

Capuano Early Childhood Center

Presented by:
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High Performance Green Facilities

- Improved Learning and Working Environment
- Costs less to maintain and operate
- Sensitive to the Environment



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Capuano Early Childhood Center Somerville, MA



- Grades Pre-K to 1
- 80,000 square feet, 2 story
- 400/560 students
- Fully air conditioned
- Built on Public Park
- MTC Green School Program
- LEED Registered
- Occupied September 2003

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Green Metrics

- NESEA Green Building Award – 2004
- 18 energy efficiency enhancements
- 47% electricity reduction
- 24% natural gas reduction
- 41% overall energy cost reduction ~ \$60,000 annually
- Water conservation – 56% site, 26% building
- Construction Recycling – 600 tons
- \$793,260 grant funding

Design Process - In the beginning

Green for non-green clients

- Improve the learning environment
- Decrease maintenance
- Decrease energy usage

Shhh - Don't use the word "Green"



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Design Process

Edgerly original client H. P. goals:

- Maximize daylighting in teaching spaces
- Reduce energy usage if payback reasonable
- Deliver fully functioning HVAC system
- Use materials that reduce maintenance/replacement



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Ederly Early Childhood Development Center Somerville, Massachusetts

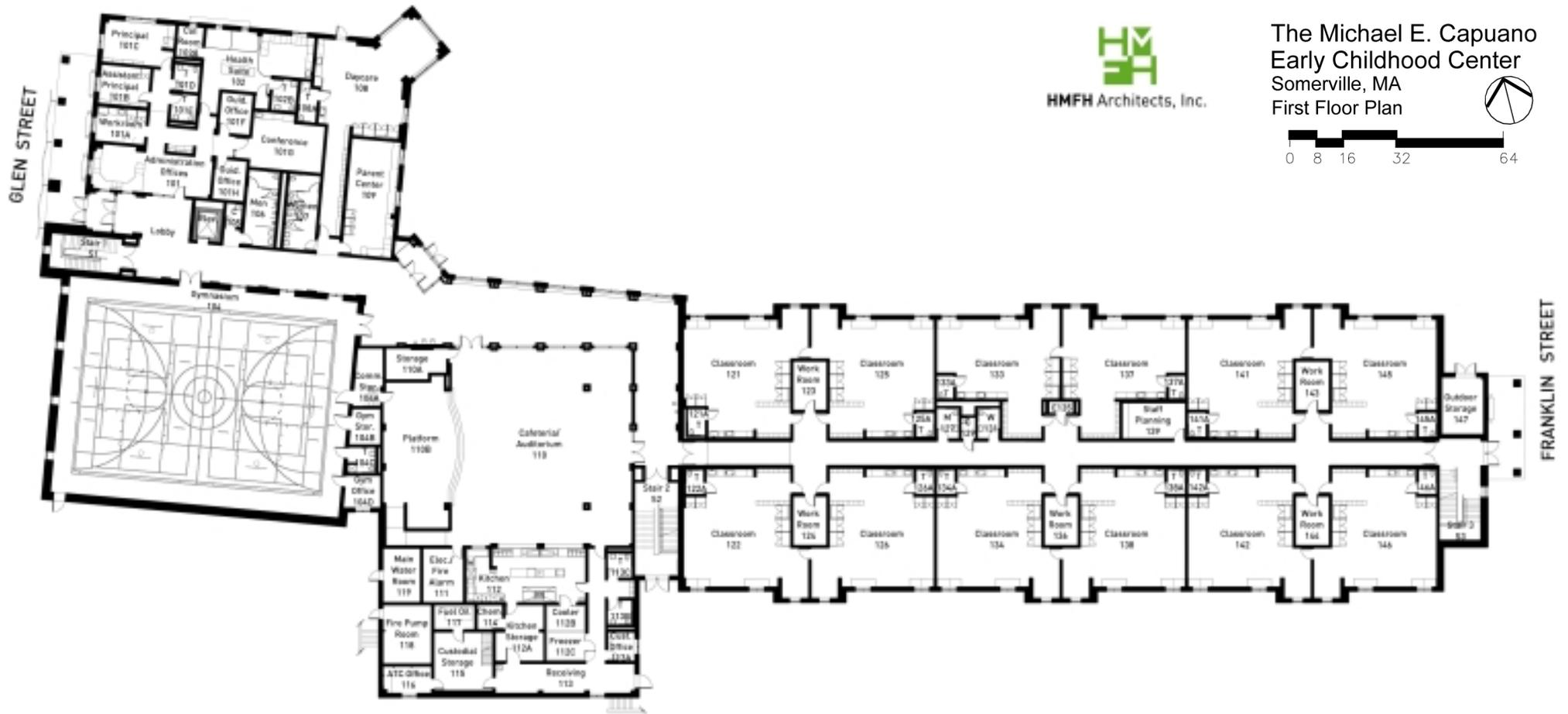


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First Floor Plan



The Michael E. Capuano
Early Childhood Center
Somerville, MA
First Floor Plan



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Decrease Environmental Impact

Site Strategies:

- Bought land to replace recreational area 1:1
- Removed PCB, lead, & mercury contaminated soils
- Net decrease in site drainage run-off –
- Roof run-off re-absorbed in underground retention / infiltration area



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Decrease Environmental Impact

Site Strategies:

- Native plantings with low water requirements
- Drip irrigation in lieu of spray heads in non-play field spaces
- Replaced tall sports lights with low light pollution pedestrian level lights
- Reduced parking, broke down lots, shaded to reduce heat island effect



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Improving The Learning & Working Environment

Example: Daylighting



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What HMG found in Capistrano

Students with the most daylighting in their classrooms (compared to least in classrooms):

- progressed 20% faster in math tests
- progressed 26% faster on reading tests

Students with poorly designed daylighting in classrooms:

- declined 21% on reading tests

➤ Net 47 % swing in performance good to bad

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Capuano School Daylighting Goals

Circulation Spaces

- Add daylight for orientation/differentiation/pleasant feel
- OK to have some direct light for “sparkle”

Teaching Spaces, Offices

- Provide excellent daylighting
- On sunny days – enough daylight to shut off lights
- On densely cloudy days – fill in with artificial light
- Minimize direct light
- Views to exterior at kid-appropriate heights



