energy model predictions. Any deviations from the energy model will be identified and the model will be edited accordingly to get a true sense of the building's utility savings. The US Department of Energy's O&M Best Practices Guide, Release 2.0 states that this level of metering and data analysis saves between 5% to 15% on utility consumption.





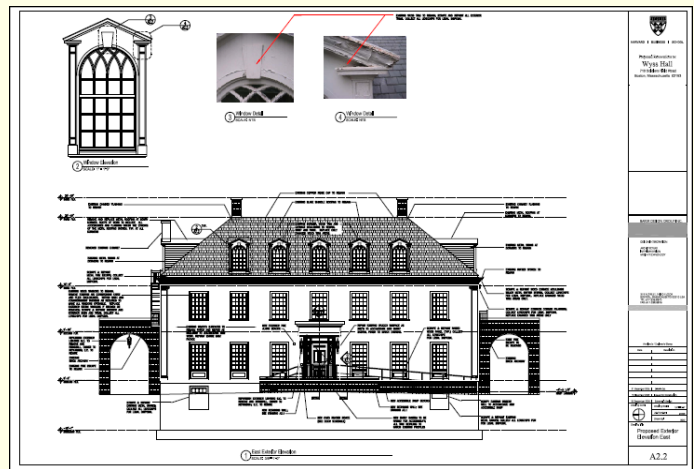
Green Power

One hundred percent of Wyss Halls predicted electricity consumption over the next two years has been offset by the purchase of Renewable Energy Certificates (RECs) from Sterling Planet. These RECs represent the environmental attributes associated with wind energy produced in Minnesota and are Green-e certified. Green-e is the nation's leading independent certification and verification program from the Center for Resource Solutions. RECs are purchased to encourage renewable energy development and to do so in the most cost effective manner.

Materials Use

Building Reuse

Harvard Business School and the Wyss Hall project team realize that the most sustainable means of constructing a building is to preserve what has already been built. When renovating Wyss Hall, the team was able to maintain over 98% of the building's structural elements, 97% of the building's shell, and 19% of the interior elements. This was done while repairing damaged areas, adding insulation and energy efficient windows, and adding an elevator and making the building more accessible.

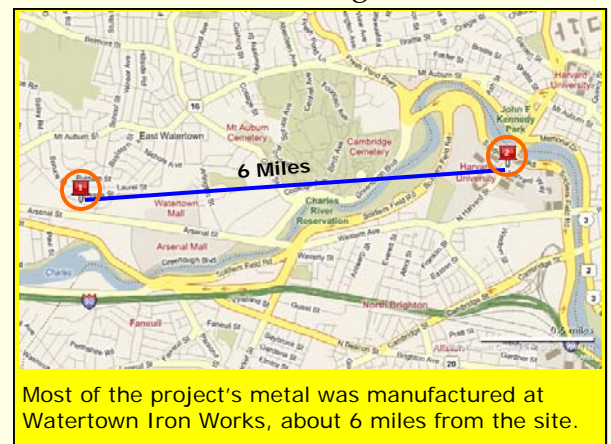


C&D Waste Diversion

The Institution Recycling Network was hired as the project's Waste Management and Construction Indoor Air Quality consultant. They worked with Richard White Sons to achieve an amazing waste diversion rate. Of the 259 tons of C&D waste generated, only 10 tons were disposed of in a landfill. The remaining 249 tons were salvaged or recycled. C&D waste management resulted in emissions reduction of 66 metric tons of carbon dioxide, according to the Northeast Recycling Council's figures. Waste diversion was also calculated to save 506 MBTU of energy, equivalent to 87 barrels of oil. Richard White Sons and Institution Recycling Network achieved similar waste diversion rates on the HBS Hamilton Hall project, where they diverted 97% of the 1,855 tons of waste generated.

Local Materials Selection

The use of locally manufactured materials is critical to sustainable design and construction. Environmental impacts associated with transportation of heavy building materials are tremendous. The Wyss Hall team was able to source more than 66% of non-MEP materials from within 500 miles of the site. Additionally, more than 12% of the raw materials that went into manufacturing these materials could be confirmed to be harvested within 500 miles of the project site.



