High Performance Green Facilities: Practical Lessons from Sidwell Friends School

21 May 2007

Michael Saxenian
Assistant Head of School &
Chief Financial Officer

Uncommon Academic Excellence
Prizing of Diversity
Friends Values and Testimonies
Environmental Stewardship

- Walk our talk: reduce energy, water, materials use and emissions
- Provide healthy physical environment
- Create a laboratory for learning
- Serve as a beacon for others

Middle School Building

Middle School has Earned a LEED Platinum Rating

Rock Creek

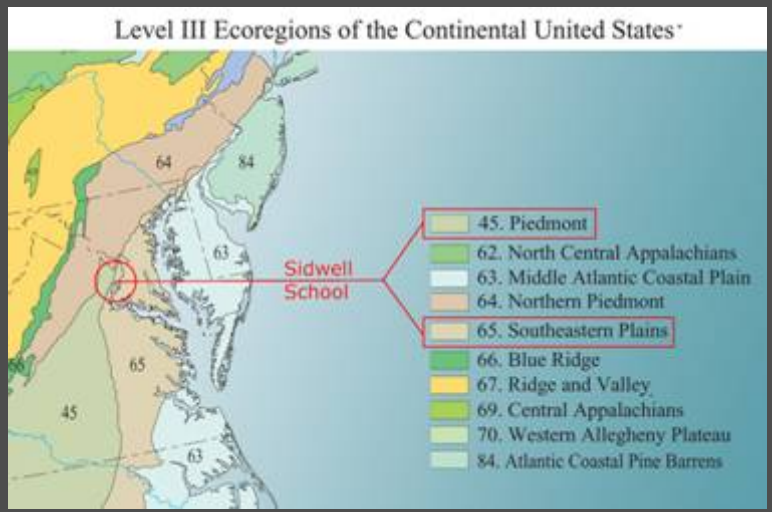
Stream Valleys

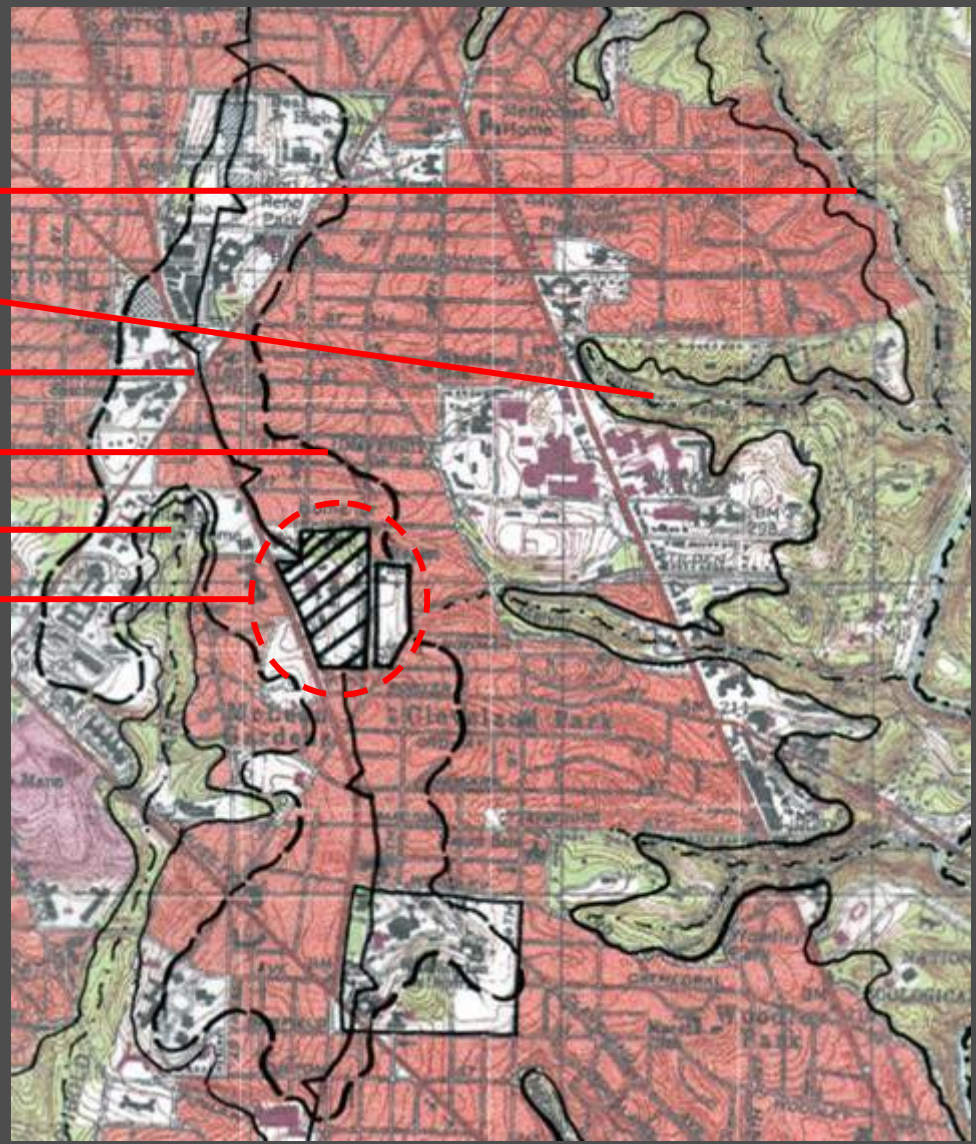
Watershed Divide