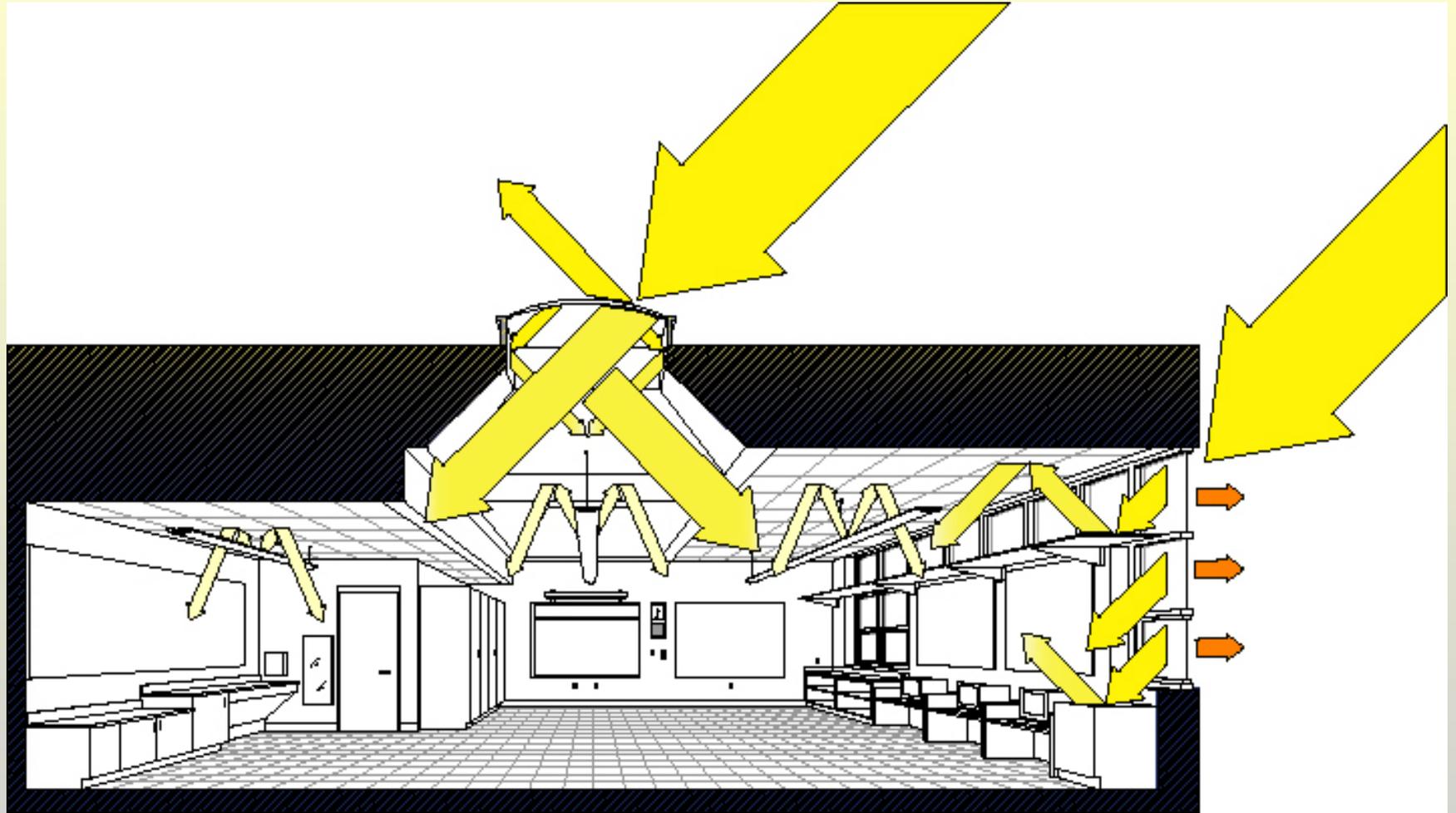
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Daylighting



Edgerly School Classroom Section

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Daylighting - Physical Model



Up on the roof - testing the model

