Optimizing Energy use in Buildings

By: Tim Peckham

ACS
Design · Construction · Integration

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Learning Objectives

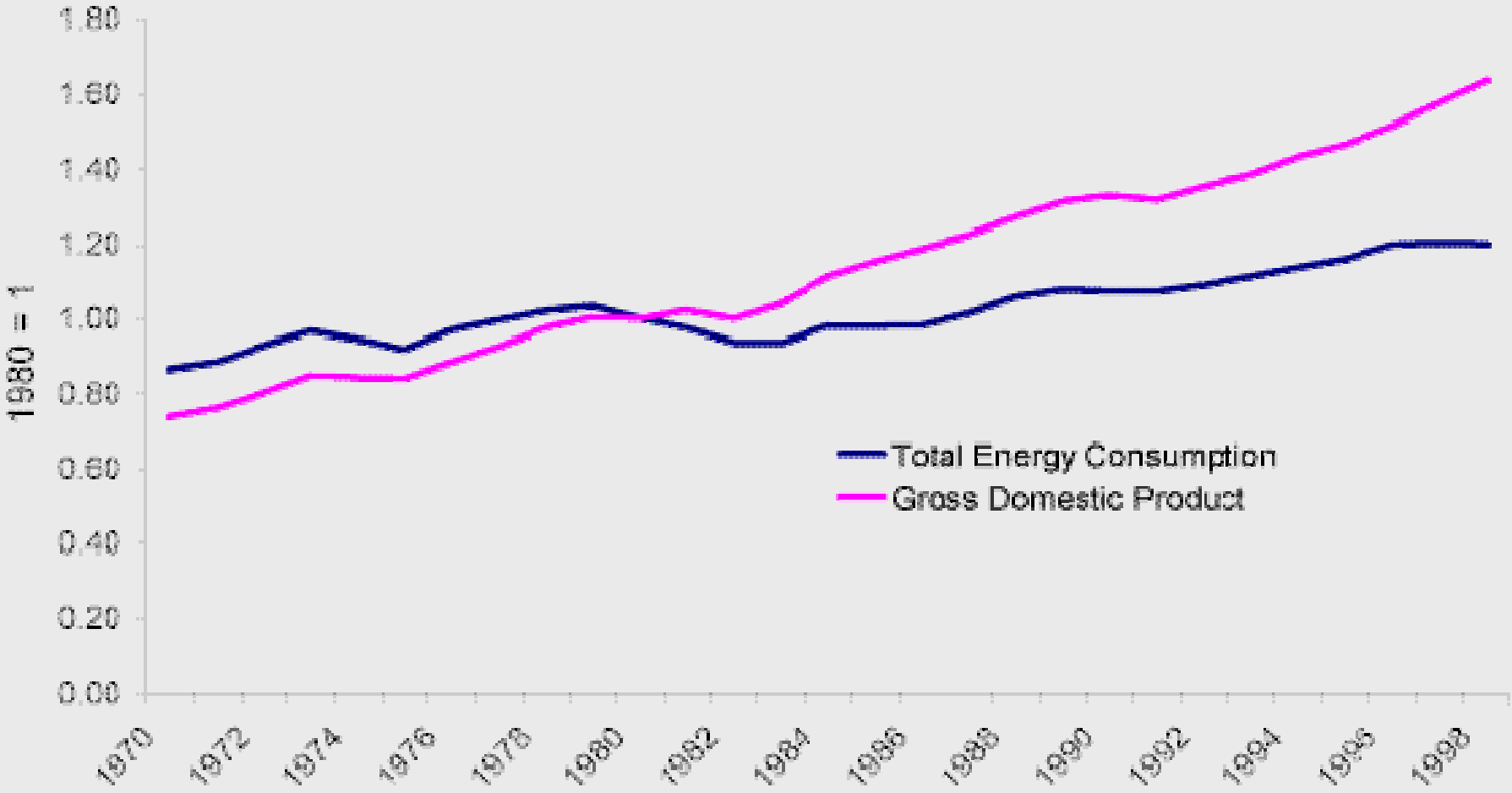
- Apply specific methods to reduce energy consumption in buildings.
- Understand the impact on reduced energy consumption on the initial building cost.
- Understand the economics of energy usage in a building.

