HBS Esteves Hall Executive Education Residence
Harvard Way, Boston, MA 02163
Project Profile

LEED-CI v3
LEED Platinum
2015

The Esteves Hall Executive Education Residence facility serves as a model for high performance building design on the Harvard Business School (HBS) campus. The project's renovation is centered on creating a healthy and sustainable learning, living and working environment that is focused on human comfort, energy and water conservation, and environmental stewardship.

The 6-story, 75,429 square foot multi-use building, located to the west of the Charles River, provides living and learning spaces for the HBS Executive Education Program. Esteves Hall houses 20 living groups with 165 bedrooms and associated living group lounges, reception lounges, and administrative offices.

Photo Copyright Susan Young, Harvard Business School, 2015

The project team applied an integrated approach to sustainable design, which incorporated environmental strategies that influenced all aspects of the building's design. The site and landscape were designed to reduce stormwater runoff and create a comfortable outdoor environment. Building envelope upgrades were designed to meet a high performance target for occupant comfort while reducing total energy use of the building. The energy efficient lighting system creates well-lit places for students and staff while also reducing energy consumption via daylight and occupancy sensors . The high efficiency HVAC system provides comfort, high indoor air quality, user controls, and energy conservation, while the plumbing design strategy conserves potable water use. The project design achieved LEED Platinum certification.

LEED® Facts

Harvard Business School
Esteves Hall Executive Education Residence

Location	Boston, MA
Rating System	LEED-CI v3
Certification Awarded	Platinum
Total Points Awarded	85/110
Sustainable Sites	21/21
Water Efficiency	11/11
Energy and Atmosphere	28/37
Materials and Resources	4/14
Indoor Environmental Quality	12/17
Innovation and Design	5/6
Regional Priority	4/4

Project Metrics

43% percent water savings compared to an Energy Policy Act of 1992 baseline

98% percent of installed equipment and appliances are Energy Star certified

30% reduction in installed lighting power density (LPD) compared to ASHRAE 90.1-2007

55% percent in annual potable water used for landscape irrigation

96% of individual spaces, including bedrooms, have individual lighting controls

96% of individual spaces, including bedrooms, have individual thermal comfort controls

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PROJECT OVERVIEW

Photo Copyright Susan Young, Harvard Business School, 2015

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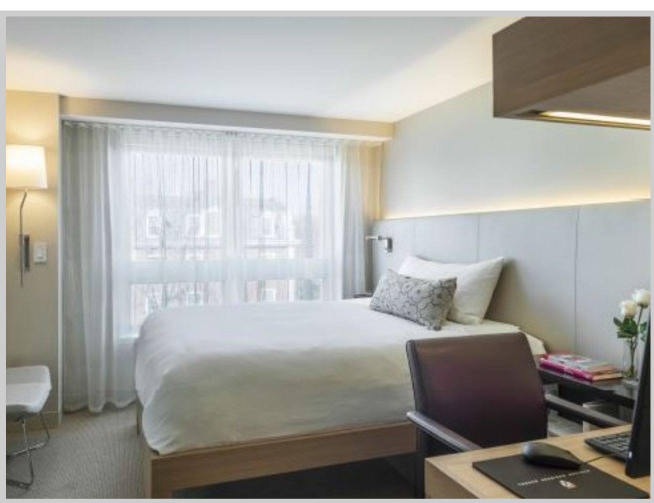


Photo Copyright Richard Mandelkorn, 2015

Rooftop Solar Thermal System—Photo Copyright Kingspan Environmental 2015

PROJECT TEAM

Owner	Harvard Business School
Project Manager	CSL Consultants
Architect	CBT Architects
MEP Engineer	Vanderweil Engineers
Contractor	Lee Kennedy Company
Commissioning Authority	BR+A Engineers
Sustainability Consultant	Harvard Green Building Services

ENERGY EFFICIENCY AND INDOOR ENVIRONMENTAL QUALITY

MECHANICAL AND ELECTRICAL SYSTEMS

ECM 1: High Efficiency Fan Coil Units (Living Groups and Bedrooms)

