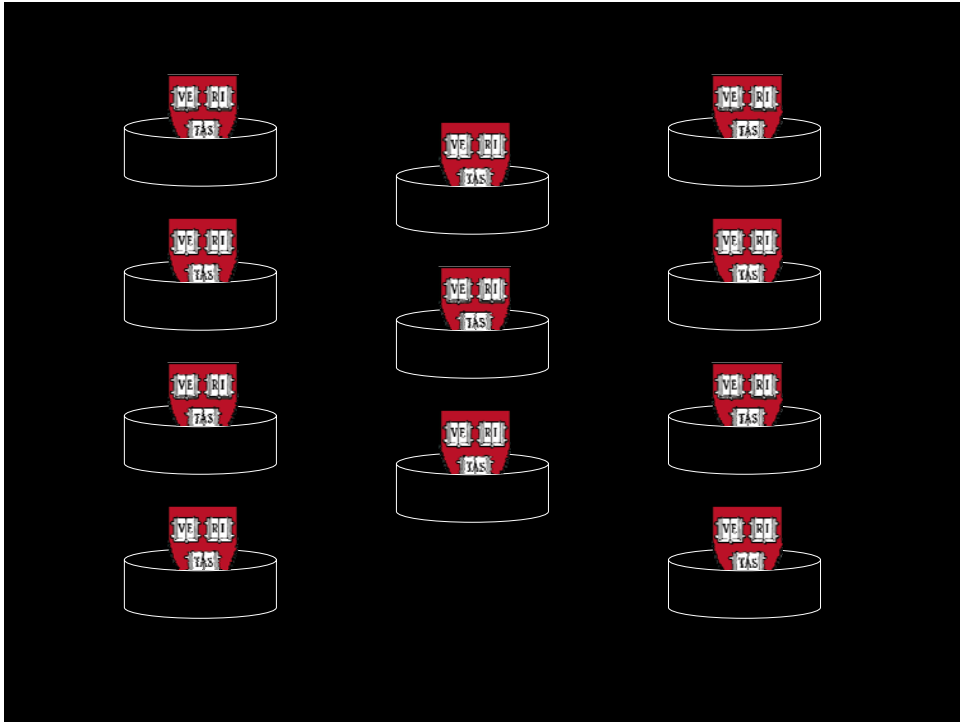


Harvard Green
Campus Initiative

An approach to campus ecology





Harvard Green Campus Initiative



Co-Chair
Faculty, Harvard School of
Public Health
Prof. Jack Spengler

Applied for \$50,000 grant from
the Provost

Co-Chair
Assoc. VP, Facilities &
Environmental Services
Tom Vautin

Harvard Green Campus Initiative

 2000

Co-Chair
Faculty, Harvard School of Public Health
Prof. Jack Spengler

Director,
Leith Sharp

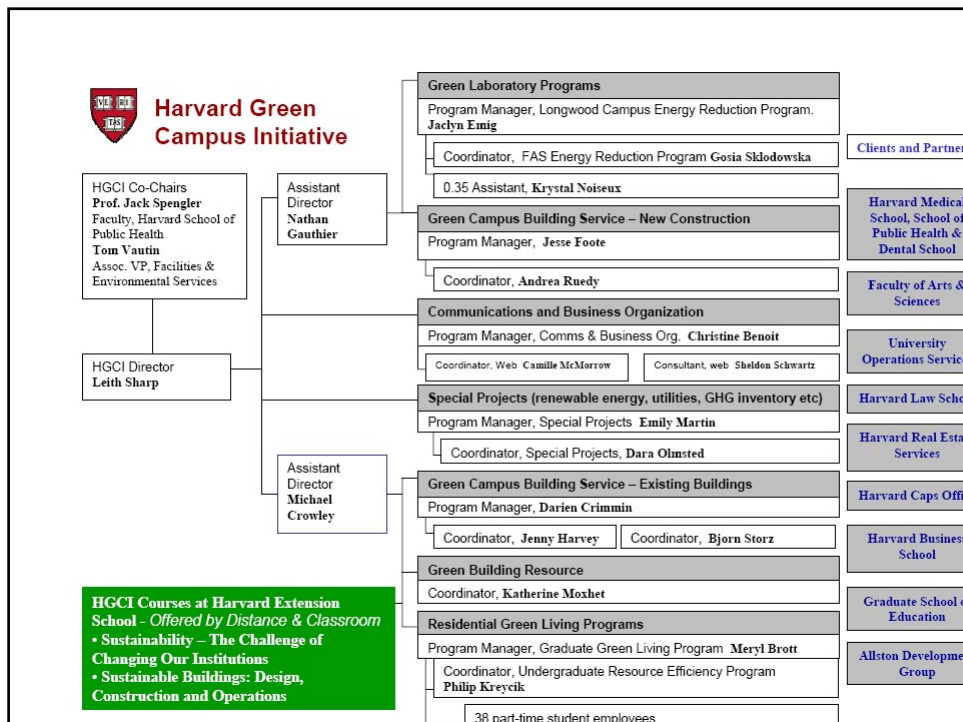
Co-Chair
Assoc. VP, Facilities & Environmental Services
Tom Vautin