Upland Ridge

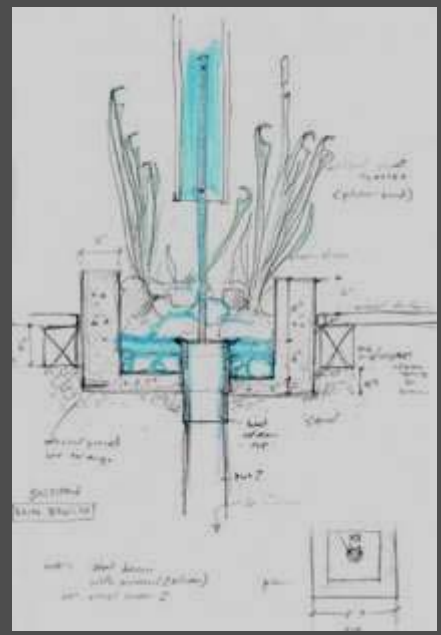
Glover Archbold Park

DC Campus





DISTRICT OF COLUMBIA CAMPUS



Rain water is revealed and connected to living systems

RAIN WATER RESOURCES

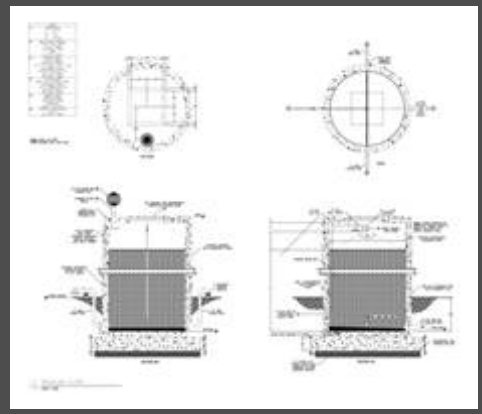
DRAWING BY ANDROPOGON ASSOCIATES LTD AND KIERAN TIMBERLAKE ASSOCIATES

1. EXISTING MIDDLE SCHOOL
2. MIDDLE SCHOOL ADDITION
3. TRICKLE FILTER WITH INTERPRETIVE DISPLAY
4. WETLANDS FOR WASTEWATER TREATMENT
5. RAIN GARDEN
6. POND

MIDDLE SCHOOL

Constructed wetland system illustrates food-waste-food cycle.

A



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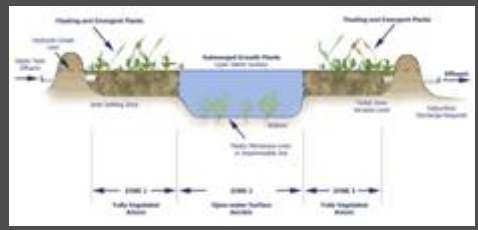