ECM 2: Enthalpy Recovery System

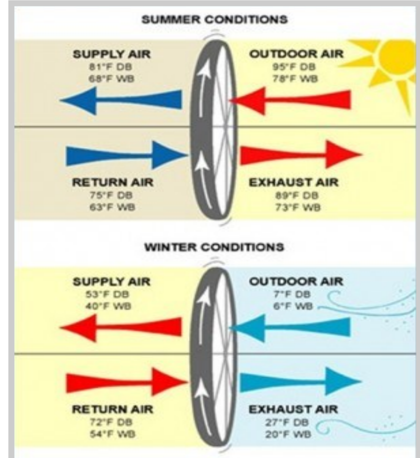
ECM 3: Window Sensors

ECM 4: Energy Efficient Lighting

ECM 5: Occupancy Sensors

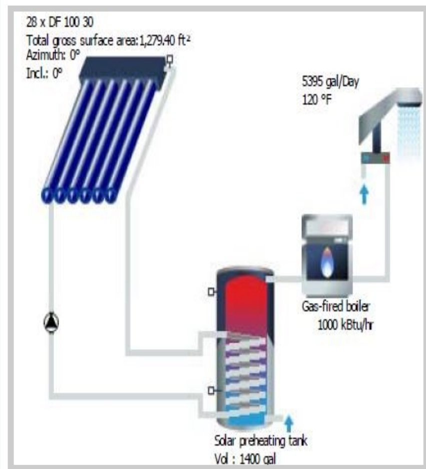
ECM 6: Solar Thermal Hot Water System

The overall strategy of the HVAC system design was to reduce energy use through the installation of high efficiency equipment and controls. The fans are controlled by variable frequency drives and have variable air volume boxes downstream of the supply fans in order to provide ventilation. Occupancy sensors tied to the fan coil units installed in the bedroom and living areas control temperature setpoints and reduce HVAC system energy when these spaces are unoccupied. Furthermore, window sensors shut down the fan coil units when the windows are opened and CO_2 sensors were installed in densely occupied spaces in order to reduce energy consumption. The HVAC system also includes an enthalpy recovery system that recovers energy from the exhaust air to precondition ventilation air (for dedicated outdoor air units). All water-side systems in the building have variable flow pumping.



Typical Energy Exchange Through an Enthalpy Wheel: Copyright DAC Sales (http://www.dac-hvac.com/energy-recovery/energy-recovery-wheels-what-is-an-enthalpy-wheel/), 2012

The solar thermal system uses 28 Kingspan DF100 30 'direct flow' style evacuated tube collectors which use energy provided by the sun to create domestic hot water. The system can store up to 1,560 gallons of solar thermal hot water and is estimated to generate enough energy to lower steam usage by 338 MMBtu annually, which is equivalent to reducing GHG emissions by 24.8 MTCDE.



Solar Thermal System Graphic—Kingspan Solar, 2015

All lighting in the building is energy efficient fluorescent or LED type. Lighting controls were installed throughout the building including vacancy sensors for living areas and specific controls for living group and common spaces. New electrical metering of distribution panels serving lighting, HVAC, and receptacle loads was also installed.

The building is provided with meters for all of the utilities serving the building (steam condensate, heating load, chilled water, electricity), along with submetering of the lighting and plug loads on a representative floor wing. This level of metering will be used by HBS to track the energy usage of Esteves Hall and verify if the energy consumption estimated during the design stage of the project was accurate.