Agenda

- Energy history
- Background of USGBC and LEED
- Basic Cost Data related to Green buildings
- Process for evaluating energy reduction options
- Simulation programs
- Optimizing systems
- Project examples

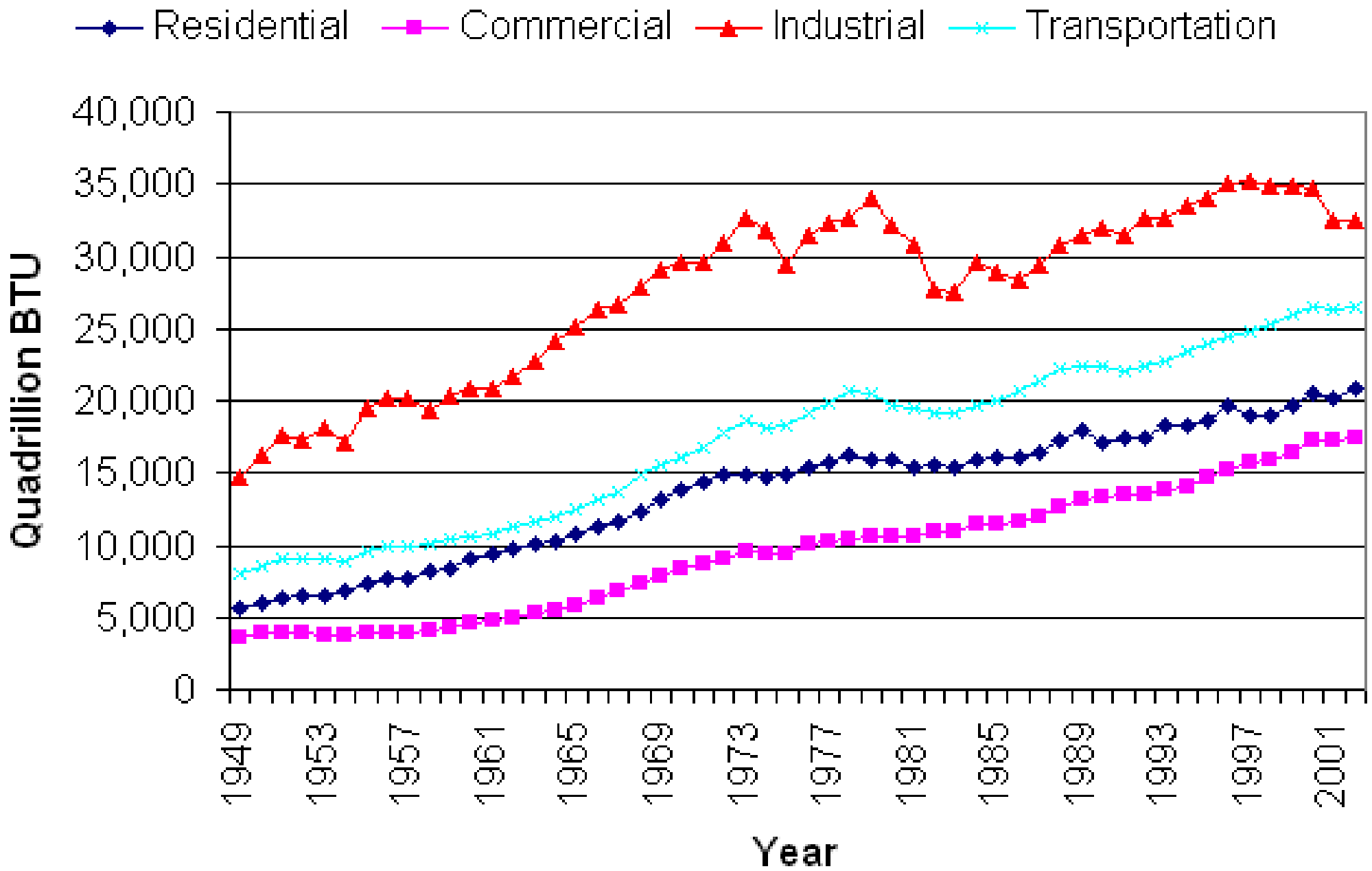
Energy History

Figure 2. Primary Energy Consumption and Gross Domestic Product, 1970-1998



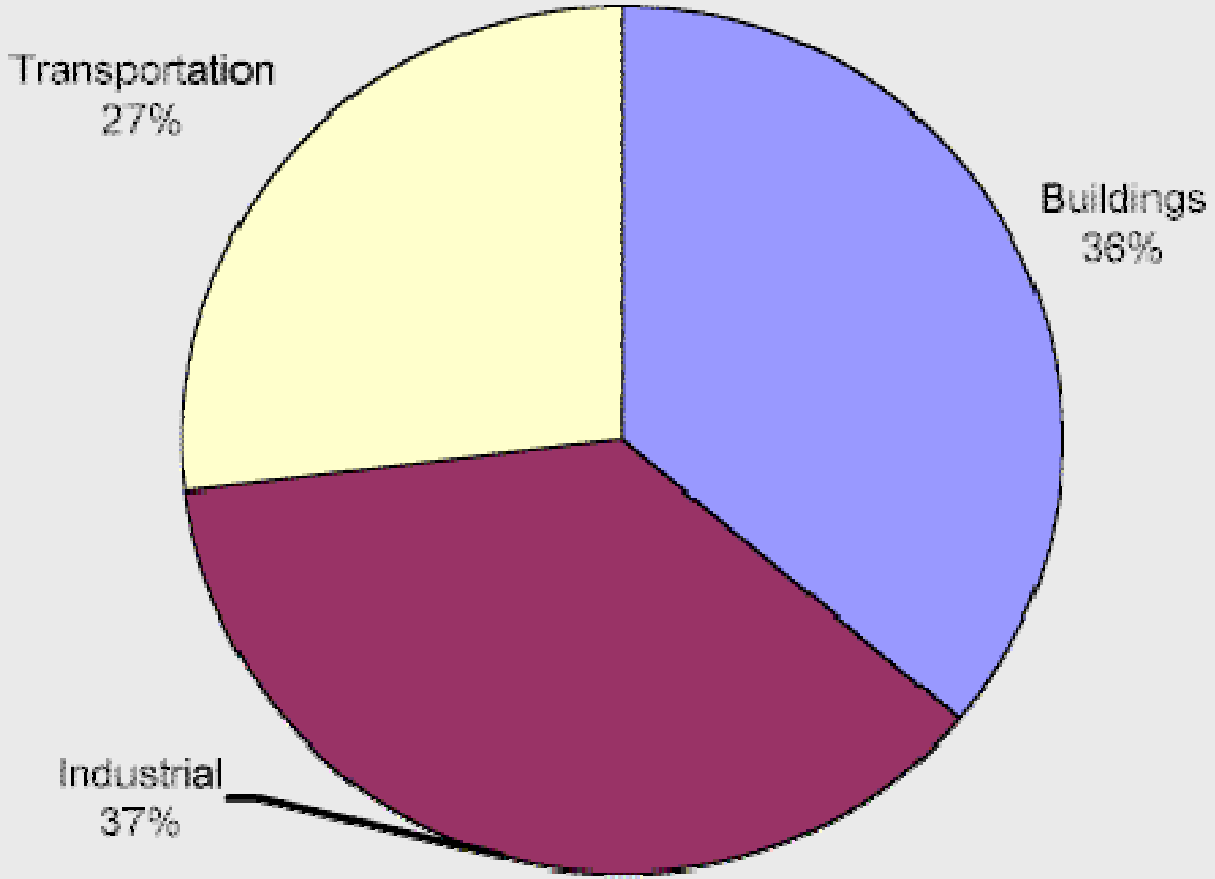
Energy Information Administration, *Annual Energy Review 1998*, Table 1.5