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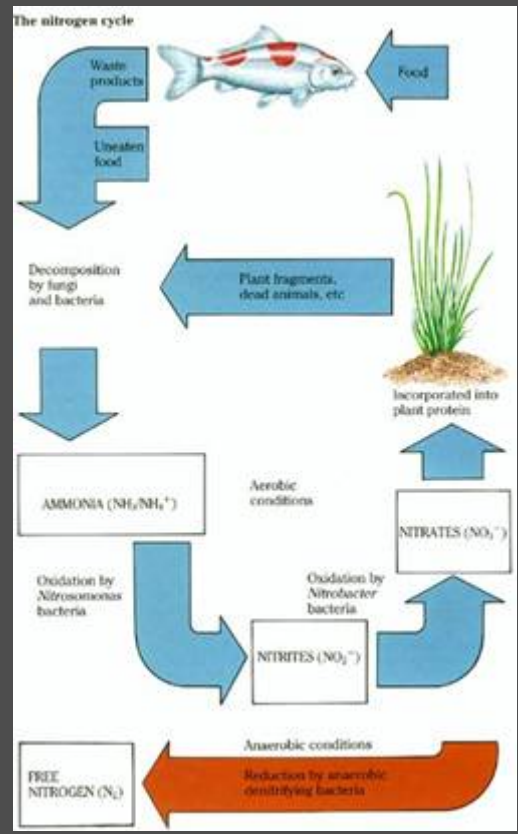
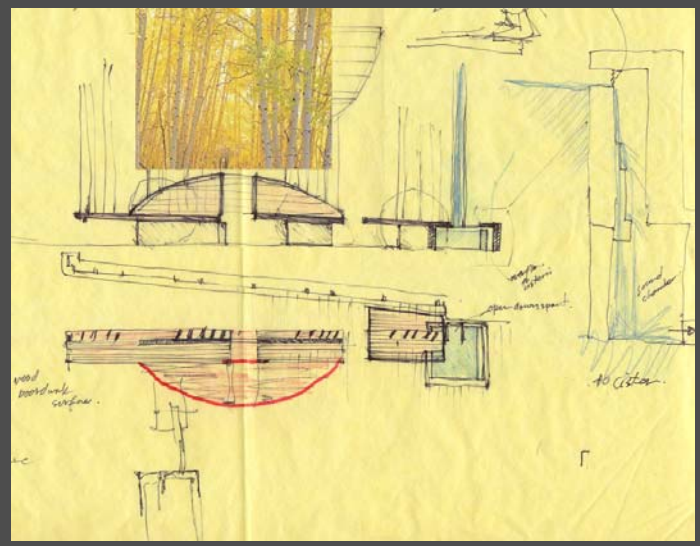
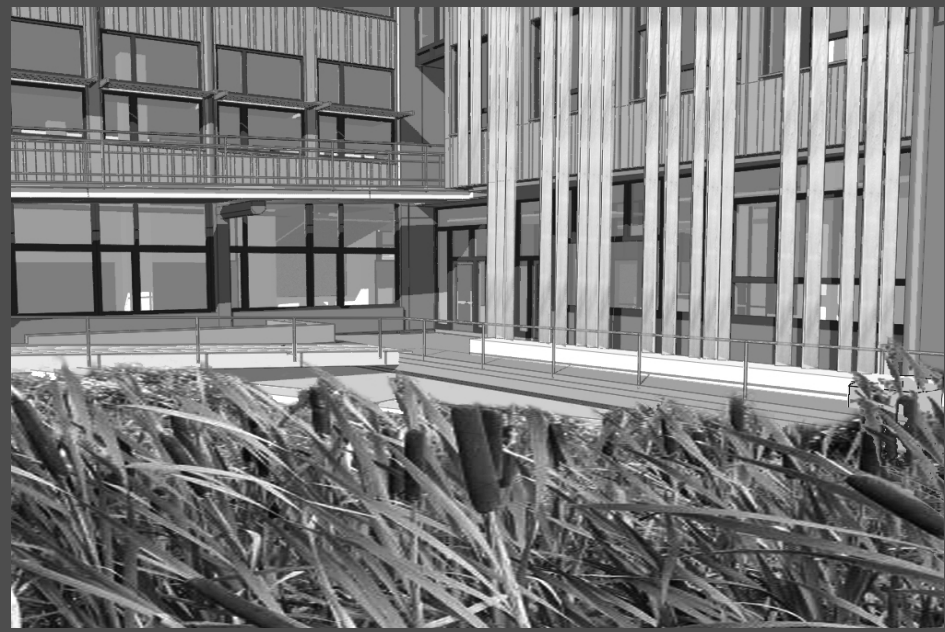