John D. Spengler, Ph.D.
•Professor of Health & Human Habitation
•Co-Chair, Harvard Green Campus Initiative

Leith Sharp
Director, Harvard Green Campus Initiative

Thomas E. Vautin,
Associate VP for Facilities & Environmental Services
•Co-Chair, Harvard Green Campus Initiative



campus sustainability

Challenges and Solutions

Time and effort = Develop green building services

Accounting practices = Bridge capital and operation costs

Institutional memory = Foster a learning organization

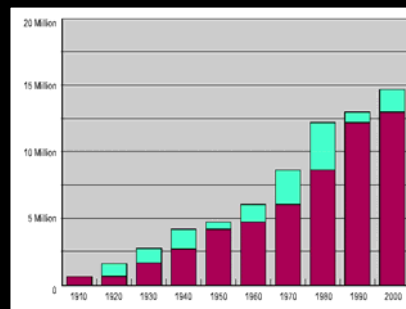
Institutional commitment = Build a business case

Harvard's Growth

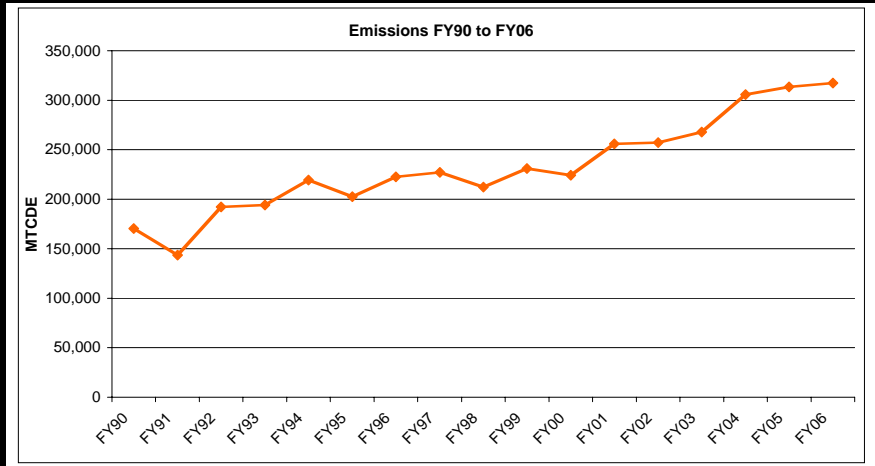
600 campus buildings

21 million gross square feet (gsf)
of floor space

- 1 million gsf per decade

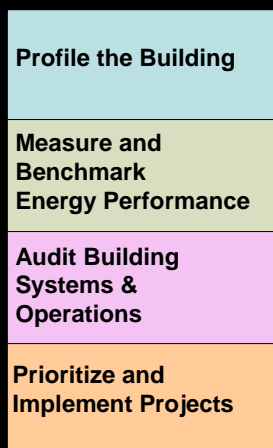


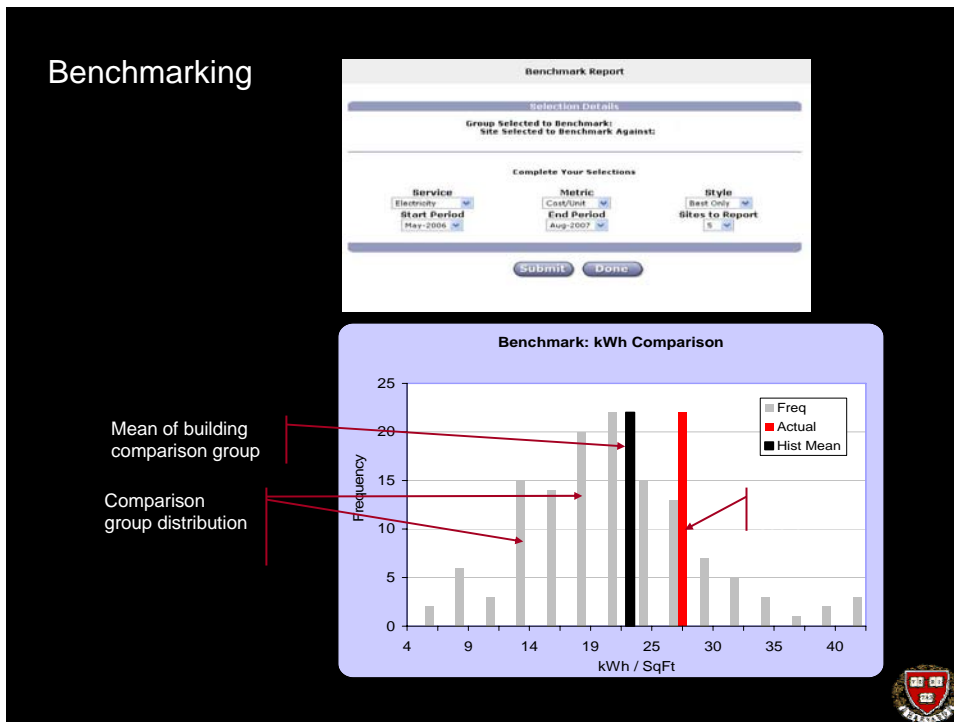
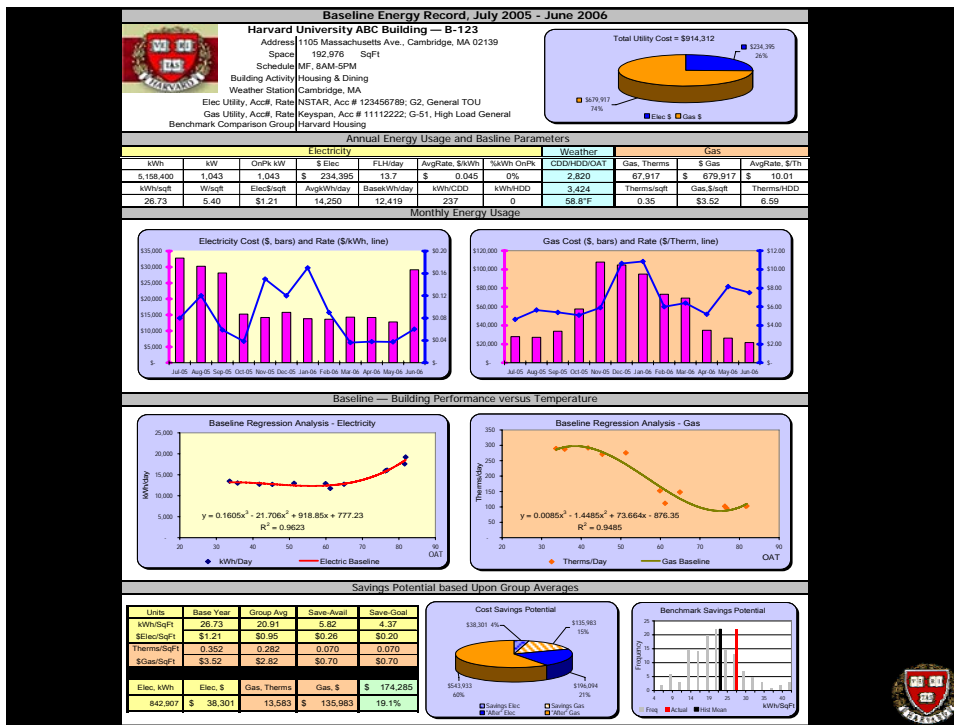
Harvard's Greenhouse Gas Emissions