US Energy Consumption



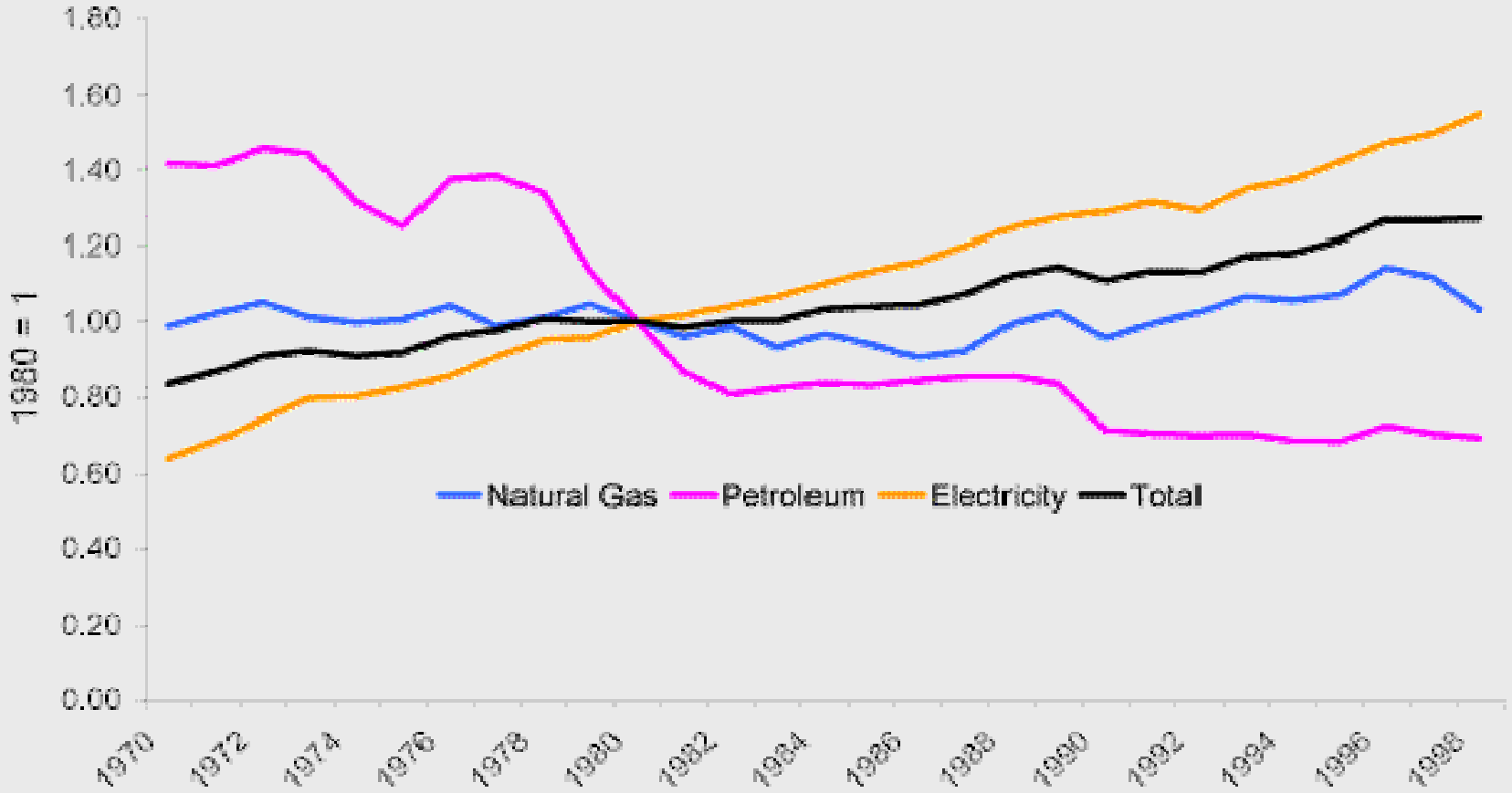
http://www.eia.doe.gov/

Figure 1. Total Primary Energy Use in the U.S. by Sector, 1998