Most of the project's metal was manufactured at Watertown Iron Works, about 6 miles from the site.

Recycled Materials

Richard White Sons tracked the recycled content of all materials installed on the project. While the project team chose not to specify materials with high recycled content if it would require additional transportation, Wyss Hall was still constructed with more than 7% of the non-MEP materials consisting of recycled content according to the USGBC's LEED calculation method. The majority of recycled content came from metals, especially steel, and gypsum wall board, though the team chose to utilize locally produced wall board with a slightly lower recycled content than what is available from manufacturing locations located further away.



Photo by: Andrea Ruedy

Indoor Air Quality

Demand Control Ventilation

In order to save energy and ensure adequate volumes of fresh air, all ventilation in Wyss Hall is controlled by CO₂. Each of the 13 occupied space in the building has a wall mounted carbon dioxide sensor. The building energy management system monitors the carbon dioxide levels and modulates the air handling unit indoor air, return air and exhaust air dampers from a minimum outdoor air volume to a maximum outdoor air volume to maintain carbon dioxide levels below the 800 ppm adjustable setpoint. If CO₂ levels were rise beyond 800 ppm, the EMS would send an alarm to HBS facilities personnel to notify them that the system isn't operating correctly.



Photo by: Nathan Gauthier

Low-VOC Materials

The design team targeted low-VOC adhesives,

sealants, paints, carpets and composite wood for the Wyss Hall project. Working with the contractor, they were able to use materials that had very little off-gassing of volatile organic compounds (VOCs). All paint in the building is from Benjamin Moore's EcoSpec line. The carpet is certified by the Carpet and Rug Institute's Green Label program and the carpet adhesive is solvent free and has zero VOCs. All composite wood on the project was either Sierra Pine's Medite II medium density fiberboard or Hoover's PyroGuard, which is made with Georgia Pacific plywood. Both products are bound with urea-formaldehyde free adhesives.



Photo by: Nathan Gauthier



Construction IAQ Management Plan

Richard White Sons worked with Institution Recycling Network to develop an Indoor Air Quality Management Plan for use during construction. For guidance, they followed the SMACNA IAQ Guidelines for Occupied Buildings under Construction, 1995. Air quality was maintained by protecting HVAC systems, controlling sources of contamination, interrupting the pathways between air contaminants and occupied spaces, employing excellent job site cleanliness, and by scheduling the use of potential contaminants prior to the installation of absorptive materials that would slowly off-gas the contaminants over time. To verify the plan's effectiveness as well as the success of the design team's selection of low-VOC products, Environmental Health, Inc. was commissioned to test the quality of the indoor air prior to occupancy. Wyss Hall was shown to have levels of formaldehyde, particulate matter, total VOC's and 4-PCH well below published recommendations.

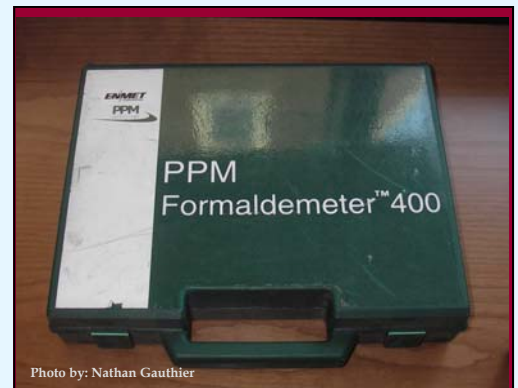


Photo by: Nathan Gauthier

Phil Terrell of Environmental Health, Inc. tested the air quality of Wyss Hall. He tested for particulate mater, VOCs, 4-PCH, and formaldehyde, and were at safe levels.



