The Full Benefits of Green Schools

NYC Green Buildings Salon

February 9, 2006

Jeff Perlman

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National Review of Green Schools: Costs, Benefits, and Implications for Massachusetts

For the Massachusetts Technology Collaborative

November 2005

Principal Author: Greg Kats
Contributing Author: Jeff Perlman
Contributing Researcher: Sachin Jamadagni

A Capital E Report

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Assumptions

- Typical School
  - $25 million, 125,000 ft^2 school built for 900 students
- Term: 20 years NC, 15 years retrofit
  - Inflation: 2%
  - Discount rate: 5% real
- Energy Prices:
  - Electricity: $0.15 kWh
  - Heating oil: $2.50/gallon
  - Natural gas: $1.50/therm
  - Annual Increase: 4% per year

Point Achievements for Green Schools Under Different Green Building Standards

	Possible MA-CHPS Points	MA-CHPS Average (16 schools)	Possible LEED Points	LEED Average (10 schools)	Possible WSS Points	WSS Average (2 schools)
SITE	14	7.8	14	6.5	16	10.7
WATER	7	2.6	5	3.4	6	3.0
ENERGY	27	8.6	17	7.2	20	9.3
MATERIALS	11	2.3	13	6.3	17	6.3
IEQ	24	10.6	15	10.1	21	14.0
EXTRA CREDIT	13	3.4	5	4.1	8	3.7
TOTAL	**96**	**35.3**	**69**	**37.6**	**88**	**47.0**

“Hard” Benefits of Green Schools

- Direct Energy Cost Savings (~33%)
- Indirect Energy Savings (price impact)
  - Value: 50% of Direct Energy Cost Savings
- Emissions Reduction (energy)
  - NOx, SO_2, CO_2, PM_{10}, Hg
- Water/Wastewater Efficiency
  - Indoor Low-flow Plumbing, Landscaping, Rainwater Catchment
  - Reduced water/sewer expenditures (~32%)
  - Avoided societal costs of increasing capacity
- Waste Reduction
  - New MA laws require all construction to meet strict low waste standards

Analysis: 12 MA Schools

School	*State*	*Year Complete*	*2005 MA-CHPS*	*LEED Score*	*Cost Premium*	*Energy Savings*	*Water Savings*
Ashland High School*	MA	2005	19		1.91%	29%	
Berkshire Hills Regional Middle School*	MA	2004	27		3.99%	34%	0%
Blackstone Valley Regional Vocational Technical High School*	MA	2005	27		0.91%	32%	12%
Michael E. Capuano Early Childhood Center	MA	2003		26	3.60%	41%	
Crocker Farm School	MA	2001	37		1.07%	32%	62%
Danvers—Holten-Richmond Middle School*	MA	2005	25		3.79%	23%	7%
Dedham Middle School*	MA	2006	32		2.89%	29%	78%
Newton South High School	MA			32	1.36%	20%	20%
Melrose Middle School*	MA		36		2.02%	29%	35%
Whitman-Hanson Regional High School*	MA	2005	35		1.50%	35%	38%
Williamstown Elementary School	MA	2002	37		0.00%	31%	
Woburn High School*	MA	2006	32		3.07%	30%	50%
AVERAGE			***30***	***29***	***2.18%***	***30.4%***	***33.6%***