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Daylighting - skylights



2nd floor - with skylights
Equinox at noon - south side



2nd floor - without skylights
Equinox at noon - south side

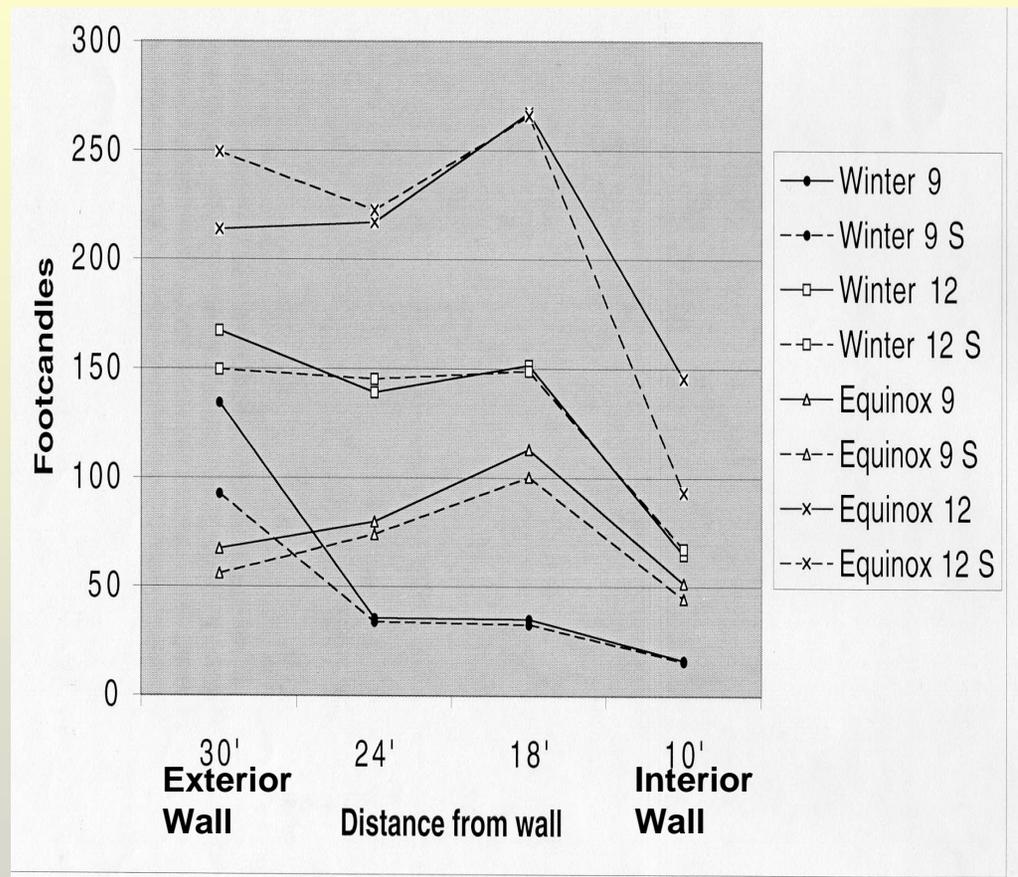
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Daylighting - Analysis Graph