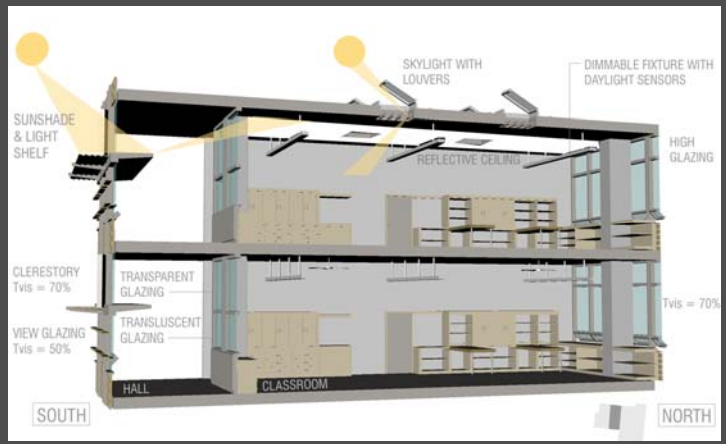


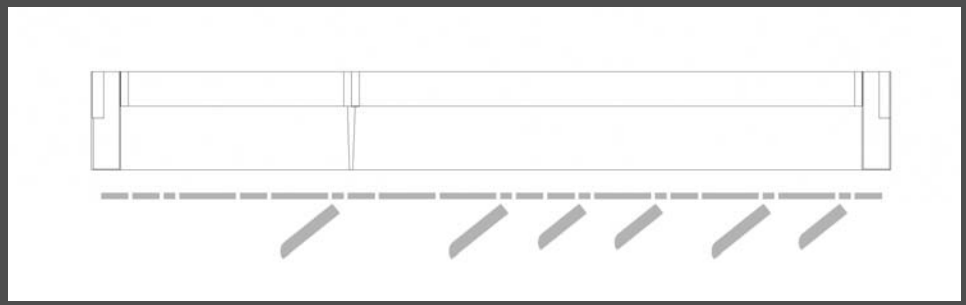
Building elements refer to the original and secondary sources.

SOURCE KNOWLEDGE



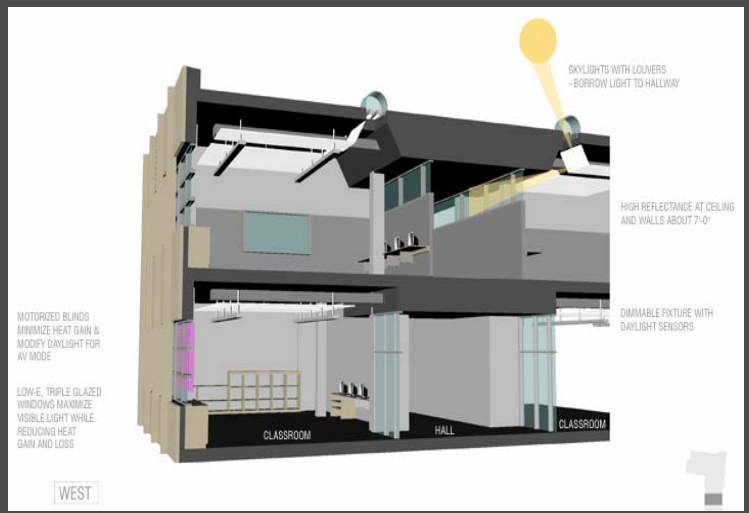
MIDDLE SCHOOL WOOD SKIN

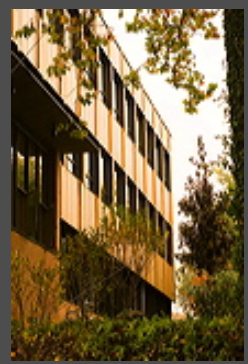

SKYLIGHT WITH LOUVERS
DIMMABLE FIXTURE WITH DAYLIGHT SENSORS
SUNSHADE & LIGHT SHELF
REFLECTIVE CEILING
HIGH GLAZING
CLERESTORY Tvis = 70%
TRANSPARENT GLAZING
TRANSLUSCENT GLAZING
VIEW GLAZING Tvis = 50%
Tvis = 70%
HALL
CLASSROOM
SOUTH
NORTH



The vertical fins are angled 51.25 degrees N of W to maximize shading between Noon and 3:30pm

