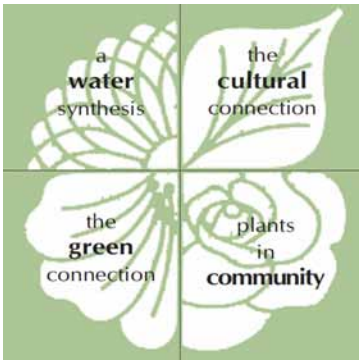
Queens Botanical Garden Visitor Center

16,000 SF Interpretive center

Received LEED Platinum certification in 2008

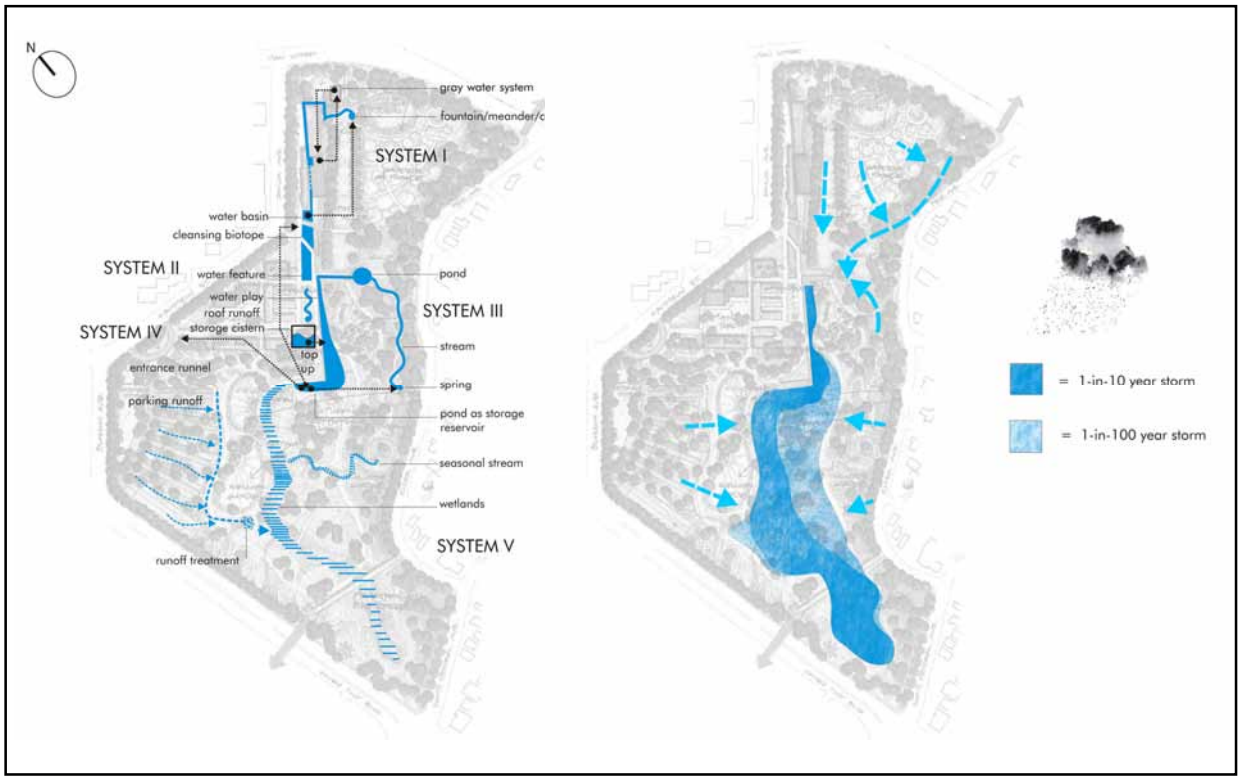
Part of extensive new masterplan that reimagines garden