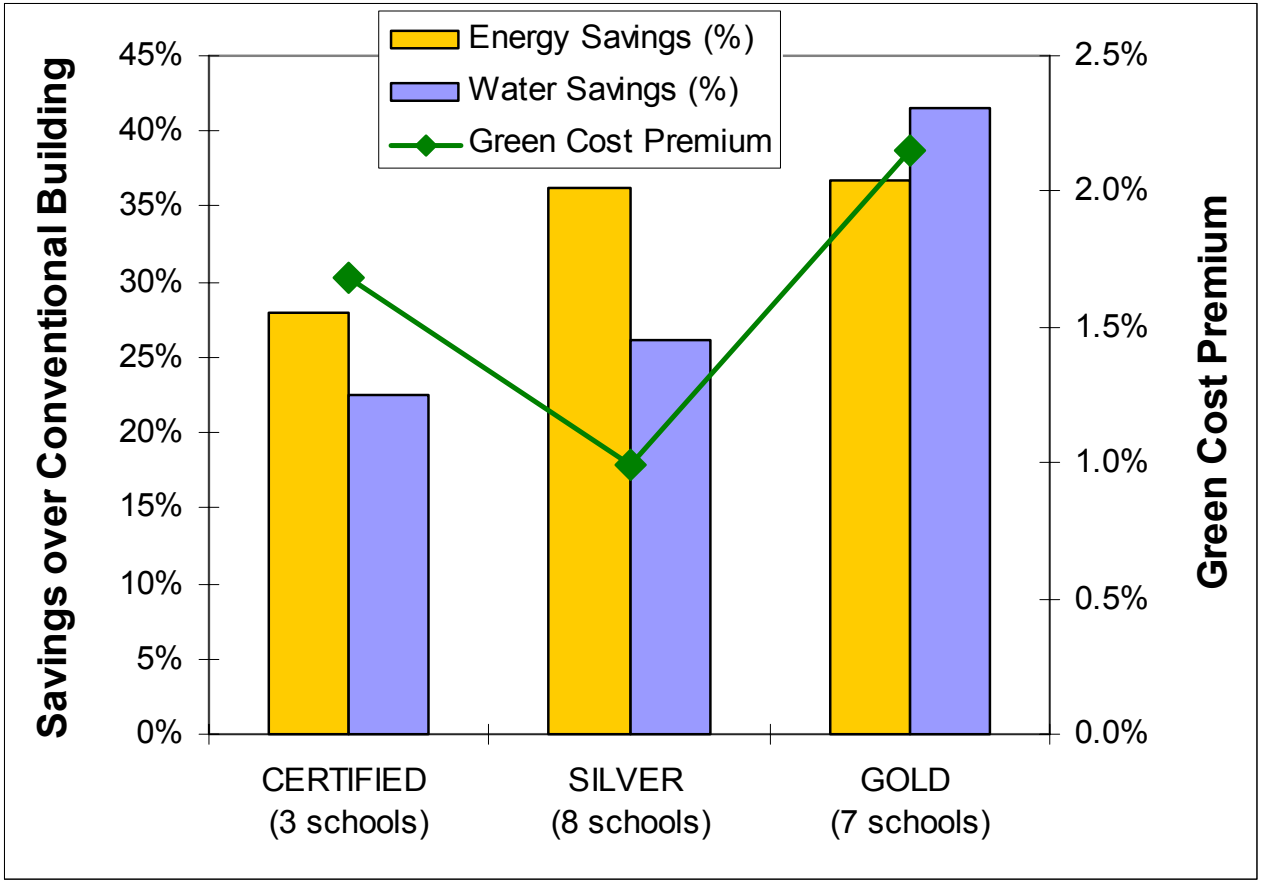
Analysis: 18 non-MA Schools

Name	*State*	*Year Complete*	*2005 MA-CHPS*	*LEED Score*	*LEED Level*	*Cost Premium*	*Energy Savings*	*Water Savings*
Ash Creek Intermediate School	OR	2002				0.00%	30%	20%
Canby Middle School	OR	2006		40	3-GOLD	0.00%	47%	30%
Clackamas	OR	2002		33		0.30%	38%	20%
Clearview Elementary	PA	2002	49	42	3-GOLD	1.30%	59%	39%
C-TEC	OH	2006	35	38	2-SILVER	0.53%	23%	45%
The Dalles Middle School	OR	2002			2-SILVER	0.50%	50%	20%
Lincoln Heights Elementary School	WA	2006			2-SILVER		30%	20%
Model Green School	IL	2004		34	2-SILVER	0.99%	30%	20%
Prairie Crossing Charter School	IL	2004		34	2-SILVER	3.00%	48%	16%
Punahou School	HI	2004		43	3-GOLD	6.27%	43%	50%
Third Creek Elementary	NC	2002		39	3-GOLD	1.52%	26%	63%
Twin Valley Elementary	PA	2004	41	35	2-SILVER	1.50%	49%	42%
Summerfield Elementary School	NJ	2006	42	44	3-GOLD	0.78%	32%	35%
Washington Middle School	WA	2006		40	3-GOLD	3.03%	25%	40%
Willow School Phase 1	NJ	2003		39	3-GOLD		25%	34%
Woodword Academy Classroom	GA	2002		34	2-SILVER	0.00%	31%	23%
Woodword Academy Dining	GA	2003		27	1-CERTIFIED	0.10%	23%	25%
Wrightsville Elementary School	PA	2003		38	2-SILVER	0.40%	30%	23%
AVERAGE			***41.8***	***37.3***		***1.26%***	***35.5%***	***31.9%***