EAST AND WEST ORIENTATION



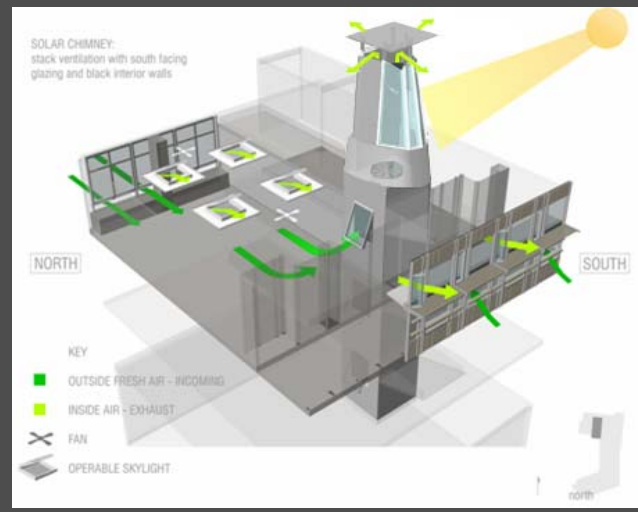


Orientation, high-efficiency envelop and reliance on natural lighting save energy at the outset.

Wall and roof systems balance thermal performance with optimal daylighting.

NORTH ORIENTATION

SUNSCREENS AND LIGHT SHELF


SOLAR CHIMNEY:
stack ventilation with south facing glazing and black interior walls
NORTH
SOUTH
KEY
OUTSIDE FRESH AIR - INCOMING
INSIDE AIR - EXHAUST
FAN
OPERABLE SKYLIGHT
north

Energy Model for Addition

EA Prerequisite 2 / EA Credit 1 / EA Credit 2

ECB Table - MS New (Double glazed windows and no solar thermal)

Energy Summary by End Use

Regulated Energy Summary by End Use	Energy Type	Proposed Building Energy [10^3 Btu]	Proposed Building Peak [10^3 Btu]	Budget Building Energy [10^3 Btu]	Budget Building Peak [10^3 Btu]	Proposed / Budget Energy [%]
Lighting - Conditioned	Electricity	32,287		411,198		8%
Lighting - Unconditioned						
Space Heating	Gas	424,610		697,350		61%
Space Cooling	Electricity	96,417		210,650		46%
Pumps	Electricity	30,751		51,127		60%
Fans - Interior Ventilation	Electricity	41,570		47,884		87%
Fans - Interior Exhaust						
Service Water Heating	Gas	189,860		189,860		100%
TOTAL BUILDING CONSUMPTION		**815,495.7**		**1,608,069.7**		**51%**

Energy and Cost Summary by Fuel	DEC'' Use [10^3 Btu]	DEC'' Cost [$]	ECB' Use [10^3 Btu]	ECB' Cost [$]	DEC'' / ECB' Energy %	DEC'' / ECB' Cost %
Electricity	201,026	$ 4,182	720,860	$ 14,996	28%	28%
Natural Gas	614,470	$ 4,529	887,210	$ 6,539	69%	69%
Other Fossil Fuel	-	$ -	-		-	-
Subtotal Nonrenewable (DEC')	815,496	8,711	1,608,070	21,535		
Subtotal Renewable (REC')	(59,095)	(436)				-
Total	756,401	$ 8,275	1,608,070	$ 21,535		