S = Shelf

**2nd floor - with skylights
south side**

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Daylighting - skylights



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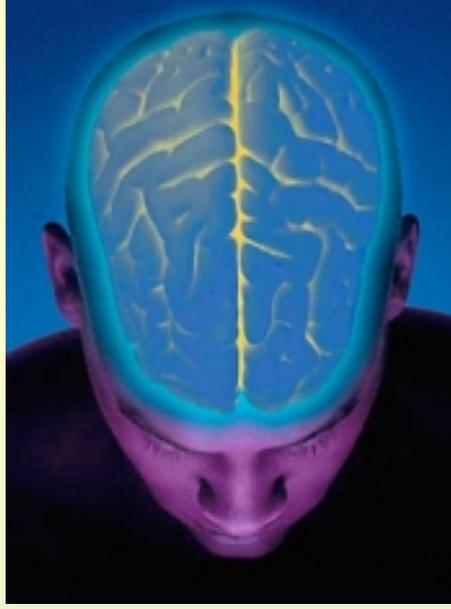


Multi-purpose Materials

Fiberglass acoustic ceiling tile in lieu of mineral fiber tile (multi-tasking material):

- Washable
- Stain resistant
- Does not sag
- Does not support mold or mildew growth
- 70 % NRC improvement
- 88 % light reflectance – increases lighting efficiency

21 ECM-4: Daylight Dimming Control



Strategy:

- Dim lights near windows and skylights & then shut them off when daylight is sufficient

Base Case:

- Lights on in rooms whenever occupied

Upgrade:

- Add photocell at windows, skylights
- Add dimming ballasts to linear fluorescents
- Assumes extra daylighting provided - skylights, clerestories, light shelves....

ECM No.	Savings Per Year				Increm't'l Cost	U. Payback w/out Inc.	NSTAR Incentive	Cost After Incentive	Util. Inc. Payback	Owner Payback	Include in Project
	kWh	MMBtu	Utility \$	Owner \$							
4	41,404	(83)	\$2,744	\$6,002	\$16,740	6.1	\$11,691	\$5,049	1.8	0.8	Yes

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Improve Thermal Building Envelope

Architectural Enclosure:

- Continuous air barrier
- Add Icynene to exterior wall, R12 upgraded to R23
- Increase roof rigid insulation from 4" to 5 1/2" R20 upgraded to R27.5
- Provide R5 rigid insulation under entire slab-on-grade
- Upgrade window glazing to 1 1/2" heat mirror R4.5
- Glazing tuned to different exposures



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Icynene Expanding Foam Insulation