Summary of Findings for Green Schools

	Cost Premium	***Energy Savings***	***Water Savings***
Average of 12 MA Schools	2.18%	30.4%	33.6%
Average of all 30 Schools	1.65%	33.4%	32.1%

Green School Cost Premium and Performance vs. LEED Level



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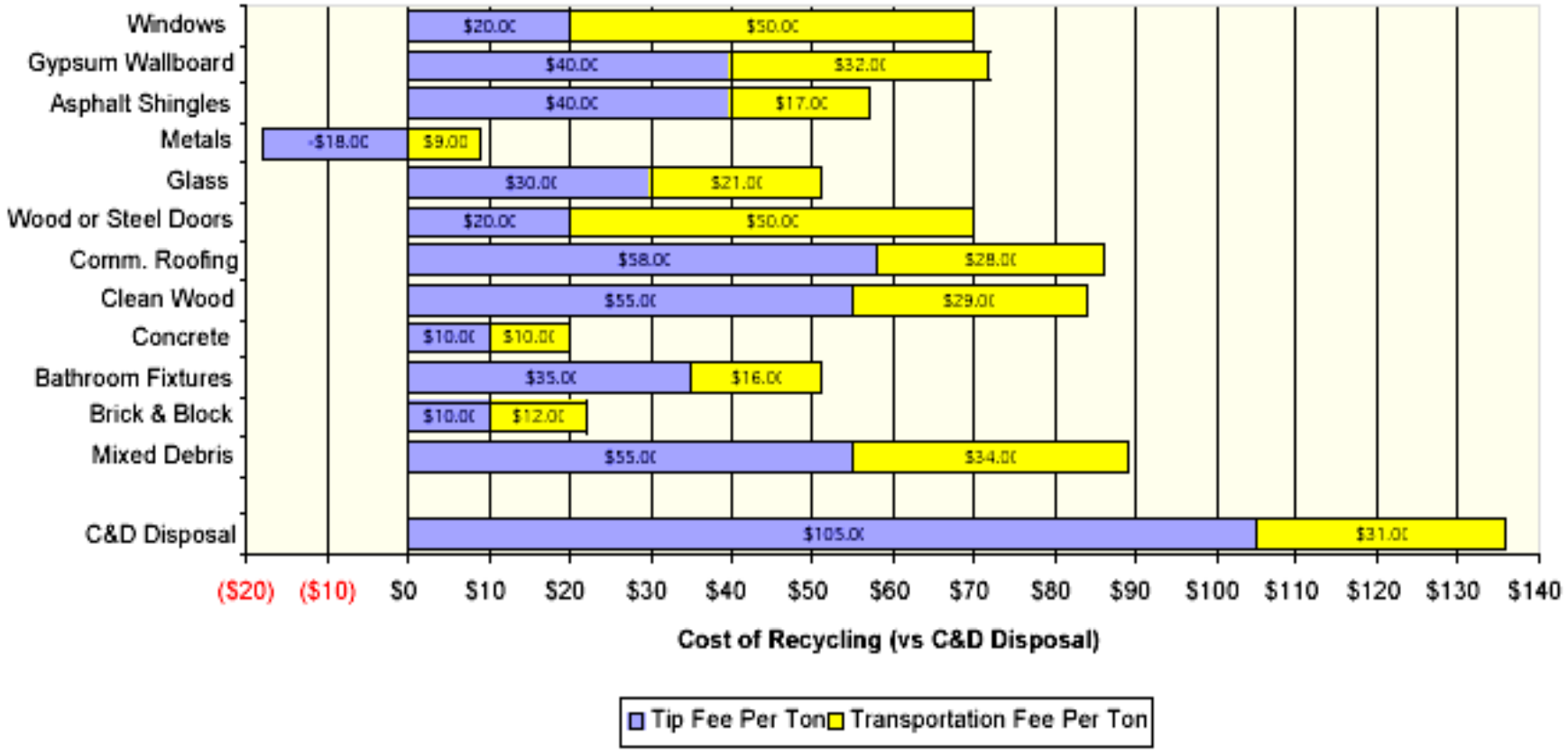
Energy Costs are typically