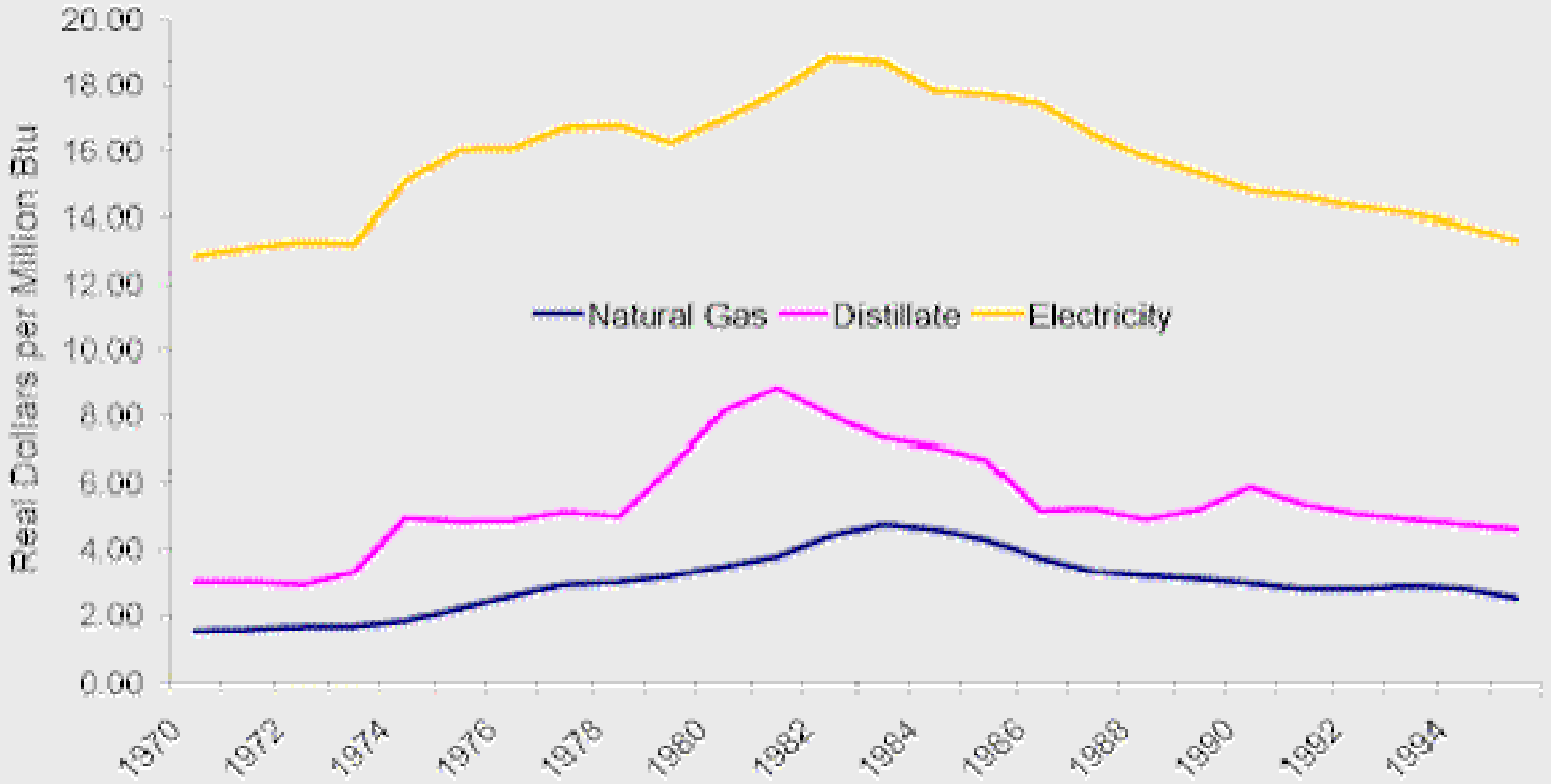
Energy Information Administration, *State Energy Data Report 1998*, *Emissions of Greenhouse Gases in the United States 1998*