% increase since 1992: 65%











Building Assessment Process





Leadership in Energy and Environmental Design (LEED)



 <p>5 Cowperthwaite Street HRES*</p> <p>GOLD Completed August 2007</p>	 <p>Aldrich Hall HBS*</p> <p>SILVER Completed Aug 2006</p>	 <p>Wyss Hall HBS*</p> <p>GOLD Completed Aug 2006</p>	 <p>Zero Arrow Street ART*</p> <p>CERTIFIED Completed Aug 2006</p>
 <p>Blackstone UOS*</p> <p>PLATINUM Completed May 2006</p>	 <p>Hamilton Hall HBS*</p> <p>GOLD Completed May 2006</p>	 <p>90 Mount Auburn Street HRES & HULS*</p> <p>GOLD Completed April 2006</p>	 <p>Schlesinger Library HRES*</p> <p>CERTIFIED Completed Feb 2005</p>
 <p>60 Oxford Street UIS and DEAS*</p> <p>CERTIFIED Completed June 2004</p>	 <p>One Western Avenue HBS*</p> <p>SILVER Completed Aug 2003</p>		

campus sustainability

Challenges and Solutions

Time and effort = Develop green building services

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Institutional commitment = Build a business case

Loan Fund

Full Cost

5 year payback maximum

Simple payback used



Cost Differential

10 year payback maximum

Lifecycle costing used



\$12 million interest-free capital for conservation projects

\$41.2 million lent since 2000

158 projects

~ 27% median return on investment

Green Campus Loan Fund Incremental Cost Loan Calculator - Inputs

Discard This Calculator After October 31, 2008
This form is updated twice a year with the latest utility rates and forecasts. After the date above, obtain a new copy of this form.

Assumptions

Maintenance Escalation	3.50%
Annual Admin Fee	2.00%
Discount Rate	5.75%

[Reset Form](#)

	Base Case	Design Case		
20 Year Net Present Cost	\$19,011,252	\$17,609,866		
Initial Cost				
Total Cost	\$9,006,987	\$9,450,720		
Rebate				
Net Cost	\$8,006,987	\$9,450,720		
Operating Costs				
	Quantity	Annual Cost (FY08 rates)	Quantity	Annual Cost (FY08 rates)
Maintenance (\$)		\$0		\$0
Cambridge Chilled Water (Ton Days)	0	\$0	8,054	\$77,399
Cambridge Electricity (MWh)	3,121,125	\$505,119	2,086,423	\$339,670
Cambridge Steam (MMBtu)	4,574	\$132,646	1,888	\$51,894
Cambridge Water (CC)		\$0		\$0
Boston Water (CC)		\$0		\$0
Electric Direct		\$0		\$0
Residential (MWh)		\$0		\$0
Commercial (MWh)		\$0		\$0
#2 Fuel Oil (Gallons)		\$0		\$0
#4 Fuel Oil (Barrels)		\$0		\$0
Boston Gas (Therms)		\$0		\$0
Cambridge Gas (Therms)		\$0		\$0
Transportation Gas (Therms)		\$0		\$0
TOTAL ANNUAL COST (FY07 rates)		\$640,765		\$471,763

Greenhouse gases (Metric tons CO2 equivalent)	Emissions Reductions		NOx (kilograms)		SOx (kilograms)	
	Annual	20 years	Annual	20 years	Annual	20 years
	-70	-1,401	-1	-24	-294	-5,87
	424	8,485	7	145	1,780	35,59
	304	6,075	4	75	0	0
TOTAL	658	13,158	10	190	1,486	29,72

One-Time Costs (Repair, Replacement, Salvage, etc)

Year 1 - FY 2009		
Year 2 - FY 2010		
Year 3 - FY 2011		
Year 4 - FY 2012		
Year 5 - FY 2013		
Year 6 - FY 2014		
Year 7 - FY 2015		
Year 8 - FY 2016		
Year 9 - FY 2017		
Year 10 - FY 2018		
Year 11 - FY 2019		

Escalation Calculator

FY08 Value	
Escalation	3.50%
Year	5
Current Dollar Value	\$0.00

Green Campus Loan Fund Incremental Cost Loan Calculator - Analysis

Cost Differential (Loan Amount) **\$1,451,741**

Annual Operating Savings (FY08 rates) **\$169,003**

Internal Rate of Return **14.37%**

[Calculate IRR](#)