- 2-4% of school district budgets
- 16% of “manageable costs”

The Cost of Recycling vs Disposal of C&D Wastes (Boston area)



Source: The Institution Recycling Network, 2005

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Health & Learning
Benefits of Green Schools

Enhanced Indoor Air Quality

Increased Learning, Productivity & Performance (3%)

Increased Future Earnings of Students (1.4%)

Reduced Asthma (25%)

Reduced Colds and Flu (15%)

Reduced Teacher Turnover (3%)

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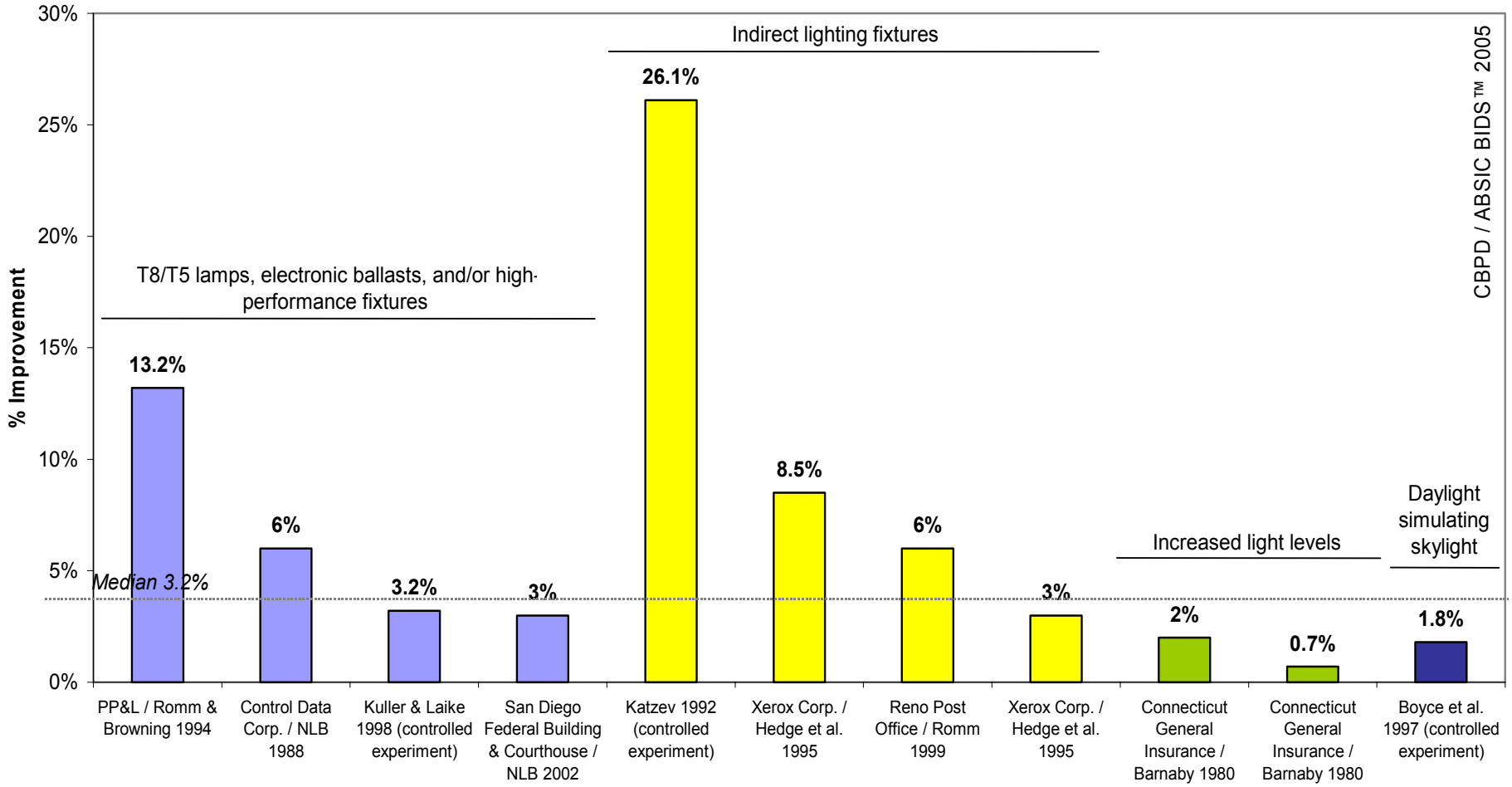
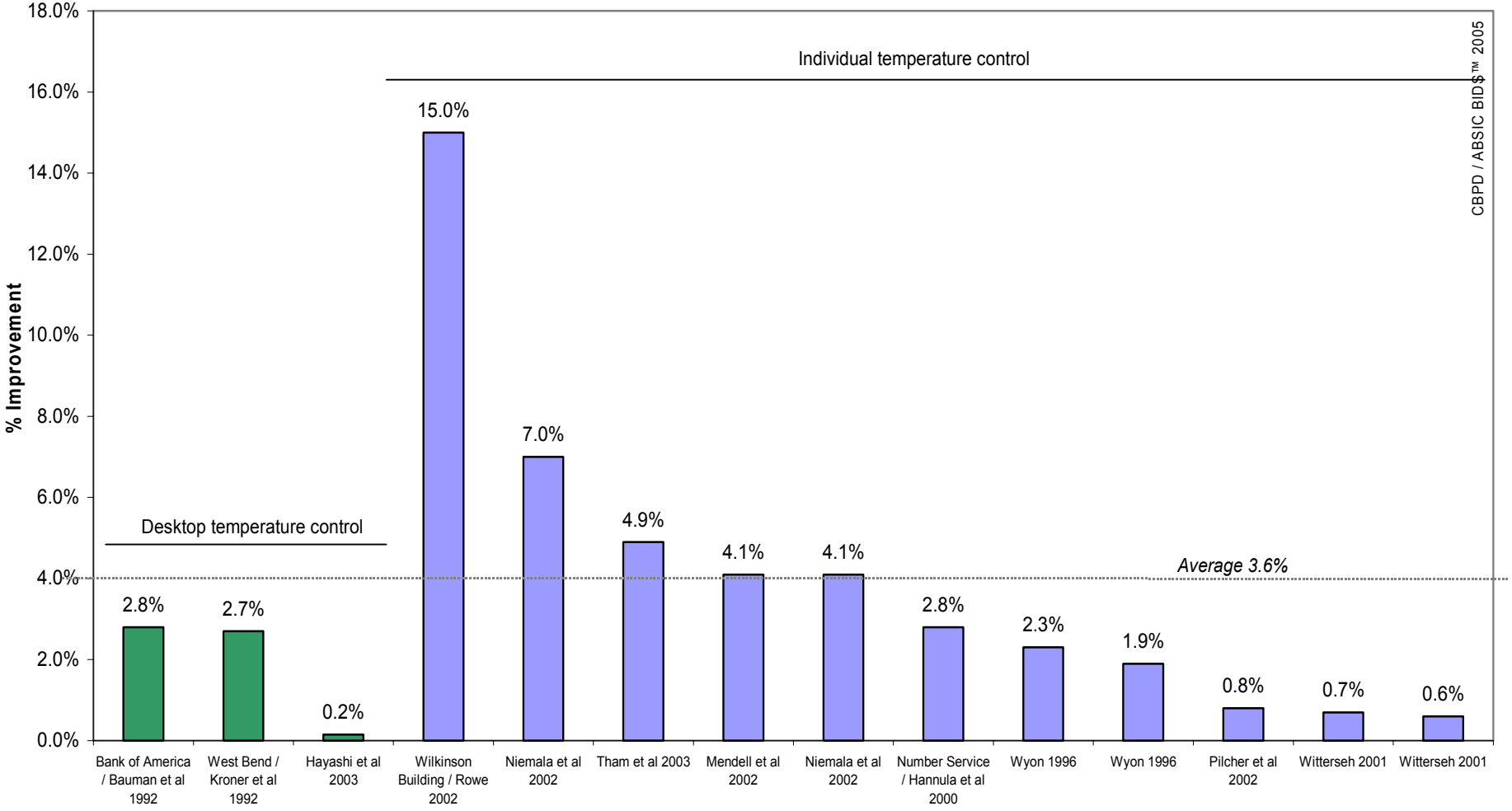
Productivity Gains from High Performance Lighting Systems