Figure 4. Energy Consumption in the Buildings Sector by Energy Source, 1970-1998



Energy Information Administration, *Annual Energy Review 1998*, Table 2.1

Figure 3. Consumer Price Estimates for Energy, 1970-1995

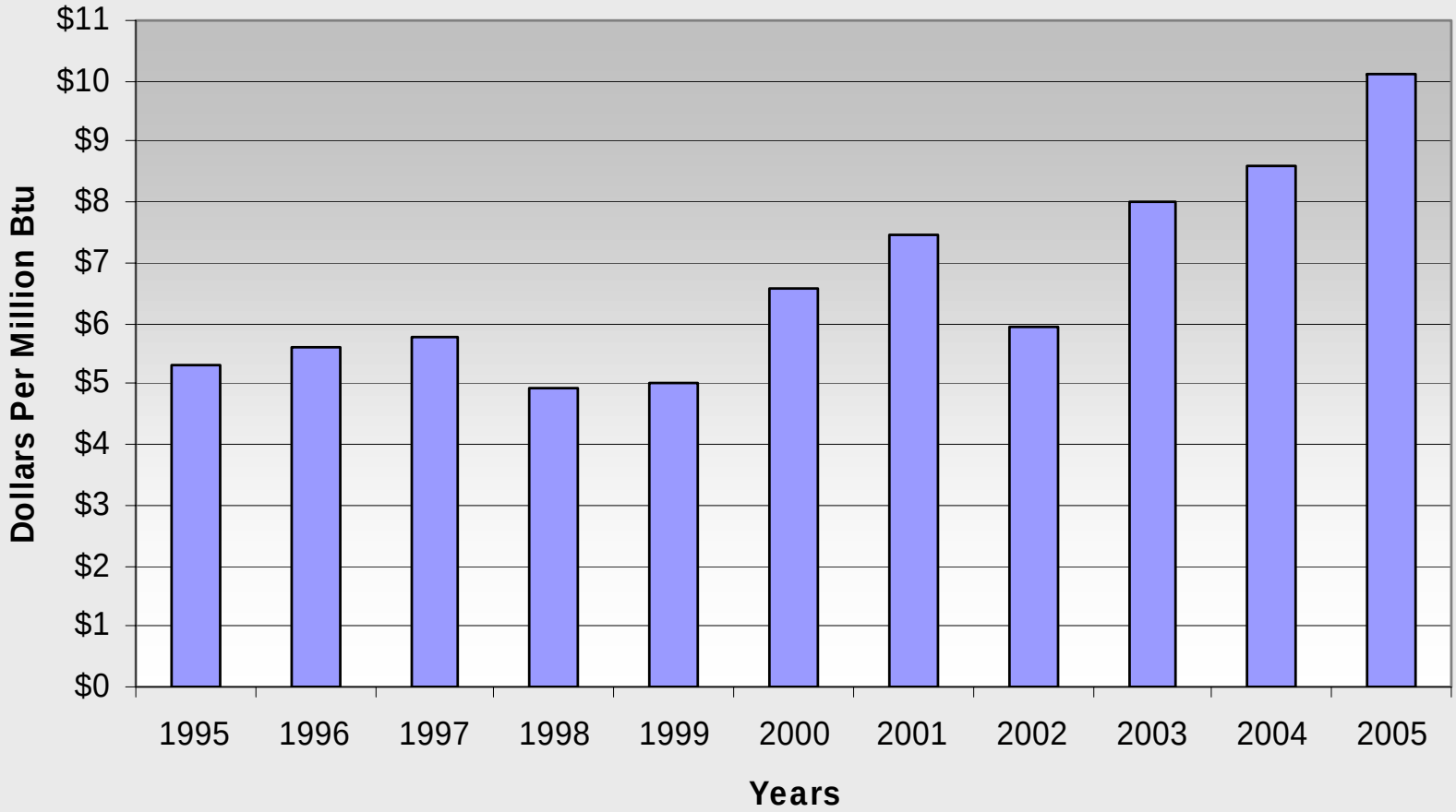


Note: Real price estimates were derived using the Consumer Price Index (1982-1984 = 100).
Energy Information Administration, *Annual Energy Review 1998*, Table 3.3