Loan Payback:

Year	Principal	Annual Savings	Annual Admin Fee	Payment
1 FY2009	\$1,451,741	\$174,163	\$43,552	\$174,163
2 FY2010	\$1,277,578	\$183,400	\$38,327	\$183,400
3 FY2011	\$1,094,179	\$192,740	\$32,825	\$192,740
4 FY2012	\$901,438	\$202,108	\$27,043	\$202,108
5 FY2013	\$699,330	\$212,615	\$20,980	\$212,615
6 FY2014	\$486,716	\$220,056	\$14,601	\$220,056
7 FY2015	\$266,680	\$227,758	\$8,000	\$227,758
8 FY2016	\$38,902	\$235,730	\$1,167	\$225,398
9 FY2017	\$0	\$243,980	\$0	\$0
10 FY2018	\$0	\$252,519	\$0	\$0
11 FY2019	\$0	\$261,358	\$0	\$0
12 FY2020	\$0	\$270,495	\$0	\$0
13 FY2021	\$0	\$279,973	\$0	\$0
14 FY2022	\$0	\$289,772	\$0	\$0
15 FY2023	\$0	\$299,914	\$0	\$0
16 FY2024	\$0	\$310,411	\$0	\$0
17 FY2025	\$0	\$321,275	\$0	\$0
18 FY2026	\$0	\$332,520	\$0	\$0
19 FY2027	\$0	\$344,158	\$0	\$0
20 FY2028	\$0	\$356,203	\$0	\$0

Net Savings, Green Case compared to Base Case

Note: Payback Period occurs on the year the line crosses the x-axis

campus sustainability

Challenges and Solutions

Time and effort = Develop green building services

Accounting practices = Bridge capital and operation costs

Institutional memory = Foster a learning organization

Institutional commitment = Build a business case

Home | HGCI Home | Site Map

Harvard Green Campus Initiative Green Building Resource

Green Building Guidelines | Implementation Tools | **Technologies & Products** | Case Studies | LEED Submittals | HGCI Services | Links


The Green Building Resource

The Harvard Green Campus Initiative has developed this Green Building Resource to support the implementation of Harvard's Green Building Guidelines and Harvard's Sustainability Principles.

The Resource is the result of seven years of work, and includes the experience and knowledge gained from 25 Harvard LEED projects. It has been designed to foster continuous improvement in cost-effective green building design, using LEED as the accountability tool. The Resource will be continuously updated and expanded to reflect the frontier of best practice across the university.

It is our hope that by creating and sharing this Resource, we can both support and learn from others as we all strive to meet the profound challenge of becoming an environmentally sustainable society.

Leith Sharp
Director, HGCI



Zero Arrow Street
LEED NC

Updated: Wednesday, December 5, 2007 4:01 PM
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Sponsors & Participants
Harvard Business School | Harvard Faculty of Arts & Sciences | Harvard Law School
Harvard Real Estate Services / CAPS | University Operations Services

The Resource Project Team
Leith Sharp, Director | Michael Crowley, Assistant Director
Nathan Gauthier, Assistant Director | Jesse Foote, Manager, Green Building Service
Andrea Ruedy, Coordinator, Green Building Service
Katharine Moxhet, Coordinator, Green Building Resource
Sheldon Schwartz & Camille McMorrow, Web Development

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For web site comments, contact: resource@greencampus.harvard.edu

TECHNOLOGIES & PRODUCTS IN HARVARD PROJECTS



HVAC: SUPPLY

- Ground Source Heat Pumps
- Boilers
- Chillers



HVAC: DISTRIBUTION

- Induction Heating and Cooling
- Displacement Ventilation



HVAC: CONTROLS

- Demand Control Ventilation
- Variable Frequency Drives
- Setback and Scheduling



HVAC: EXHAUST

- Heat Recovery for Exhaust Systems
- Fume Hoods
- Biological Safety Cabinets



ENERGY

- Building Energy Model
- Onsite Renewable Energy
- Cogeneration



INTERIOR LIGHTING

- Efficient Lighting
- Occupant Controls
- Occupancy Sensors and Daylight Controls