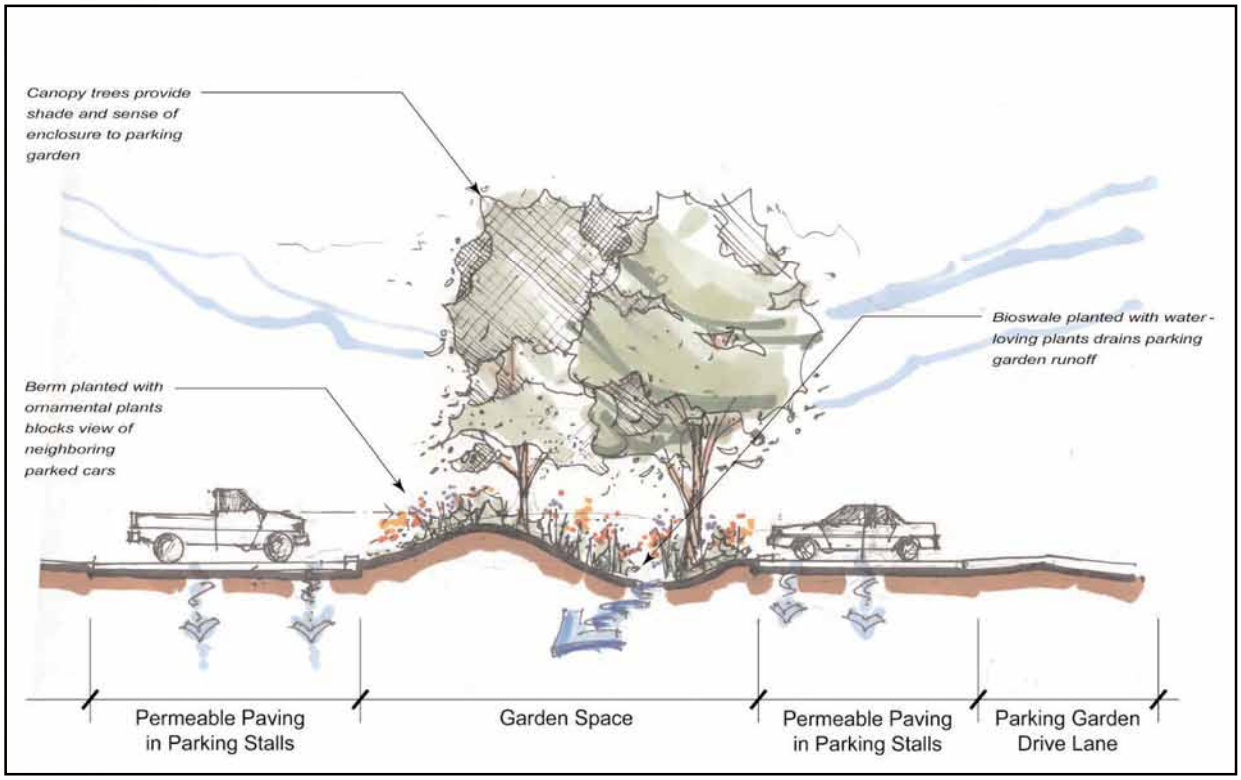


LECTURE TEN
CASE STUDIES
QUEENS BOTANICAL GARDEN VISITOR CENTER
GENZYME CENTER
SIDWELL FRIENDS SCHOOL
ALDO LEOPOLD LEGACY CENTER
ADAM JOSEPH LEWIS CENTER
ARCH 2450 SUSTAINABILITY THROUGH ARCHITECTURE
NYC COLLEGE OF TECHNOLOGY

Masterplan

A 2002 masterplan developed by Atelier Dreiseitl, Conservation Design forum and the garden uses water as a defining element. The Visitor's Center implements the first stage of this plan.


N
gray water system
fountain/meander/c
SYSTEM I
water basin
cleansing biotope
SYSTEM II
water feature
water play
roof runoff
storage cistern
SYSTEM IV
top up
entrance runnel
parking runoff
pond
SYSTEM III
stream
spring
pond as storage reservoir
seasonal stream
wetlands
SYSTEM V
runoff treatment
= 1-in-10 year storm
= 1-in-100 year storm

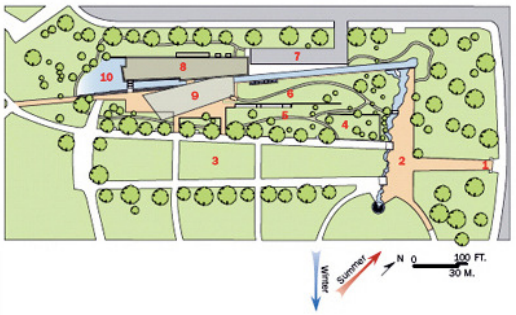

Canopy trees provide shade and sense of enclosure to parking garden
Bioswale planted with water-loving plants drains parking garden runoff
Berm planted with ornamental plants blocks view of neighboring parked cars
Permeable Paving in Parking Stalls
Garden Space
Permeable Paving in Parking Stalls
Parking Garden Drive Lane

LECTURE TEN

CASE STUDIES

Siteplan

A 2002 masterplan developed by Atelier Dreiseitl, Conservation Design forum and the garden uses water as a defining element. The Visitor's Center implements the first stage of this plan.



SUSTAINABILITY THROUGH ARCHITECTURE

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CASE STUDIES

QUEENS BOTANICAL GARDEN VISITOR CENTER

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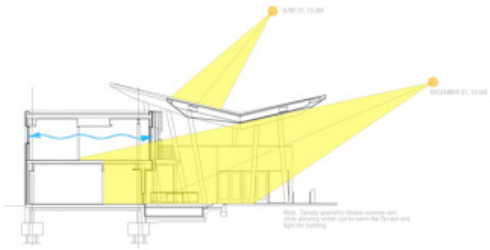
SIDWELL FRIENDS SCHOOL