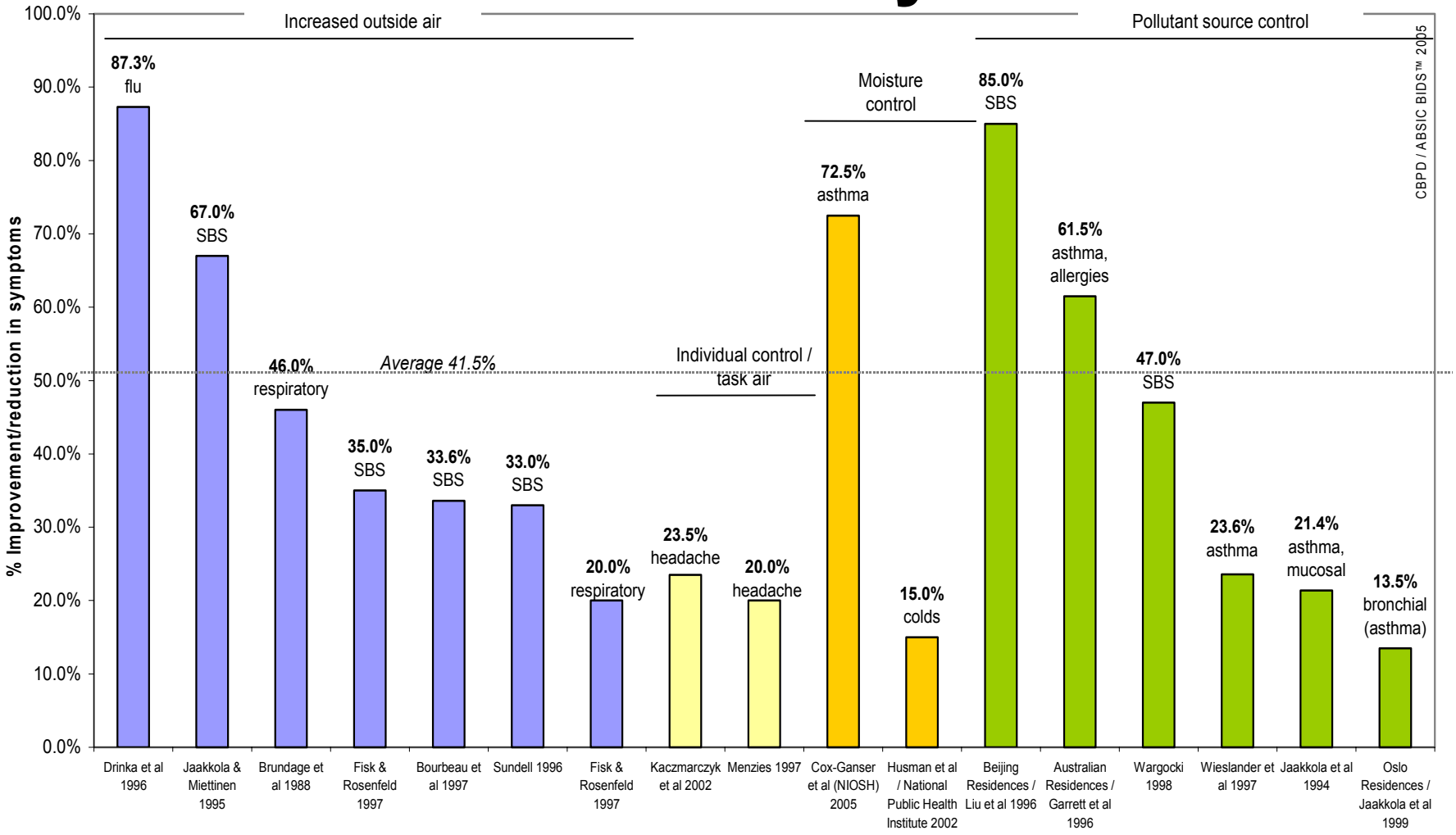
Source: Carnegie Mellon University Center for Building Performance, 2005