Percent Savings = (ECB' $ -DEC'' $)/ECB' $ = 62%

Credit 1 Points Awarded = 10

Percent Renewable = 100 x (REC'$)/DEC'$ = 5%

Credit 2 Points Awarded = 1

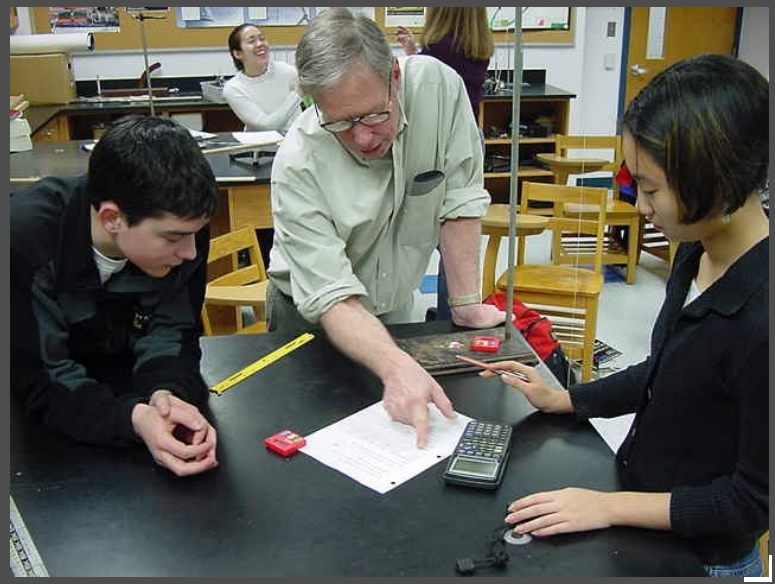
Impacts:

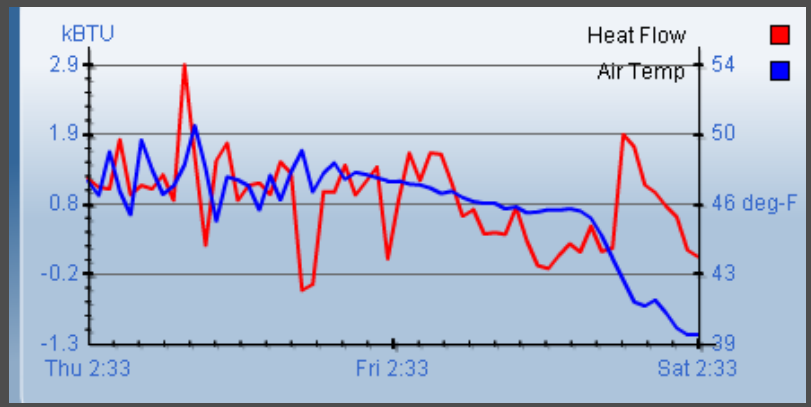
- HVAC loads
- Building controls
- AV systems
- Window shading systems
- Configuration of interior spaces
- Interior materials selection
- Roofscape
- Building cladding

$13,000 projected annual energy savings (north wing only)

Overall energy savings of 55% building-wide relative to code requirements

Efficient Lighting Design Reduced Energy Use Associated with Lighting by 92%





Displays in Classrooms and on Internet will Allow Students to Monitor and Analyze Building Performance

Little or no additional cost

Life cycle payback

Pedagogically or ethically compelling

- "Signature Strategies"

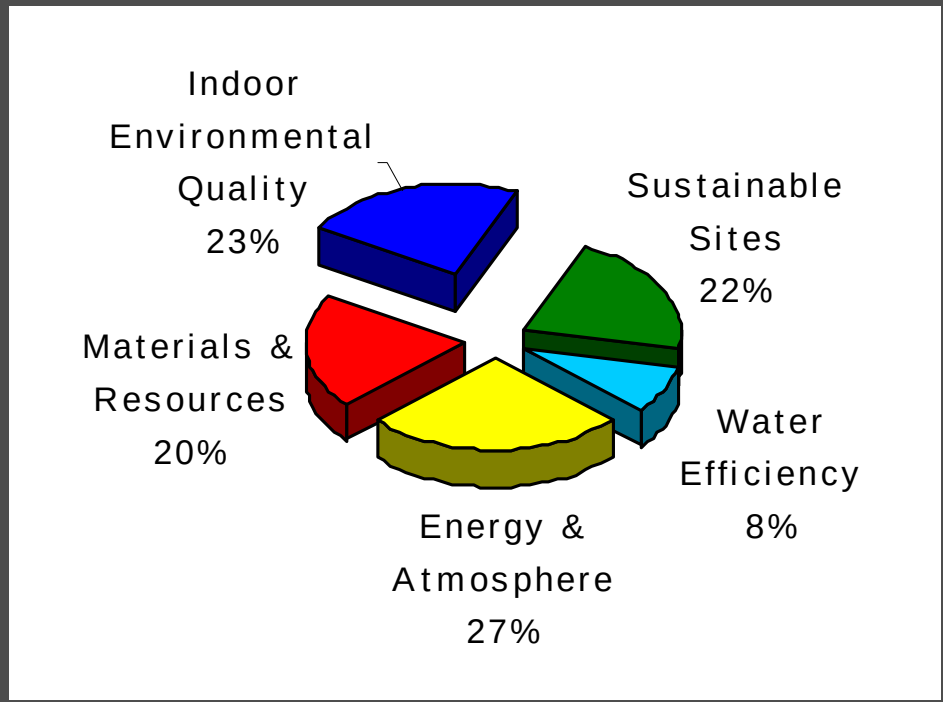
ESTABLISH PRINCIPLES FOR HIGH PERFORMANCE INVESTMENT

Pros

- LEED provides nationally recognized framework
- Third party validation
- Focuses design choices
- Supports mainstay of the movement