INDOOR ENVIRONMENTAL QUALITY

The high indoor environmental quality of the Esteves Hall building was a significant focus of the project. The selection of low chemical-emitting building and finish materials, as well as appropriate construction measures to prevent mold and mildew growth within the building ensure a high level of indoor air quality, and thus occupant health, throughout the project. All chemical use spaces have auto closing doors as well as compliant exhaust systems. To reduce contaminants brought in from the outdoors, all main entryways have grills or floor mats. Other strategies to increase the indoor environmental quality addressed the lighting and thermal comfort of the space. These included:

- High efficiency lighting with appropriate light levels
- Filtered outdoor air for ventilation
- Occupancy sensors and controls
- Daylight access and views
- Triple glazed windows installed on Northern side of building

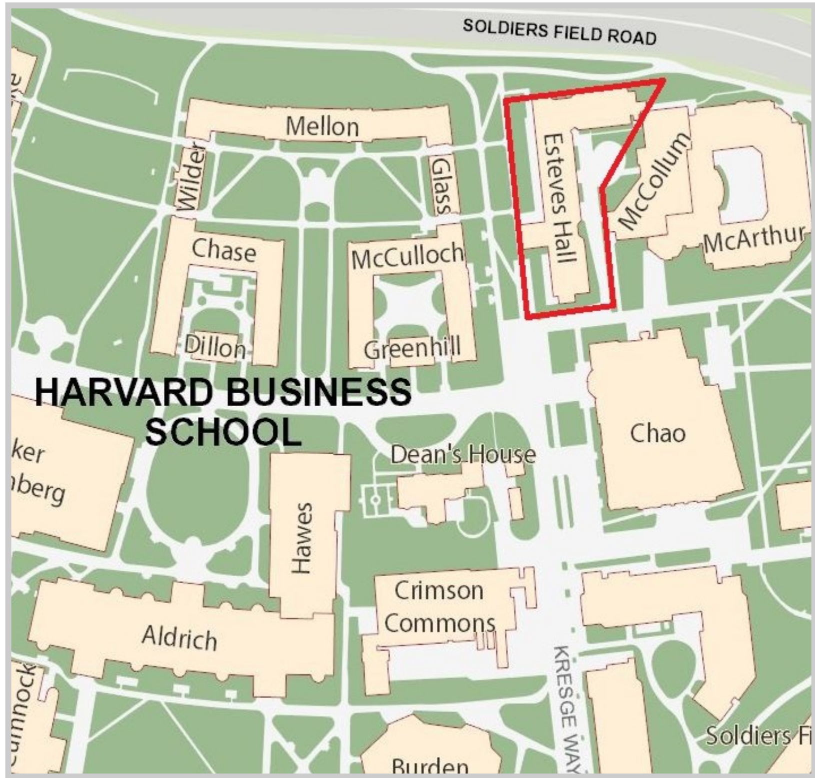
Landscape and Site

The Esteves Hall landscape and site are designed to be integrated into the Harvard Business School campus and surrounding community. The design is centered on reducing and filtering stormwater runoff, mitigating the urban heat island effect, and creating a comfortable outdoor environment around Esteves Hall.

The proximity to the Charles River makes stormwater management a priority for the project. Using a Jellyfish Model, the site was designed to filter sediments and phosphorous. Infiltration basins on the site then slowly release stormwater during off peak hours. This system will help reduce peak stormwater run-off rates to ease the burden on the local infrastructure. In addition, stormwater is also managed through the use of porous pavement.

The project's site design strategy to have limited hardscape and a vast vegetated area on the ground contributes to reducing the urban heat island effect. The design also included a high albedo roof membrane, pavers with high SRI values, and increased shading of the hardscape areas.

For most of the landscaped areas, native plant species were used in order to help reduce the need for non-natural fertilizers and pesticides as well as decrease the need for irrigation.



Plumbing Systems and Potable Water Use Reduction

1.28 GPF Toilet: Copyright American Standard, 2012

0.125 GPF Urinal: Copyright American Standard, 2012

Decreasing the demand for potable water is the first step towards sustainable water management. Sinks, toilets, urinals, showers, and irrigation systems that are designed to use less water than typical fixtures and systems are widely available and when combined with conscientious occupant use patterns and controls, can result in a large reduction in water use.

Some of the water conservation strategies incorporated in the project include:

- Low-flow plumbing fixtures (urinals: 0.125 GPF; toilets: 1.28 GPF; showers: 1.5 GPM; lavatory faucets: 0.5 GPM)
- Water efficient appliances
- Water efficient irrigation system

These strategies led to a 43% reduction in water use, compared to the EPAct 1992 baseline.