Energy Costs

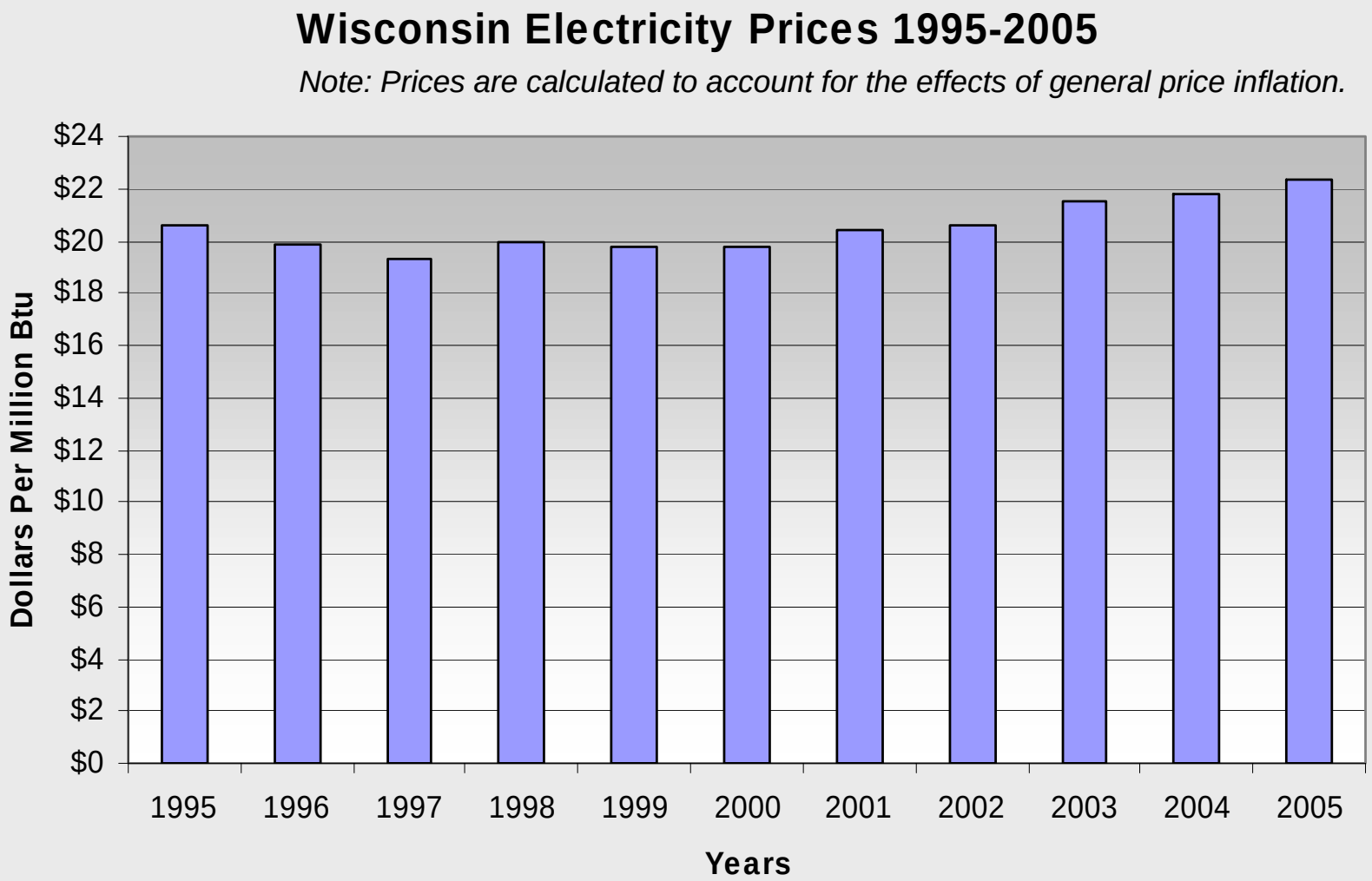
Wisconsin Natural Gas Prices 1995-2005

Note: Prices are calculated to account for the effects of general price inflation.



Source: State of Wisconsin - Department of Administration

Energy Costs



Source: State of Wisconsin - Department of Administration

Background of USGBC and LEED

What is LEED®?

Leadership in Energy & Environmental Design

LEED was developed by the U.S. Green Building Council (USGBC) as a unique rating system for designing, constructing and certifying “green” buildings worldwide.

USGBC is a national coalition of leaders from across the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work.

LEED-NC Version 2.2 Project Checklist

Project Name
Project Location

Date

Yes	?	No	Project Totals (pre-certification estimates)	69 Points
	1			

Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points

Sustainable Sites — 14 Points

Yes	?	No			
Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
	?		Credit 1	**Site Selection**	1
			Credit 2	**Development Density & Community Connectivity**	1
			Credit 3	**Brownfield Redevelopment**	1
			Credit 4.1	**Alternative Transportation:** Public Transportation Access	1
			Credit 4.2	**Alternative Transportation:** Bicycle Storage & Changing Rooms	1
			Credit 4.3	**Alternative Transportation:** Low Emitting & Fuel Efficient Vehicles	1
			Credit 4.4	**Alternative Transportation:** Parking Capacity	1
			Credit 5.1	**Site Development:** Protect or Restore Habitat	1
			Credit 5.2	**Site Development:** Maximize Open Space	1
			Credit 6.1	**Stormwater Management:** Quantity Control	1
			Credit 6.2	**Stormwater Management:** Quality Control	1
			Credit 7.1	**Heat Island Effect:** Non-Roof	1
			Credit 7.2	**Heat Island Effect:** Roof	1
			Credit 8	**Light Pollution Reduction**	1

Water Efficiency — 5 Points