Cons

- Can distort choices
- Additional cost



DECIDE WHETHER TO SEEK LEED CERTIFICATION

Incremental Cost of Green Design and LEED™ Certification	
Credits in Base Budget (Gold + 1)	
Minimum Premium for Gold (Certification Costs)	<1%
Premium for Gold with Cushion (Gold + 3)	2%
Minimum Premium for Platinum	10%
Premium for Platinum with Cushion (Platinum + 3)	15%

Budget based on prioritizing all possible LEED™ points from least to most cost.

All values are percentage additions to base budget project cost at Design Development.

UNDERSTAND THE COSTS OF ACHIEVING GOALS

Table A: Financial Benefits of Green Schools ($/ft²)	
Energy	$9
Emissions	$1
Water and Wastewater	$1
Increased Earnings	$49
Asthma Reduction	$3
Cold and Flu Reduction	$5
Teacher Retention	$4
Employment Impact	$2
TOTAL	$74
COST OF GREENING	($3)
NET FINANCIAL BENEFITS	$71

Source: *Greening America's Schools,* Capital E, 2006

Research indicates high performance buildings can enhance:

- Health
- Productivity
- Sense of well being

SFS research in collaboration with Yale School of Forestry and Environmental Studies

SIDWELL WILL CONTRIBUTE TO PRIMARY RESEARCH ON HIGH PERFORMANCE BUILDINGS

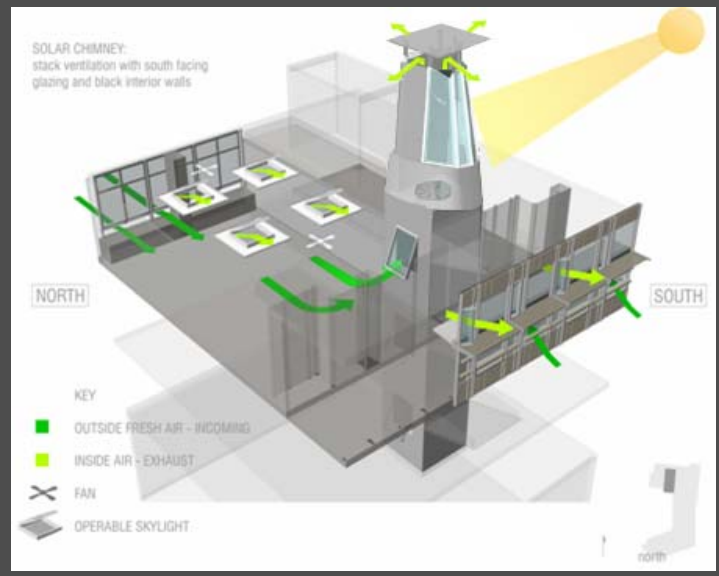
- Energy efficient heating (geothermal heat pump), cooling and lighting
- Improved air quality through low VOC (Volatile Organic Compounds) paint and carpet
- Preserves National Landmark historic building and school symbol

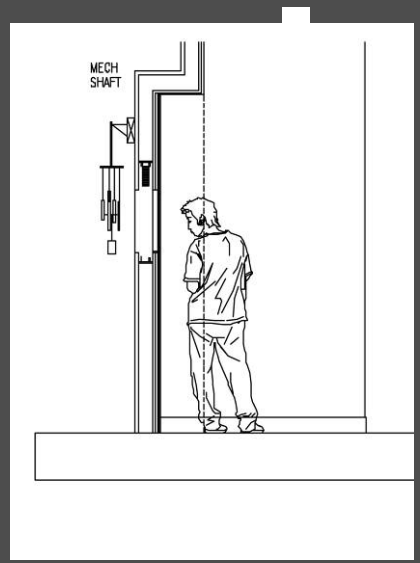
- No specific LEED goal for LS project
- Application of ethical and financial principals expected to result in high Silver or low Gold LEED rating