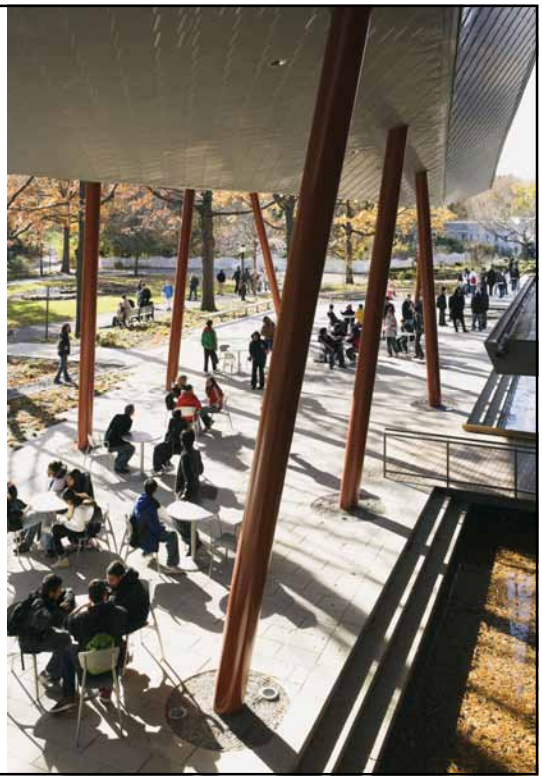
ALDO LEOPOLD LEGACY CENTER

ADAM JOSEPH LEWIS CENTER

Site

Large canopy open to South shelters outdoor space and extends usage into cold weather months.





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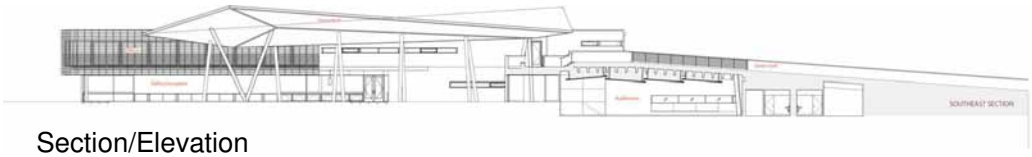
Site

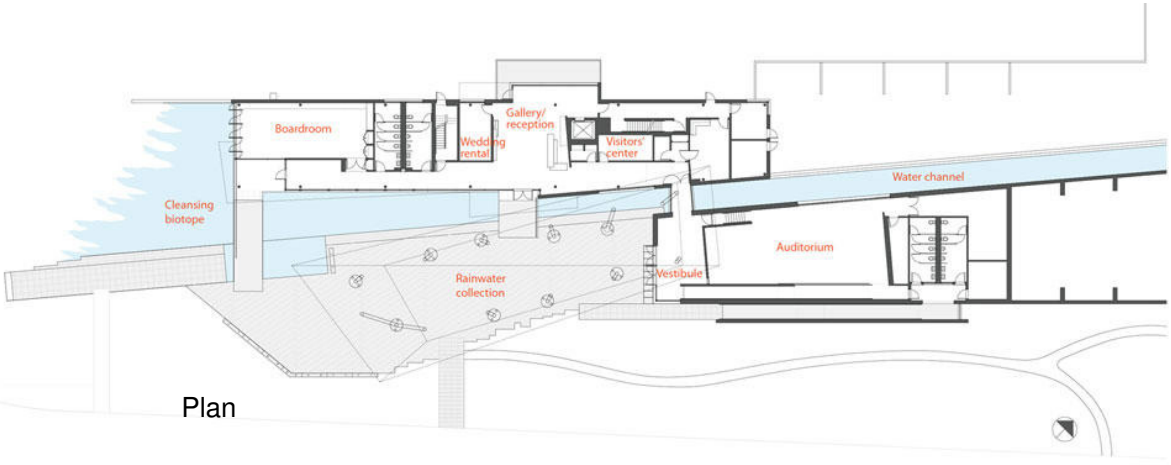
Green roof above the auditorium is planted with native species.

A recent summertime test of roof temperatures found;

- The black weatherproofing membrane on admin bldg at 170 degrees.
- The white PVC water-collection roof over the plaza at 115 degrees.
- The green roof came in at 85 degrees, the ambient temperature that day.



Section/Elevation



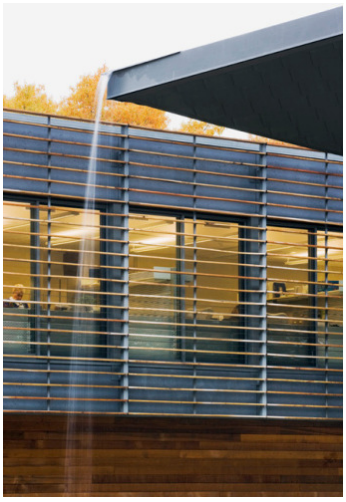
Plan

Water

Rainwater cascades into cleansing biotope from canopy.

Public toilets supplied by graywater cleansed in constructed wetland.

Constructed wetland recycles up to 4,000 gallons of water weekly.



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CASE STUDIES

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Materials

Local materials constituted 33% of materials used

Recycled content materials

- Wallboard, tile, carpet, office systems and bathroom partitions
- Concrete used for cast-in-place and architectural applications includes blast furnace slag and recycled steel reinforcing.