First large commercial building to use it

- 3" applied, R3.6/in.
- Fills all gaps, holes
- Never falls down
- No odor – CO₂ only
- ~\$.80 - \$1.00/s.f.
- Reduces leakage – need for pressurization

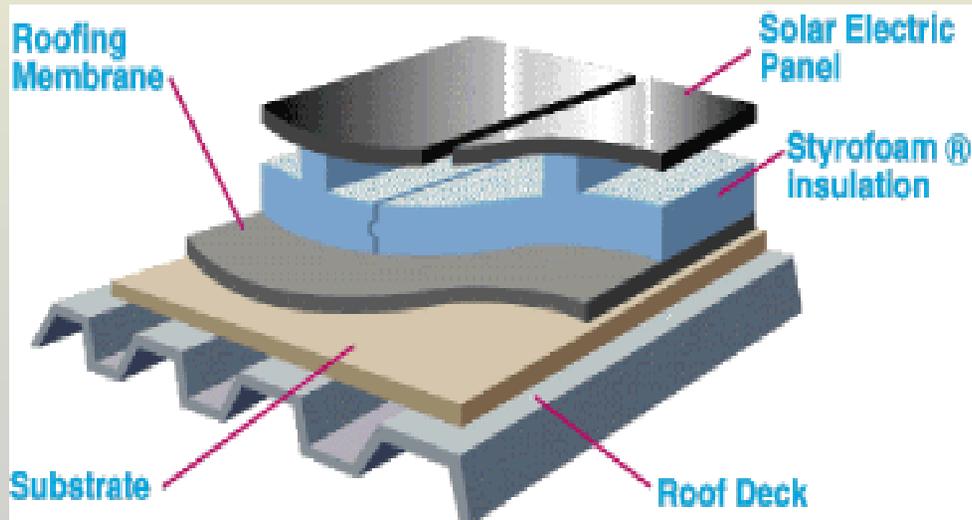


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Renewable Energy

- 34.96 kWp Photovoltaic System on roof
- 400-watt Wind Turbine
- Submeter Gas, Electric, Water
- Environmental Curriculum



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H.P. Incremental Construction Costs

Base Building Construct'n Cost	\$12,220,000	\$152.33/sf
Base Incremental H.P. Constr. Cost	\$420,000	\$5.23/sf
Renewable Energy/Submetering	\$416,000	\$4.69/sf
<u>Additional Design/Energy Analysis Fees</u>	<u>\$165,000</u>	<u>\$2.06/sf</u>
Subtotal Incremental Costs:	\$1,001,000	\$12.48/sf
Total Building Construction Cost	\$13,221,000	\$164.85/sf

H. P. Incremental Funding

Massachusetts Technology Collaborative:

Renewable Energy – Construction	\$320,000
Energy Efficiency – Construction	\$150,000
Green Consulting Fees	\$130,000
<u>Green Curriculum Development</u>	<u>\$30,000</u>
Subtotal:	\$630,000

NSTAR Electric, Keyspan Gas:

Electrical Efficiency Construction Incentives	\$99,000
Natural Gas Efficiency Construction Incentives	\$14,000
Commissioning	\$15,000
<u>Design and Analysis Fees</u>	<u>\$35,000</u>
Subtotal:	\$163,000

Total from Utility and MTC: \$793,000 \$9.89/sf

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H. P. Net Cost



H.P. Incremental Cost	\$1,001,000	\$12.48/sf
H.P. Incremental Funding	\$793,000	\$9.89/sf
<u>Net Increase</u>	<u>\$208,000</u>	<u>\$2.59/sf</u>

Increase As Percent of Total:	\$2.59/ \$164.85	1.6%
Payback based on energy alone:	\$208,000/\$58,060	3.6 yrs

What can you do to help?

- Educate building inspectors – ie. Waterless urinals, greywater systems
- Lobby Utility Companies for renewable energy intertie simplification, higher threshold for retail sale back to grid
- Incentivise clients - \$ works in public sector
- Fund in-depth case studies – Concrete info allows conservative public clients to adopt new technologies
- Get high performance requirements into codes
ie – MA Green School regulations for SBA

Contact Information



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