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

Energy & Atmosphere — 17 Points

Yes	?	No			
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**Fundamental Refrigerant Management**	Required
			Credit 1	**Optimize Energy Performance**	1 to 10
			Credit 2.1	**On-Site Renewable Energy:** 2.5%	1
			Credit 2.2	**On-Site Renewable Energy:** 7.5%	1
			Credit 2.3	**On-Site Renewable Energy:** 12.5%	1
			Credit 3	**Enhanced Commissioning**	1
			Credit 4	**Enhanced Refrigerant Management**	1
			Credit 5	**Measurement & Verification**	1
			Credit 6	**Green Power**	1

Innovation & Design Process — 5 Points

Yes	?	No			
			Credit 1.1	**Innovation in Design:** Provide Specific Title	1
			Credit 1.2	**Innovation in Design:** Provide Specific Title	1
			Credit 1.3	**Innovation in Design:** Provide Specific Title	1
			Credit 1.4	**Innovation in Design:** Provide Specific Title	1
			Credit 2	**LEED™ Accredited Professional**	1

Materials & Resources — 13 Points

Yes	?	No			
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
			Credit 1.1	**Building Reuse:** Maintain 75% of Existing Walls, Floors & Roof	1
			Credit 1.2	**Building Reuse:** Maintain 95% of Existing Walls, Floors & Roof	1
			Credit 1.3	**Building Reuse:** Maintain 50% of Interior Non-Structural Elements	1
			Credit 2.1	**Construction Waste Management:** Divert 50%	1
			Credit 2.2	**Construction Waste Management:** Divert 75%	1
			Credit 3.1	**Resource Reuse:** 5%	1
			Credit 3.2	**Resource Reuse:**10%	1
			Credit 4.1	**Recycled Content:** 10% (post-consumer + ½ pre-consumer)	1
			Credit 4.2	**Recycled Content:** 20% (post-consumer + ½ pre-consumer)	1
			Credit 5.1	**Regional Materials:** 10% Extracted, Processed & Mfr. Regionally	1
			Credit 5.2	**Regional Materials:** 20% Extracted, Processed & Mfr. Regionally	1
			Credit 6	**Rapidly Renewable Materials**	1
			Credit 7	**Certified Wood**	1