FSC certified woods

- Black locust for brise soleil, bridges and outdoor benches.
- Red cedar for siding

Rapidly renewable materials

- Bamboo Panels and Veneer

LECTURE TEN
CASE STUDIES

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Indoor Environment

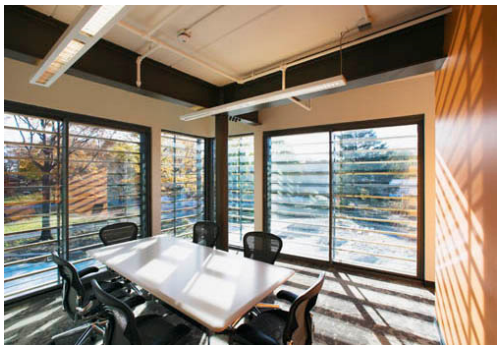
Narrow footprint and open plan allow 84% of occupied spaces to be daylit

No and low VOC materials protect air quality

Operable windows

Ventilation air controlled by CO2 sensors

Building employs a Digital Addressable Lighting Interface (DALI) which automatically adjusts lighting based on available daylight and occupancy



LECTURE TEN
CASE STUDIES

SUSTAINABILITY THROUGH ARCHITECTURE
NYC COLLEGE OF TECHNOLOGY

Energy

Energy systems use 41% less energy than comparable building primarily through ground source heat pumps, natural ventilation, daylighting and controls.

Annual End-Use Breakdown

End Use	Quantity	MMBtu	kBtu/ft2
Heating	132 MMBtu	132	8.34
Cooling	29.9 MMBtu	29.9	1.89
Lighting	116 MMBtu	116	7.33
Fans/Pumps	175 MMBtu	175	11.1
Plug Loads and Equipment	55 MMBtu	55	3.47
Vertical Transport	43 MMBtu	43	2.72
Domestic Hot Water	2.7 MMBtu	2.7	0.171
Exterior lighting	76 MMBtu	76	4.8

Annual Purchased Energy Use

Fuel	Quantity	Cost($)	MMBtu	kBtu/ft2	$/ft2
Electricity	163,000 kWh	$13,766.00	556	35.1	$0.87
Natural Gas	0 MMBtu		0	0	

Annual On-site Renewable Energy Production

Fuel	Quantity		MMBtu	kBtu/ft2	
Photovoltaics	74.7 MMBtu		74.7	4.72	

Total Annual Building Energy Consumption

Fuel		Cost	MMBtu	kBtu/ft2	$/ft2
Total Purchased		$13,766.00	556	35.1	$0.87
Total On-Site Renewable			74.7	4.72	
Grand Total		$13,766.00	630	39.8	$0.87

13 Sustainable Sites — Possible Points: 14

Y			
Y	Prereq 1	Erosion & Sedimentation Control	
1	Credit 1	Site Selection	1
	Credit 2	Development Density	1
1	Credit 3	Brownfield Redevelopment	1
1	Credit 4.1	Alternative Transportation, Public Transportation Access	1
1	Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
1	Credit 4.3	Alternative Transportation, Alternative Fuel Vehicles	1
1	Credit 4.4	Alternative Transportation, Parking Capacity & Carpooling	1
1	Credit 5.1	Reduced Site Disturbance, Protect or Restore Open Space	1
1	Credit 5.2	Reduced Site Disturbance, Development Footprint	1
1	Credit 6.1	Stormwater Management, Rate & Quantity	1
1	Credit 6.2	Stormwater Management, Treatment	1
1	Credit 7.1	Landscape & Exterior Design to Reduce Heat Islands, Non-Roof	1
1	Credit 7.2	Landscape & Exterior Design to Reduce Heat Islands, Roof	1
1	Credit 8	Light Pollution Reduction	1

5 Water Efficiency — Possible Points: 5

Y			
1	Credit 1.1	Water Efficient Landscaping, Reduce by 50%	1
1	Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1
1	Credit 2	Innovative Wastewater Technologies	1
1	Credit 3.1	Water Use Reduction, 20% Reduction	1
1	Credit 3.2	Water Use Reduction, 30% Reduction	1

11 Energy & Atmosphere — Possible Points: 17

Y			
Y	Prereq 1	Fundamental Building Systems Commissioning	
Y	Prereq 2	Minimum Energy Performance	
Y	Prereq 3	CFC Reduction in HVAC&R Equipment	
1	Credit 1.1	Optimize Energy Performance, 15% New / 5% Existing	1
1	Credit 1.2	Optimize Energy Performance, 20% New / 10% Existing	1
1	Credit 1.3	Optimize Energy Performance, 25% New / 15% Existing	1
1	Credit 1.4	Optimize Energy Performance, 30% New / 20% Existing	1
1	Credit 1.5	Optimize Energy Performance, 35% New / 25% Existing	1
1	Credit 1.6	Optimize Energy Performance, 40% New / 30% Existing	1
	Credit 1.7	Optimize Energy Performance, 45% New / 35% Existing	1
	Credit 1.8	Optimize Energy Performance, 50% New / 40% Existing	1
	Credit 1.9	Optimize Energy Performance, 55% New / 45% Existing	1
	Credit 1.10	Optimize Energy Performance, 60% New / 50% Existing	1
1	Credit 2.1	Renewable Energy, 5%	1
1	Credit 2.2	Renewable Energy, 10%	1
1	Credit 2.3	Renewable Energy, 15%	1
1	Credit 3	Additional Commissioning	1
	Credit 4	Ozone Depletion	1
	Credit 5	Measurement & Verification	1
1	Credit 6	Green Power	1