Other Green Projects at Sidwell Friends School

Demonstrates green design does not:

- Come at the cost of faculty compensation
- Drive tuition growth
- Conflict with other institutional objectives



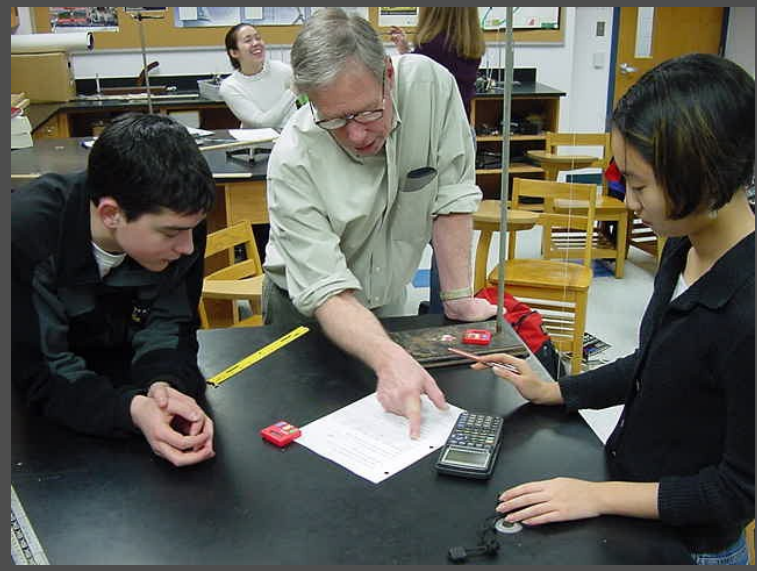


LONG RANGE FINANCIAL PLAN

Project champion

Progressive Buy-In

- There is a problem
- The school can be part of the solution
- We can afford to do it
- The school will be improved if we do



SOLIDIFY LEADERSHIP

Mindset – Intent and commitment to succeed

Process – Integrated, all parties engaged

Tools – Benchmarks (LEED), Modeling Programs (DOE2), Payback Analysis Framework

Outcomes – Technology, Products, Techniques

FRAMEWORK TO EFFECTIVELY ACHIEVE HIGH PERFORMANCE DESIGN

Adapted from Bill Reed

- Project serves as a catalyst for broader change
  - Operations
  - Transportation
  - Curriculum
- Faculty and staff serving on Environmental Stewardship Committee
- Trustees and experts serve on Green Advisory Board
- Develop a culture of sustainability

LEVERAGE THE BUILDING PROJECT

Bike to School Day

ECO

Green Team

Summer Programs

EXPECT SPONTANEOUS, INDIVIDUAL-DRIVEN IDEAS TO BUBBLE UP

SIDWELL FRIENDS SCHOOL

Washington, DC

Mike Saxenian, saxenianm@sidwell.edu

KIERANTIMBERLAKE ASSOCIATES LLP

Architect, Philadelphia PA

Amy Floresta, afloresta@kierantimberlake.com

ANDROPOGON ASSOCIATES LTD

Landscape Architect, Philadelphia PA

Jose Alminana, alminanaj@andropogon.com

GREENSHAPE LLC

Sustainable Design Consultant, Washington DC

Iris Amdur, irisamdur@greenshape.com

INTEGRATIVE DESIGN COLLABORATIVE

Sustainable Design Consultant, Arlington MA

JFW, INC

Project Manager, Gaithersburg MD

BRUCE E. BROOKS & ASSOCIATES

Building Systems Engineer, Philadelphia

VIKA INC

Civil Engineer, McLean VA

CVM

Structural Engineer, Wayne PA

NATURAL SYSTEMS INTERNATIONAL

Wetland Engineer, Santa Fe NM

SEAN O'CONNOR ASSOCIATES

Lighting Consultant, Philadelphia PA

BENYA LIGHTING DESIGN

Lighting Consultant, Tigard OR

SHEN MILSOM WILKE

AV/IT/Acoustics Consultant, Arlington VA

USSI

Security/IT Consultant, Washington DC

ENGINEERING ECONOMICS INC

Commissioning Agent, Arlington VA

HITT CONTRACTING INC

General Contractor, Fairfax VA

DESIGN TEAM