PRODUCTS AND MATERIALS

Materials for the Esteves Hall project were selected for their high recycled content, and whenever possible, local extraction and manufacture. Additionally, the majority of building woodwork is Forest Stewardship Council (FSC) certified wood, which comes from sustainably managed forests. Recycled materials can either be post-consumer (material that has been through the public recycling process) or pre-consumer (material that is a by-product of manufacturing). Local materials can be environmentally preferable because they reduce transportation energy and support local economies. The material selection process was also driven by the goal of creating a healthy working environment that will improve occupant productivity and well-being. The design of the building interior can significantly contribute to this project goal.

The use of green building materials and along with high quality construction methods can help achieve not only LEED points but also support the local community. Making sustainable choices about the materials that went into Esteves Hall allowed the project to have a positive impact on both building occupants and the building industry.

Roxul Acoustical Fire Batt Insulation

- 75% pre-consumer recycled content
- Manufactured 454 miles from site

Armstrong OPTIMA Open Plan

- 12% post-consumer recycled content
- 59% pre-consumer recycled content

LATICRETE 9235 Membrane

- Low-VOC: 2.4 g/L
- GREENGUARD Certified

Bull Moose Tube HSS Tubing

- 57% post-consumer recycled content
- 38% pre-consumer recycled content
- Manufactured 488 miles from site
- Materials extracted 282 miles from site

KEY HIGHLIGHTS

44% recycled materials (post-consumer content plus one-half of pre-consumer content) value as a percentage of total materials value

14% regional materials (manufactured within 500 miles) value as a percentage of total materials value

100% interior flooring materials, finishes, and adhesives are low emitting

100% low-VOC, or no-VOC adhesives and sealants, were used

82% of construction waste diverted from landfill via recycling and reuse

Please note that while many products are described in this project profile, these are provided for informational purposes only, to show a representative sample of what was included in this project. Harvard University and its affiliates do not specifically endorse nor recommend any of the products listed in this project profile and this profile may not be used in commercial or political materials, advertisements, emails, products, promotions that in any way suggests approval or endorsement of Harvard University.

Project Scorecard

LEED FOR COMMERCIAL INTERIORS (V2009)

ATTEMPTED: 85, DENIED: 0, PENDING: 0, AWARDED: 85 OF 110 POINTS

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SUSTAINABLE SITES	21 OF 21
SSc1 Site Selection	5 / 5
SSc2 Development Density and Community Connectivity	6 / 6
SSc3.1Alternative Transportation-Public Transportation Access	6 / 6
SSc3.2Alternative Transportation-Bicycle Storage and Changing Room	2 / 2
SSc3.3Alternative Transportation-Parking Availability	2 / 2

WATER EFFICIENCY	11 OF 11
WEp1 Water Use Reduction-20% Reduction	Y
WEc1 Water Use Reduction	11 / 11

ENERGY AND ATMOSPHERE	28 OF 37
EAp1 Fundamental Commissioning of the Building Energy Systems	Y
EAp2 Minimum Energy Performance	Y
EAp3 Fundamental Refrigerant Mgmt	Y
EAc1.1Optimize Energy Performance-Lighting Power	4 / 5
EAc1.2Optimize Energy Performance-Lighting Controls	0 / 3
EAc1.3Optimize Energy Performance-HVAC	5 / 10
EAc1.4Optimize Energy Performance-Equipment and Appliances	4 / 4
EAc2 Enhanced Commissioning	5 / 5
EAc3 Measurement and Verification	5 / 5
EAc4 Green Power	5 / 5

MATERIALS AND RESOURCES	4 OF 14
MRp1 Storage and Collection of Recyclables	Y
MRc1.1Tenant Space-Long-Term Commitment	1 / 1
MRc1.2Building Reuse	0 / 2
MRc2 Construction Waste Mgmt	2 / 2
MRc3.1Materials Reuse	0 / 2
MRc3.2Materials Reuse-Furniture and Furnishings	0 / 1
MRc4 Recycled Content	1 / 2
MRc5 Regional Materials	0 / 2
MRc6 Rapidly Renewable Materials	0 / 1
MRc7 Certified Wood	0 / 1