7 Materials & Resources — Possible Points: 13

Y			
Y	Prereq 1	Storage & Collection of Recyclables	
	Credit 1.1	Building Reuse, Maintain 75% of Existing Shell	1
	Credit 1.2	Building Reuse, Maintain 100% of Shell	1
	Credit 1.3	Building Reuse, Maintain 100% Shell & 50% Non-Shell	1
1	Credit 2.1	Construction Waste Management, Divert 50%	1
1	Credit 2.2	Construction Waste Management, Divert 75%	1
	Credit 3.1	Resource Reuse, Specify 5%	1
	Credit 3.2	Resource Reuse, Specify 10%	1
1	Credit 4.1	Recycled Content, Specify 5%	1
1	Credit 4.2	Recycled Content, Specify 10%	1
1	Credit 5.1	Local/Regional Materials, 20% Manufactured Locally	1
1	Credit 5.2	Local/Regional Materials, of 20% Above, 50% Harvested Locally	1
	Credit 6	Rapidly Renewable Materials	1
1	Credit 7	Certified Wood	1

12 Indoor Environmental Quality — Possible Points: 15

Y			
Y	Prereq 1	Minimum IAQ Performance	
Y	Prereq 2	Environmental Tobacco Smoke (ETS) Control	
1	Credit 1	Carbon Dioxide Monitoring	1
1	Credit 2	Ventilation Effectiveness	1
1	Credit 3.1	Construction IAQ Management Plan, During Construction	1
1	Credit 3.2	Construction IAQ Management Plan, Before Occupancy	1
1	Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	1
1	Credit 4.2	Low-Emitting Materials, Paints	1
1	Credit 4.3	Low-Emitting Materials, Carpet	1
	Credit 4.4	Low-Emitting Materials, Composite Wood & Agrifiber Products	1
1	Credit 5	Indoor Chemical & Pollutant Source Control	1
1	Credit 6.1	Controllability of Systems, Perimeter	1
	Credit 6.2	Controllability of Systems, Non-Perimeter	1
1	Credit 7.1	Thermal Comfort, Comply with ASHRAE 55-1992	1
	Credit 7.2	Thermal Comfort, Permanent Monitoring System	1
1	Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1
1	Credit 8.2	Daylight & Views, Views for 90% of Spaces	1

4 Innovation & Design Process — Possible Points: 5

Y			
1	Credit 1.1	Innovation in Design: Exemplary Performance SSc6.1	1
1	Credit 1.2	Innovation in Design: Credit Title	1
1	Credit 1.3	Innovation in Design: Exemplary Performance WEc3	1
1	Credit 1.4	Innovation in Design: Green Building Education	1
1	Credit 2	LEED® Accredited Professional	1

LECTURE TEN
CASE STUDIES
QUEENS BOTANICAL GARDEN VISITOR CENTER
GENZYME CENTER
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ARCH 2450 SUSTAINABILITY THROUGH ARCHITECTURE
NYC COLLEGE OF TECHNOLOGY

The Aldo Leopold Legacy Center

12,000 SF Interpretive center and offices in 3 building complex

Received LEED Platinum certification in 2007 (61 points)

Zero emissions/carbon neutral

LECTURE TEN

CASE STUDIES

QUEENS BOTANICAL GARDEN VISITOR CENTER

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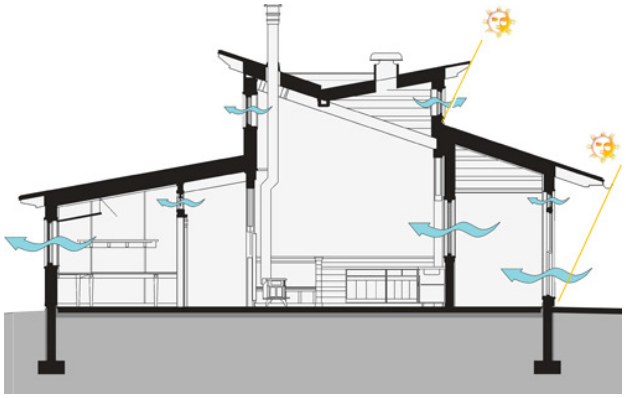
Indoor Environment

All occupied spaces have natural ventilation

Full daylighting

Radiant floor heating

All adhesives, sealants, paints, and composite-wood products specified with low chemical emissions



Energy

Ground loop heat pump

600 feet of concrete earth tube, 13 feet below the surface, preconditions ventilation air

Demand controlled ventilation

Solar hot water

3000 SF of photovoltaic panels

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CASE STUDIES
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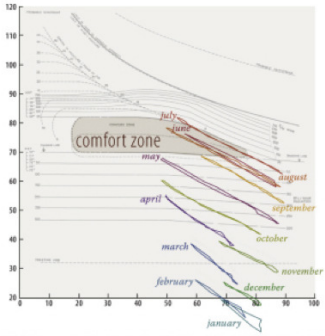
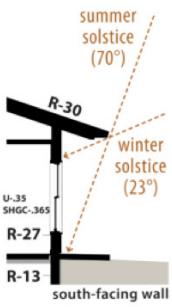
Energy