Productivity Gains from Improved Temperature Control



Source: Carnegie Mellon University Center for Building Performance, 2005

Health Gains from Improved Indoor Air Quality



Source: Carnegie Mellon University Center for Building Performance, 2005

Learning Increase Examples

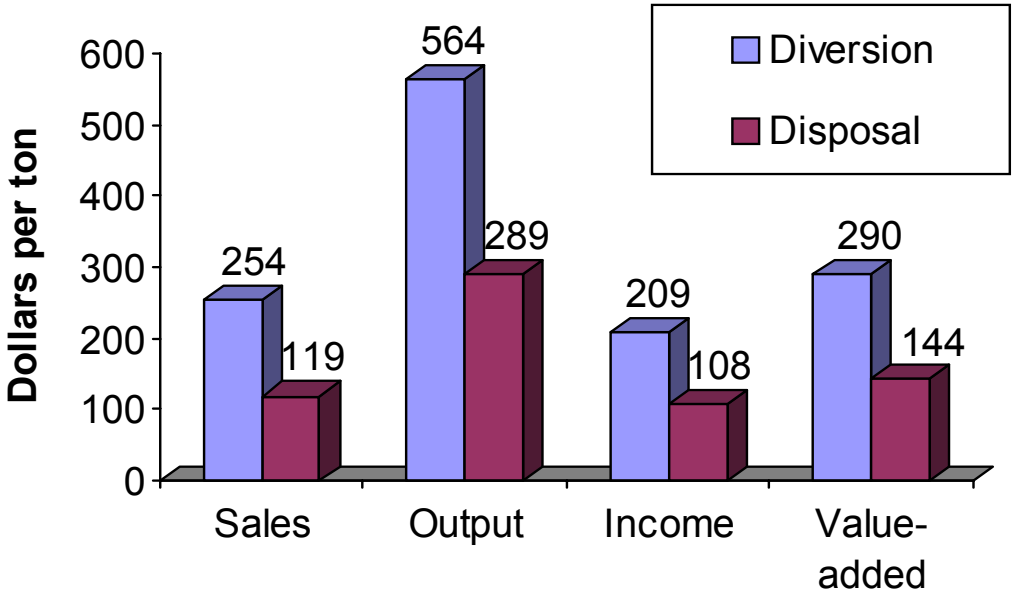
- Illinois – 5% increase in attendance
- Ash Creek, OR – 15% reduced absenteeism

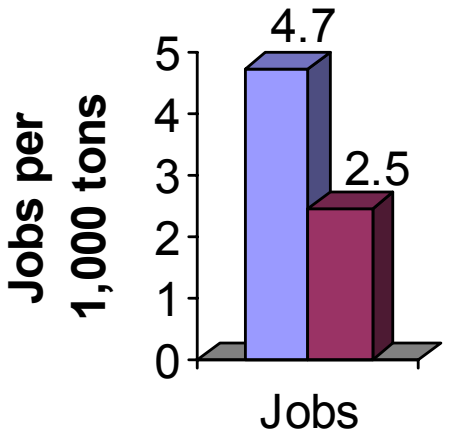
- Washington DC – 3-4% higher test scores
- Third Creek Elementary, NC – from 60% to 80% of students on grade level in math and reading
- Clearview Elementary, PA – 19% increase in reading scores

Employment Benefits of Green Schools

- Energy Efficiency
  - 3 short term jobs, one long term job per school
- Renewable Energy
  - More labor intensive, less polluting
- Waste Diversion
  - Recycling creates nearly 2x more jobs than waste disposal

Job Impacts of Waste Diversion





Source: Goldman and Ogishi, April 2001

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Benefits not Quantified

- Reduced Teacher Sick Days
- Heat Island Reduction
- Lower Operations and Maintenance (O&M) Costs
- Enhancement of generating system reliability and improved power quality
- Insurance and risk related benefits
- Improving Equity and Addressing Spiritual Values
- Educational enrichment as an aspect of greener, healthier facilities

The Financial Benefits of Green School Design ($/ft^2)

Energy	$14
Emissions	$1
Water & Wastewater	$1
Increased Earnings	$37
Asthma Reduction	$4
Teacher Retention	$4
Employment Impact	$3
TOTAL NPV	**$68**
Costs of Green Design	**$4**
NET FINANCIAL BENEFITS	**$60-$70**