ENVELOPE

- Green Roofs
- Cool Roofs
- Glazing
- Insulation



CONVEYING SYSTEMS

- Elevators



PLUMBING

- Dual-Flush Toilets
- Waterless Urinals
- Low-Flow Lavatories and Showerheads



MATERIALS & FINISHES

- Certified Wood
- Composite Wood
- Floors and Carpets
- Adhesives, Sealants,



SITE & LANDSCAPE

- Stormwater Management
- Irrigation
- Native Plants



EQUIPMENT & APPLIANCES

- Range Hood Controls
- Steam Kettles
- Dishwashers



Harvard Green Campus Initiative Green Building Resource

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HARVARD LEED FOR NEW CONSTRUCTION (LEED-NC) SUBMITTALS

The table below provides a summary of each LEED project's scorecard. Below this summary are links to each project's LEED submittals. Submittals are considered pending review by the USGBC unless linked to a document. An asterisk (*) indicates a Model LEED submittal. Please take note of LEED version, as submittals vary. All information is continually updated as projects reach completion. Click here for a [printable PDF TABLE](#).

LEED-NC SUMMARY OF CREDITS

Building Name	LEED Rating	Version	Construction Completion Date	Total	SS	WE	EA	MR	EQ	ID
Ten Akron Street	Attempting GOLD	v2.2	July 2008	40	11	4	3	6	11	5
Aldrich Hall	SILVER	v2.2	August 2006	33	9	2	4	3	10	5
Allston First Science Center	Attempting GOLD	v2.2	In Design	49	12	4	10	5	13	5
Blackstone	PLATINUM	v2.1	May 2006	55	12	4	12	8	14	5
Byerly Hall	Attempting SILVER	v2.2	In Design	36	8	2	3	3	15	5
Five Cowperthwaite Street	GOLD	v2.1	August 2007	41	13	2	7	6	8	5
Gallatin Hall	Attempting GOLD	v2.2	Under Construction	35	8	2	3	5	12	5
Hamilton Hall	GOLD	v2.1	May 2006	46	10	3	6	9	13	5
90 Mount Auburn Street	GOLD	v2.1	April 2006	39	11	3	6	6	9	4
Northwest Corner	Attempting GOLD	v2.2	Under Construction	40	11	3	8	5	9	4
60 Oxford Street	CERTIFIED	v2.0	June 2004	26	11	0	6	2	3	4
Rockefeller Hall	Attempting GOLD	v2.2	Under Construction	40	8	2	8	6	11	5
Schlesinger Library	CERTIFIED	v2.1	February 2005	29	7	1	5	6	6	4
Weld Hill, Arnold Arboretum	Attempting GOLD	v2.1	In Design	48	9	4	9	6	15	5
One Western Avenue	SILVER	v2.0	August 2003	33	9	0	11	5	5	3
Wyss Hall	GOLD	v2.1	August 2006	44	10	3	5	7	14	5
Zero Arrow Street	CERTIFIED	v2.1	October 2004	31	8	2	5	7	8	1

TOTAL: Certified: 26-32 points, Silver: 33-38 points, Gold: 39-51 points, Platinum: 52-69 points

www.greencampus.harvard.edu/theresource

campus sustainability

Challenges and Solutions

Time and effort = Develop green building services

Accounting practices = Bridge capital and operation costs

Institutional memory = Foster a learning organization

Institutional commitment = Build a business case

Grass Roots

Building Managers
Facilities staff
Project managers
Custodial, transport & procurement staff

Confidence & capacity

Evidence
Confidence
Business case for green

Top Level Leadership

President, Provost, Deans, VPs

Authority

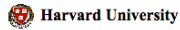
Legitimacy
Priority
Mood / Culture
Goals

Upper Middle Management

2nd level deans
Associate VPs
CFOs
COOs

Systems integration

Capital approvals systems
Finance & accounting



Statement of Sustainability Principles

Harvard University is committed to developing and maintaining an environment that enhances human health and fosters a transition toward sustainability. Sustainability should be advanced through research, analysis, and experience gained over time. To that end, Harvard University is committed to continuous improvement in:

- **Demonstrating institutional practices that promote sustainability**, including measures to increase efficiency and use of renewable resources, and to decrease production of waste and hazardous materials, both in Harvard's own operations and in those of its suppliers.
- **Promoting health, productivity and safety** of the University community through design and maintenance of the built environment.
- **Enhancing the health of campus ecosystems** and increasing the diversity of native species.
- **Developing planning tools** to enable comparative analysis of sustainability implications and to support long-term economic, environmental and socially responsible decision-making.
- **Encouraging environmental inquiry** and institutional learning throughout the University community.
- **Establishing indicators for sustainability** that will enable monitoring reporting and continuous improvement.