Zoning allows 3 season use of appropriate spaces

Thermal flux zone between office areas and outdoors

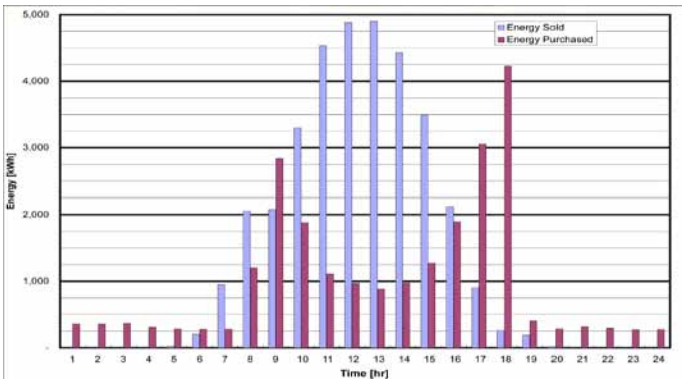
Enclosure insulation levels twice code mandated minimum





LECTURE TEN
CASE STUDIES

Energy



Total Annual Building Energy Consumption

Fuel		Cost	MMBtu	kBtu/ft2	$/ft2
Total Purchased		($549.00)	-24	-2.02	($0.05)
Total On-Site Renewable			209	17.6	
Grand Total		($549.00)	185	15.6	($0.05)

Annual End-Use Breakdown

End Use	Quantity	MMBtu	kBtu/ft2
Heating	62.3 MMBtu	62.3	7.05
Cooling	7.93 MMBtu	7.93	0.897
Lighting	51.8 MMBtu	51.8	4.36
Fans/Pumps	26.7 MMBtu	26.7	2.25
Plug Loads and Equipment	33.8 MMBtu	33.8	2.85
Vertical Transport			
Domestic Hot Water	2.49 MMBtu	2.49	0.21
Other			

SUSTAINABILITY THROUGH ARCHITECTURE
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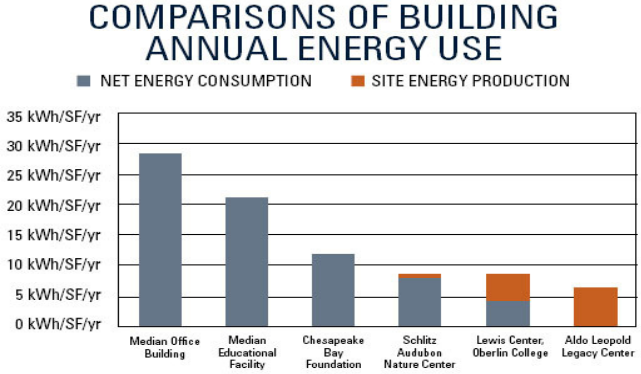
Carbon Neutral Design

Set a site solar budget
3,000 SF of PV panels provide 50,000 kWh per year

Design to the budget
building demand limited to 5 kWh/SF/year



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Carbon Neutral Analysis

	Components	Metric tons of CO2
Scope One	direct emissions due to combustion wood stove, ALF vehicle use	19.9
Scope Two	indirect emissions due to electricity generation no emissions, offset credits provided by solar electric generation and green power contract	(20.8)
Scope Three	indirect emissions due to organizational activities Employee commuting, business travel, solid waste removal	25.4
Sequestration	Carbon absorbed by managed forest	(29.1)
	balance	(4.6)

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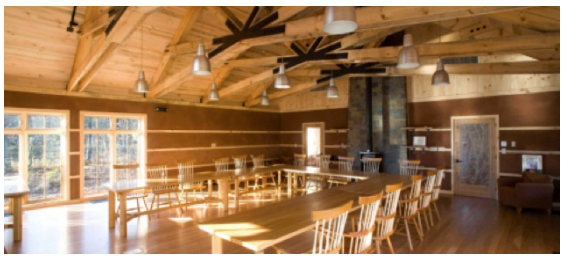
Materials

Site harvested cherry, maple, and other woods were used as finish materials and furniture throughout the building.

Plaster walls are made of locally obtained sand, clay, and straw.

Stained concrete floors connected to the ground-source heat-pump system provide radiant heating and cooling.



12 Sustainable Sites — Possible Points: 14

Y	Prereq 1	Erosion & Sedimentation Control	
1	Credit 1	Site Selection	1
	Credit 2	Development Density	1
1	Credit 3	Brownfield Redevelopment	1
	Credit 4.1	Alternative Transportation, Public Transportation Access	1
1	Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
1	Credit 4.3	Alternative Transportation, Alternative Fuel Vehicles	1
1	Credit 4.4	Alternative Transportation, Parking Capacity & Carpooling	1
1	Credit 5.1	Reduced Site Disturbance, Protect or Restore Open Space	1
1	Credit 5.2	Reduced Site Disturbance, Development Footprint	1
1	Credit 6.1	Stormwater Management, Rate & Quantity	1
1	Credit 6.2	Stormwater Management, Treatment	1
1	Credit 7.1	Landscape & Exterior Design to Reduce Heat Islands, Non-Roof	1
1	Credit 7.2	Landscape & Exterior Design to Reduce Heat Islands, Roof	1
1	Credit 8	Light Pollution Reduction	1