Photo by: Nathan Gauthier

Individual temperature and lighting control is important to occupant comfort and productivity and to energy efficiency. Often, office buildings will share temperature or lighting controls between spaces in order to save cost initially, despite the fact that some occupants will be uncomfortable and over-heated, cooled, or lighted. Wyss Hall provides individual lighting and temperature controls to all spaces. Each room in the building has operable windows, a digital thermometer that controls a Hansa Smart Panel air conditioner and fin tube radiation, and at least one light switch that is controlled by an occupancy sensor. Common rooms have multiple lighting scenes with dimmers so lighting can be precisely controlled.

Controllability of Indoor Conditions

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Access to Daylight

The narrow footprint and distribution of space over 4 floors helps contribute to the high number of windows to provide daylight and views to the outside. When choosing replacement windows for Wyss Hall, the design team considered the glazing's visible transmittance to ensure abundance daylight penetrates the building's interior. In all, 89% of occupied spaces receive at least 2% of the visible light available outside. On a sunny day, this is usually enough to forgo turning on the electric lighting. More than 91% of the spaces have a direct view of a window.

Innovation

Exemplary Recycling Rates

Harvard Business School provides collection sites for paper, cardboard, and bottles and cans in Wyss Hall and all other buildings around campus. HBS recycled 248 tons of these items during FY '06. Harvard Recycling and Waste Management, along with their sub-contractors, also collect additional items as needed, such as wooden pallets, used computer equipment, old furnishings, surplus supplies, and food waste for composting from the Shad Hall cafeteria and grill. These materials accounted for an additional 393 tons

of recycling. In addition, HBS composted 167 tons of landscaping waste. In all, HBS recycled, composted, or salvaged over 48% of its waste in the 2006 fiscal year.

Occupant Education Campaigns

HBS has developed two educational outreach programs that focus on sustainable living and use the HBS campus as a learning laboratory. One education program, the Graduate Green Living Program, focuses on all HBS students and the other, the Green Team, targets HBS staff.

Both select champions to promote sustainability in their dormitories, classrooms, or departments. In the case of the Graduate Green Living Program, the green representatives must go through a competitive application process and are then compensated for their time, allowing for additional accountability and motivation. Green Team members are encouraged to participate by HBS department heads. Both programs are coordinated by paid staff to educate the participants, suggest topics and methods of outreach, and monitor the programs' progress.

Project Details

Building Type: Graduate Research
Address: 710 Soldiers Field Rd.
City: Boston
State: Massachusetts
Construction: April '06 to Aug. '06
Square Feet: 5,000
Levels: 3 above & 1 below grade

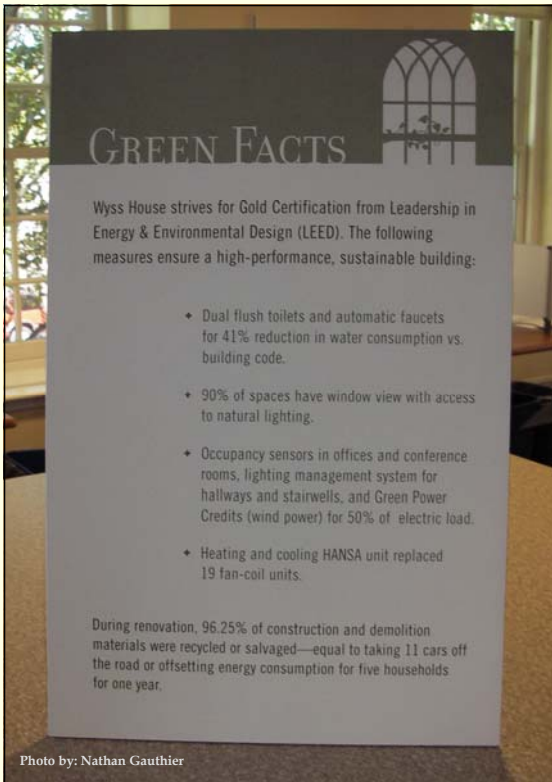


Photo by: Nathan Gauthier
Meryl Brott of Harvard Green Campus Initiative works with the Graduate Green Living Program to improve the sustainability of HBS students.



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