INDOOR ENVIRONMENTAL QUALITY	12 OF 17
IEQp1 Minimum IAQ Performance	Y
IEQp2 Environmental Tobacco Smoke (ETS) Control	Y
IEQc1 Outdoor Air Delivery Monitoring	1 / 1
IEQc2 Increased Ventilation	0 / 1
IEQc3.1Construction IAQ Mgmt Plan-During Construction	1 / 1
IEQc3.2Construction IAQ Mgmt Plan-Before Occupancy	1 / 1
IEQc4.1Low-Emitting Materials-Adhesives and Sealants	1 / 1
IEQc4.2Low-Emitting Materials-Paints and Coatings	1 / 1
IEQc4.3Low-Emitting Materials-Flooring Systems	1 / 1
IEQc4.4Low-Emitting Materials-Composite Wood and Agrifiber Products	0 / 1
IEQc4.5Low-Emitting Materials-Systems Furniture and Seating	0 / 1
IEQc5 Indoor Chemical and Pollutant Source Control	1 / 1
IEQc6.1Controllability of Systems-Lighting	1 / 1
IEQc6.2Controllability of Systems-Thermal Comfort	1 / 1
IEQc7.1Thermal Comfort-Design	1 / 1
IEQc7.2Thermal Comfort-Verification	1 / 1
IEQc8.1Daylight and Views-Daylight	0 / 2
IEQc8.2Daylight and Views-Views for Seated Spaces	1 / 1

INNOVATION IN DESIGN	5 OF 6
IDc1.1 Innovation in Design	0 / 1
IDc1.1 Innovation in Design - Occupant Education	1 / 1
IDc1.2 Innovation in Design	0 / 1
IDc1.2 IDc1.2: Low-Mercury Lighting Design	1 / 1
IDc1.3 Innovation in Design	0 / 1
IDc1.3 Innovation in Design	0 / 1
IDc1.4 Exemplary Performance - Energy Performance Equip Appliances	1 / 1
IDc1.4 Innovation in Design	0 / 1
IDc1.5 Innovation in Design	0 / 1
IDc1.5 Innovation in Design - Exemplary Performance EAc4 Green Powe	1 / 1
IDc2 LEED® Accredited Professional	1 / 1

REGIONAL PRIORITY CREDITS	4 OF 4
SSc3.2 Alternative Transportation-Bicycle Storage and Changing Room	1 / 1
WEc1 Water Use Reduction	1 / 1
EAc1.1 Optimize Energy Performance-Lighting Power	1 / 1
EAc1.3 Optimize Energy Performance-HVAC	1 / 1
MRc3.1Materials Reuse	0 / 1
MRc5 Regional Materials	0 / 1

TOTAL	85 OF 110

Project Highlight: Solar Hot Water System

One of Esteves Hall's key sustainability features is its solar thermal hot water system. The solar thermal system uses energy provided by the sun and transfers this energy to create domestic hot water through the use of 28 Kingspan DF100 30 'direct flow' style evacuated tube collectors. The hot water collection tank is located in a central vault shared by both Esteves and the new Chao building, thus allowing both buildings to utilize this hot water. In total, the system can store up to 1,560 gallons of solar thermal hot water. It is estimated the system will generate enough energy to lower steam usage by 338 MMBtu annually, which is equivalent to a reducing GHG emissions by 24.8 MTCDE. This system is an excellent way to lower energy consumed for domestic hot water.

More Information

- Harvard Business School: http://www.hbs.edu/Pages/default.aspx
- HBS Sustainability: http://green.harvard.edu/schools-units/business-hbs
- Harvard—Green Building Resource: http://www.energyandfacilities.harvard.edu/green-building-resource
- Harvard—Green Building Services: http://www.energyandfacilities.harvard.edu/project-technical-support/capital-projects/sustainable-design-support-services