5 Water Efficiency — Possible Points: 5

1	Credit 1.1	Water Efficient Landscaping, Reduce by 50%	1
1	Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1
1	Credit 2	Innovative Wastewater Technologies	1
1	Credit 3.1	Water Use Reduction, 20% Reduction	1
1	Credit 3.2	Water Use Reduction, 30% Reduction	1

17 Energy & Atmosphere — Possible Points: 17

Y	Prereq 1	Fundamental Building Systems Commissioning	
Y	Prereq 2	Minimum Energy Performance	
Y	Prereq 3	CFC Reduction in HVAC&R Equipment	
1	Credit 1.1	Optimize Energy Performance, 15% New / 5% Existing	1
1	Credit 1.2	Optimize Energy Performance, 20% New / 10% Existing	1
1	Credit 1.3	Optimize Energy Performance, 25% New / 15% Existing	1
1	Credit 1.4	Optimize Energy Performance, 30% New / 20% Existing	1
1	Credit 1.5	Optimize Energy Performance, 35% New / 25% Existing	1
1	Credit 1.6	Optimize Energy Performance, 40% New / 30% Existing	1
1	Credit 1.7	Optimize Energy Performance, 45% New / 35% Existing	1
1	Credit 1.8	Optimize Energy Performance, 50% New / 40% Existing	1
1	Credit 1.9	Optimize Energy Performance, 55% New / 45% Existing	1
1	Credit 1.10	Optimize Energy Performance, 60% New / 50% Existing	1
1	Credit 2.1	Renewable Energy, 5%	1
1	Credit 2.2	Renewable Energy, 10%	1
1	Credit 2.3	Renewable Energy, 15%	1
1	Credit 3	Additional Commissioning	1
1	Credit 4	Ozone Depletion	1
1	Credit 5	Measurement & Verification	1
1	Credit 6	Green Power	1

7 Materials & Resources — Possible Points: 13

Y	Prereq 1	Storage & Collection of Recyclables	
	Credit 1.1	Building Reuse, Maintain 75% of Existing Shell	1
	Credit 1.2	Building Reuse, Maintain 100% of Shell	1
	Credit 1.3	Building Reuse, Maintain 100% Shell & 50% Non-Shell	1
1	Credit 2.1	Construction Waste Management, Divert 50%	1
1	Credit 2.2	Construction Waste Management, Divert 75%	1
	Credit 3.1	Resource Reuse, Specify 5%	1
	Credit 3.2	Resource Reuse, Specify 10%	1
1	Credit 4.1	Recycled Content, Specify 5%	1
1	Credit 4.2	Recycled Content, Specify 10%	1
1	Credit 5.1	Local/Regional Materials, 20% Manufactured Locally	1
1	Credit 5.2	Local/Regional Materials, of 20% Above, 50% Harvested Locally	1
	Credit 6	Rapidly Renewable Materials	1
1	Credit 7	Certified Wood	1

15 Indoor Environmental Quality — Possible Points: 15

Y	Prereq 1	Minimum IAQ Performance	
Y	Prereq 2	Environmental Tobacco Smoke (ETS) Control	
1	Credit 1	Carbon Dioxide Monitoring	1
1	Credit 2	Ventilation Effectiveness	1
1	Credit 3.1	Construction IAQ Management Plan, During Construction	1
1	Credit 3.2	Construction IAQ Management Plan, Before Occupancy	1
1	Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	1
1	Credit 4.2	Low-Emitting Materials, Paints	1
1	Credit 4.3	Low-Emitting Materials, Carpet	1
1	Credit 4.4	Low-Emitting Materials, Composite Wood & Agrifiber Products	1
1	Credit 5	Indoor Chemical & Pollutant Source Control	1
1	Credit 6.1	Controllability of Systems, Perimeter	1
1	Credit 6.2	Controllability of Systems, Non-Perimeter	1
1	Credit 7.1	Thermal Comfort, Comply with ASHRAE 55-1992	1
1	Credit 7.2	Thermal Comfort, Permanent Monitoring System	1
1	Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1
1	Credit 8.2	Daylight & Views, Views for 90% of Spaces	1

5 Innovation & Design Process — Possible Points: 5

1	Credit 1.1	Innovation in Design: Exemplary Performance EAc6	1
1	Credit 1.2	Innovation in Design: Exemplary Performance EAc2	1
1	Credit 1.3	Innovation in Design: Carbon Neutral Building Operation	1
1	Credit 1.4	Innovation in Design: Exemplary Performance MRc5.1	1
1	Credit 2	LEED® Accredited Professional	1

LECTURE TEN
CASE STUDIES
QUEENS BOTANICAL GARDEN VISITOR CENTER
GENZYME CENTER
SIDWELL FRIENDS SCHOOL
ALDO LEOPOLD LEGACY CENTER
ADAM JOSEPH LEWIS CENTER
ARCH 2450 SUSTAINABILITY THROUGH ARCHITECTURE
NYC COLLEGE OF TECHNOLOGY

Adam Joseph Lewis Center for Environmental Studies

"the most important green building constructed in the last 30 years"

The 13,600 SF educational building opened in 2001

The building serves as an environmental learning lab with continuous ongoing monitoring and modifications

The building is now producing more energy than it consumes

Site Strategies

A constructed wetland and surrounding meadow ecosystem wrapping around the southeast corner of the building provide habitat for over 70 indigenous plant species and myriad animals.

