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

WHY GREEN?
Middle School Building

High Performance Green Facilities: Practical Lessons from Sidwell Friends School
Middle School has Earned a LEED Platinum Rating
High Performance Green Facilities: Practical Lessons from Sidwell Friends School

DISTRICT OF COLUMBIA CAMPUS

Rock Creek
Stream Valleys
Watershed Divide
Upland Ridge
Glover Archbold Park
DC Campus

Level III Ecoregions of the Continental United States:

- 45. Piedmont
- 62. North Central Appalachians
- 63. Middle Atlantic Coastal Plain
- 64. Northern Piedmont
- 65. Southeastern Plains
- 66. Blue Ridge
- 67. Ridge and Valley
- 69. Central Appalachians
- 70. Western Allegheny Plateau
- 84. Atlantic Coastal Pine Barrens
Rain water is revealed and connected to living systems

RAIN WATER RESOURCES
High Performance Green Facilities: Practical Lessons from Sidwell Friends School
Constructed wetland system illustrates food-waste-food cycle.

WASTE WATER RESOURCES
High Performance Green Facilities: Practical Lessons from Sidwell Friends School
Building elements refer to the original and secondary sources.

SOURCE KNOWLEDGE
High Performance Green Facilities: Practical Lessons from Sidwell Friends School
High Performance Green Facilities: Practical Lessons from Sidwell Friends School
DAYLIGHTING AND BUILDING SYSTEMS
High Performance Green Facilities: Practical Lessons from Sidwell Friends School
The vertical fins are angled 51.25 degrees N of W to maximize shading between Noon and 3:30pm
Orientation, high-efficiency envelop and reliance on natural lighting save energy at the outset.

Wall and roof systems balance thermal performance with optimal daylighting.
SUNSCREENS AND LIGHT SHELF

High Performance Green Facilities: Practical Lessons from Sidwell Friends School
PASSIVE AND ACTIVE ENERGY SYSTEMS

High Performance Green Facilities: Practical Lessons from Sidwell Friends School
High Performance Green Facilities: Practical Lessons from Sidwell Friends School

**Efficient Lighting Design** Reduced Energy Use

Associated with Lighting by 92%

**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

---

**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**

<table>
<thead>
<tr>
<th>Regulated Energy Summary by End Use</th>
<th>Energy Type</th>
<th>Energy</th>
<th>Peak</th>
<th>Energy</th>
<th>Peak</th>
<th>Budget Energy</th>
<th>Proposed / Budget Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting - Conditioned</td>
<td>Electricity</td>
<td>32,287</td>
<td>411,198</td>
<td>8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lighting - Unconditioned</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Space Heating</td>
<td>Gas</td>
<td>424,610</td>
<td>697,350</td>
<td>61%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Space Cooling</td>
<td>Electricity</td>
<td>96,417</td>
<td>210,050</td>
<td>46%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pumps</td>
<td>Electricity</td>
<td>30,751</td>
<td>51,127</td>
<td>60%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fans - Interior Ventilation</td>
<td>Electricity</td>
<td>41,570</td>
<td>47,884</td>
<td>87%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fans - Interior Exhaust</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Water Heating</td>
<td>Gas</td>
<td>1RR AM</td>
<td>1RR AM</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL BUILDING CONSUMPTION** 815,495.7 1,608,069.7 51%

**Energy and Cost Summary by Fuel**

<table>
<thead>
<tr>
<th>Energy and Cost Summary by Fuel</th>
<th>DEC** Use [10^3 Btu]</th>
<th>DEC** Cost [$]</th>
<th>EBC** Use [10^3 Btu]</th>
<th>EBC** Cost [$]</th>
<th>DEC** / EBC** Energy %</th>
<th>Cost %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>201,026</td>
<td>$4,182</td>
<td>720,860</td>
<td>$14,966</td>
<td>28%</td>
<td>28%</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>814,470</td>
<td>$4,529</td>
<td>887,210</td>
<td>$6,539</td>
<td>69%</td>
<td>69%</td>
</tr>
<tr>
<td>Other Fossil Fuel</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Subtotal Nonrenewable (DEC**)</td>
<td>815,496</td>
<td>8,711</td>
<td>1,608,070</td>
<td>21,535</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtotal Renewable (REC**)</td>
<td>(59,096)</td>
<td>(436)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>756,401</td>
<td>$8,275</td>
<td>1,608,070</td>
<td>$21,535</td>
<td>62%</td>
<td></td>
</tr>
</tbody>
</table>

**Percent Savings** = (EBC** - DEC**) / EBC** = 62%

**Credit 1 Points Awarded** = 10

**Percent Renewable** = (REC*) / DEC* = 5%

**Credit 2 Points Awarded** = 1
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”
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

<table>
<thead>
<tr>
<th>Credits in Base Budget (Gold + 1)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Premium for Gold (Certification Costs)</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Premium for Gold with Cushion (Gold + 3)</td>
<td>2%</td>
</tr>
<tr>
<td>Minimum Premium for Platinum</td>
<td>10%</td>
</tr>
<tr>
<td>Premium for Platinum with Cushion (Platinum + 3)</td>
<td>15%</td>
</tr>
</tbody>
</table>

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.
Table A: Financial Benefits of Green Schools ($/ft²)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>$9</td>
</tr>
<tr>
<td>Emissions</td>
<td>$1</td>
</tr>
<tr>
<td>Water and Wastewater</td>
<td>$1</td>
</tr>
<tr>
<td>Increased Earnings</td>
<td>$49</td>
</tr>
<tr>
<td>Asthma Reduction</td>
<td>$3</td>
</tr>
<tr>
<td>Cold and Flu Reduction</td>
<td>$5</td>
</tr>
<tr>
<td>Teacher Retention</td>
<td>$4</td>
</tr>
<tr>
<td>Employment Impact</td>
<td>$2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$74</strong></td>
</tr>
<tr>
<td><strong>COST OF GREENING</strong></td>
<td><strong>($3)</strong></td>
</tr>
<tr>
<td><strong>NET FINANCIAL BENEFITS</strong></td>
<td><strong>$71</strong></td>
</tr>
</tbody>
</table>

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
• 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
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
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
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

High Performance Green Facilities: Practical Lessons from Sidwell Friends School