The principles are the result of a process commissioned by President Lawrence H. Summers after hearing concerns from students, alumni, and members of the community regarding the development of a sustainable future campus.

Harvard University Gazette, October 14, 2004

"Operating our campus in an environmentally sustainable way is not only the right thing to do as a citizen and neighbor, it is also an economically sound way to conduct our business. As we plan for the future, these principles will set a strong course that will benefit Harvard and promote responsible growth and environmental quality in our community."

President Lawrence H. Summers, Harvard University
Harvard University Gazette, October 14, 2004

For more information visit Harvard Green Campus Initiative at
<http://www.green-campus.harvard.edu>

Harvard University

Allston's Sustainable Design Guidelines



...creating a sustainable campus.

Harvard University is committed to becoming a global model of campus sustainability. Accordingly, Harvard has adopted a set of Campus-Wide Sustainability Principles to support planning decisions that reflect a balance of economic, environmental, and socially responsible values. Based on these Principles, Harvard has established the Allston Sustainability Guidelines to ensure that Harvard's new campus in Allston integrates sustainability as a central theme in the planning and construction process.



- Green Building Guidelines
- Implementation Tools
- Technologies & Products
- Case Studies
- LEED Submittals
- HGCI Services
- Links

Now Harvard's Green Building Guidelines apply to all capital building projects at Harvard.

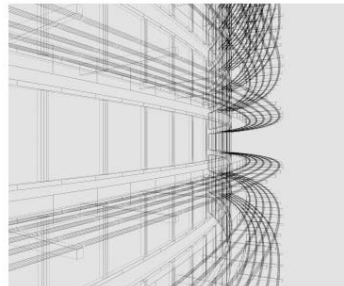
HARVARD UNIVERSITY GREEN BUILDING GUIDELINES

In 2004, President Summers approved a set of Sustainability Principles that committed Harvard to integrating sustainability into its capital projects approval process. In response to this commitment, the University Construction Managers Council engaged the Harvard Green Campus Initiative (HGCI) to convene an interfaculty committee to draft a set of green building guidelines for the university. Throughout 2007, the committee developed a set of draft guidelines that were then reviewed and approved by a group of 100 university project managers, the Capital Projects Review Committee, the University Construction Management Council, the Financial Deans and the Administrative Deans.

The guidelines are split into two different sets, one for projects that are over five million dollars in value and another set for projects that are under five million dollars.

▶ Projects Over Five Million Dollars

▶ Projects Under Five Million Dollars



To support the implementation of these guidelines, the HGCI has developed this web-based Green Building Resource. Further resources have been developed: a set of training modules (life cycle costing, LEED, cost-effective green building etc.), a range of green building services, the Green Campus Loan Fund, and an advisory service to provide immediate assistance in understanding how the guidelines apply to each project and what resources are available.

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June, 2007

Ivy Plus
Sustainability
Working

June, 2007

Ivy Council of
Presidents

Summary of Ivy Plus Greenhouse Gas Reduction Commitments

Brown University

42% below 2007 baseline by 2020

Columbia University

30% below 2005 levels by 2017 [in line with PlaNYC]

Cornell University

Signed Presidents Climate Commitment. Will have strategic plan including timetable in 2009 (already have 7% below 1990)

Harvard University

In development

University of Pennsylvania

Signed Presidents Climate Commitment. Will have strategic plan including timetable Sept 2009

Princeton University

1990 levels by 2020 (18% reduction from 2007)

Yale University

43% reduction from 2005 (10% below 1990) by 2020

Ivy Plus Key Findings and Next Steps

Many of the same questions and interests = Much scope for collaboration

Many are grappling with commitments in the face of substantial growth.

New Working Groups:

- Carbon Offsets
- Renewable energy (large scale joint investment)
- Laboratory best practices (fume hoods and air change rates)
- Annual environmental reporting
- Peer collaborations