Food production includes fruit trees and vegetable gardens.

Stormwater is fully managed onsite and used for irrigation.

Extensive use of native plants

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Water

Wastewater flows through anaerobic and aerobic reactors where biological processes begin to digest wastes. The wastewater then enters the Living Machine® solarium and flows through three open aerobic reactors. Tropical, sub-tropical and native plants such as papyrus, calla lilies and willows assist in the treatment process. Biosolids settle out in a clarifier.

Wastewater then flows through a constructed wetland surrounding the open aerobic tanks for final 'polishing.' Ultraviolet disinfection is the final step prior to the treated wastewater being reused in the buildings' toilets.

Materials

All wood is FSC certified.

Recycled-content materials were specified for structural steel, brick, the aluminum curtain-wall frame, ceramic tile, plastics, and fabrics.

The carpet and access flooring system are products of service, on lease from the manufacturer.

Salvaged materials include brick and stone from the Oberlin campus

Biodegradeable upholstery

Compressed straw panels for acoustics

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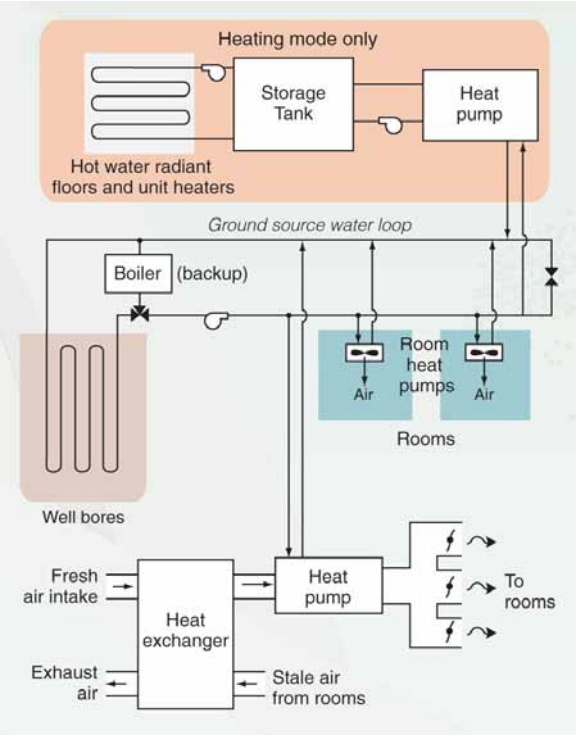
Energy

24 closed loop geothermal wells (each 240' deep) are coupled to heat pumps to serve building heating and cooling requirements.

A heat exchanger captures heat from exhaust air.

A high performance envelope includes the following component insulation values; R 35 roof, R 21 walls, R 7 windows



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60kW rooftop PV with additional 100kW array on parking structure.

Passive solar atrium and east west orientation maximize daylighting and passive heat gain opportunities.

Occupancy sensors and photoelectric daylight sensors control lighting.

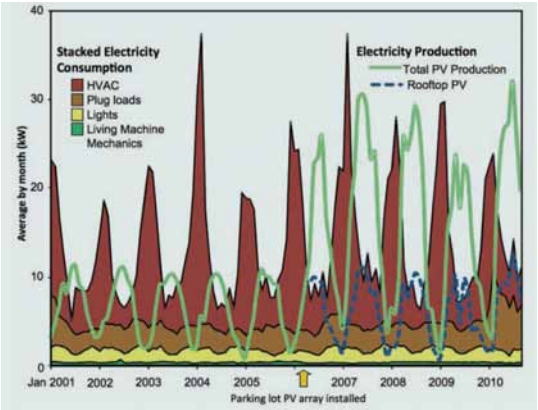
CO2 sensors and automated operable windows control ventilation.

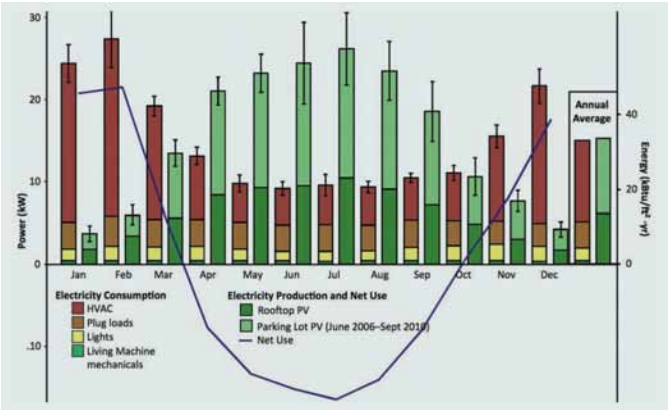
Energy-efficient light fixtures result in a 0.9 watt per ft2 lighting load.

LECTURE TEN

CASE STUDIES

Energy





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Education

Live, real time data on energy production and use, reclaimed water generation, water use and climate.

http://oberlin.edu/ajlc/