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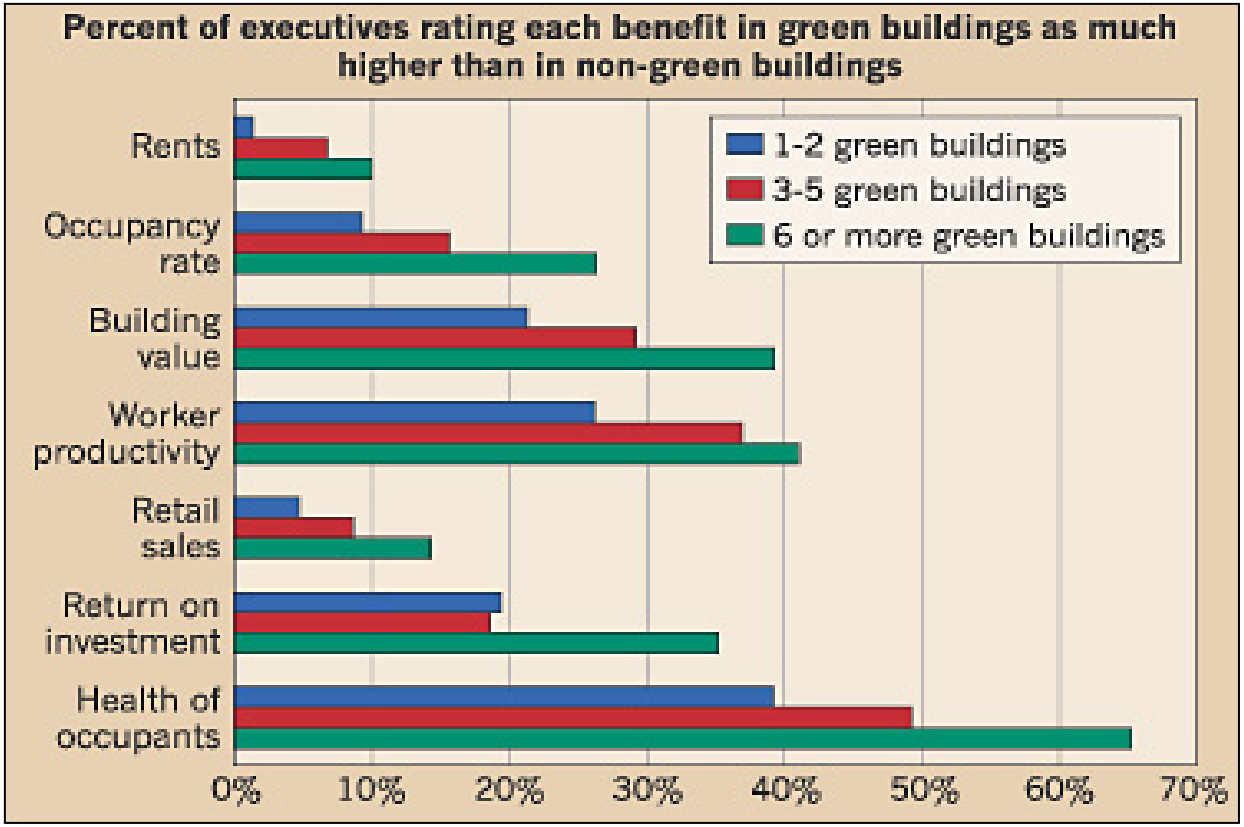
Executives' Views of Green Buildings by Number of Buildings



Source: Turner Construction Survey, 09/04

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Greening NYC Schools

- Challenges
  - Energy Purchase Disconnect (DCAS)
  - NYSERDA Ineligibility
- Opportunities
  - Local Law 86
  - NYPA Financing
  - New AND Existing Buildings

Suggestions for NYC Schools

- Create NYC-CHPS
  - LEED Certified is not sufficient
- Go for the simple stuff
  - Lighting
  - HVAC
- Integrate Green Aspects into the Curriculum
  - Solar PV
  - Water use
  - Energy Monitoring

And don’t forget to:

- **Put Energy and Water costs on the Balance Sheet for each building!**
  - This goes for all city agencies. A financial incentive to save goes a long way.

Contact Information

Jeff Perlman
President, Bright Power Inc.
37 W. 28th St. – 12th Floor
New York, NY 10001
212-803-5868
jperlman@brightpower.biz
www.brightpower.biz

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www.cap-e.com