Indoor Environmental Quality — 15 Points

Yes	?	No			
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke (ETS) Control**	Required
			Credit 1	**Outdoor Air Delivery Monitoring**	1
			Credit 2	**Increased Ventilation**	1
			Credit 3.1	**Construction IAQ Management Plan:** During Construction	1
			Credit 3.2	**Construction IAQ Management Plan:** Before Occupancy	1
			Credit 4.1	**Low-Emitting Materials:** Adhesives & Sealants	1
			Credit 4.2	**Low-Emitting Materials:** Paints & Coatings	1
			Credit 4.3	**Low-Emitting Materials:** Carpet Systems	1
			Credit 4.4	**Low-Emitting Materials:** Composite Wood & Agrifiber Products	1
			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
			Credit 6.1	**Controllability of Systems:** Lighting	1
			Credit 6.2	**Controllability of Systems:** Thermal Comfort	1
			Credit 7.1	**Thermal Comfort:** Design	1
			Credit 7.2	**Thermal Comfort:** Verification	1
			Credit 8.1	**Daylight & Views:** Daylight 75% of Spaces	1
			Credit 8.2	**Daylight & Views:** Views for 90% of Spaces	1

LEED
GREEN BUILDING RATING SYSTEM

Kettle Foods - Beloit Plant

SCORECARD AND STATUS

DESIGN APPLICATION

MY ACTION ITEMS

Displays the next steps for the project. Depending on your project role, the project status and number of points anticipated or awarded; different action items will appear.

Please provide documentation for any Credits or Prerequisites as directed by your Project Administrator.

POTENTIAL LEED RATING

Displays LEED level which is based on number of points attempted. Actual Certification Level will be based on the number of points awarded and successful completion of all Prerequisites.

This Project has attempted enough points for Gold Rating.

ATTEMPTED CREDIT SUMMARY

Displays attempted points for the project by status.

Status	Points		
	Design	Construction	Total
Pending:	32	14	46
Total Attempted:	32	14	46

APPEALED CREDIT SUMMARY

Displays your appealed Credits.

This Project is not currently under appeal.

CREDIT SCORECARD

Displays all credits and points per LEED sections. Depending on project access, one can attach team members, view attempted credits or click credits to display template.

Expand All Credit Categories

design / construction

0	**Points Documented**						**Points Available:**	**69**
0		Sustainable Sites					Possible Points:	14
No	SS	Prerequisite 1	C	Construction Activity Pollution Prevention	Civil Engineer	✓	Attempted	0
0	SS	Credit 1		Site Selection	Architect	✓	Attempted	1
	SS	Credit 2		Development Density & Community Connectivity				1
	SS	Credit 3		Brownfield Redevelopment				1
	SS	Credit 4.1		Alternative Transportation: Public Transportation Access				1
0	SS	Credit 4.2		Alternative Transportation: Bicycle Storage & Changing Rooms	Architect	✓	Attempted	1
0	SS	Credit 4.3		Alternative Transportation: Low-Emitting & Fuel Efficient Vehicles	Landscape Architect	✓	Attempted	1
0	SS	Credit 4.4		Alternative Transportation: Parking Capacity	Landscape Architect	✓	Attempted	1
0	SS	Credit 5.1	C	Site Development: Protect or Restore Habitat	Landscape Architect	✓	Attempted	1
0	SS	Credit 5.2		Site Development: Maximize Open Space	Landscape Architect	✓	Attempted	1
0	SS	Credit 6.1		Stormwater Management: Quantity Control	Civil Engineer	✓	Attempted	1
	SS	Credit 6.2		Stormwater Management: Quality Control				1
	SS	Credit 7.1	C	Heat Island Effect: Non-Roof				1
0	SS	Credit 7.2		Heat Island Effect: Roof	Architect	✓	Attempted	1
0	SS	Credit 8		Light Pollution Reduction	Lighting Designer	✓	Attempted	1
0		Water Efficiency					Possible Points:	5
0	WE	Credit 1.1-1.2		Water Efficient Landscaping	Landscape Architect	✓	Attempted	2
0	WE	Credit 2		Innovative Wastewater Technologies	Project Team Administrator	✓	Attempted	1
0	WE	Credit 3.1-3.2		Water Use Reduction	Project Team Administrator	✓	Attempted	2

ENERGY & ATMOSPHERE: OPTIMIZE ENERGY PERFORMANCE (CREDIT 1)

DESIGN APPLICATION

EA Cr 1: Optimize Energy Performance [Go]

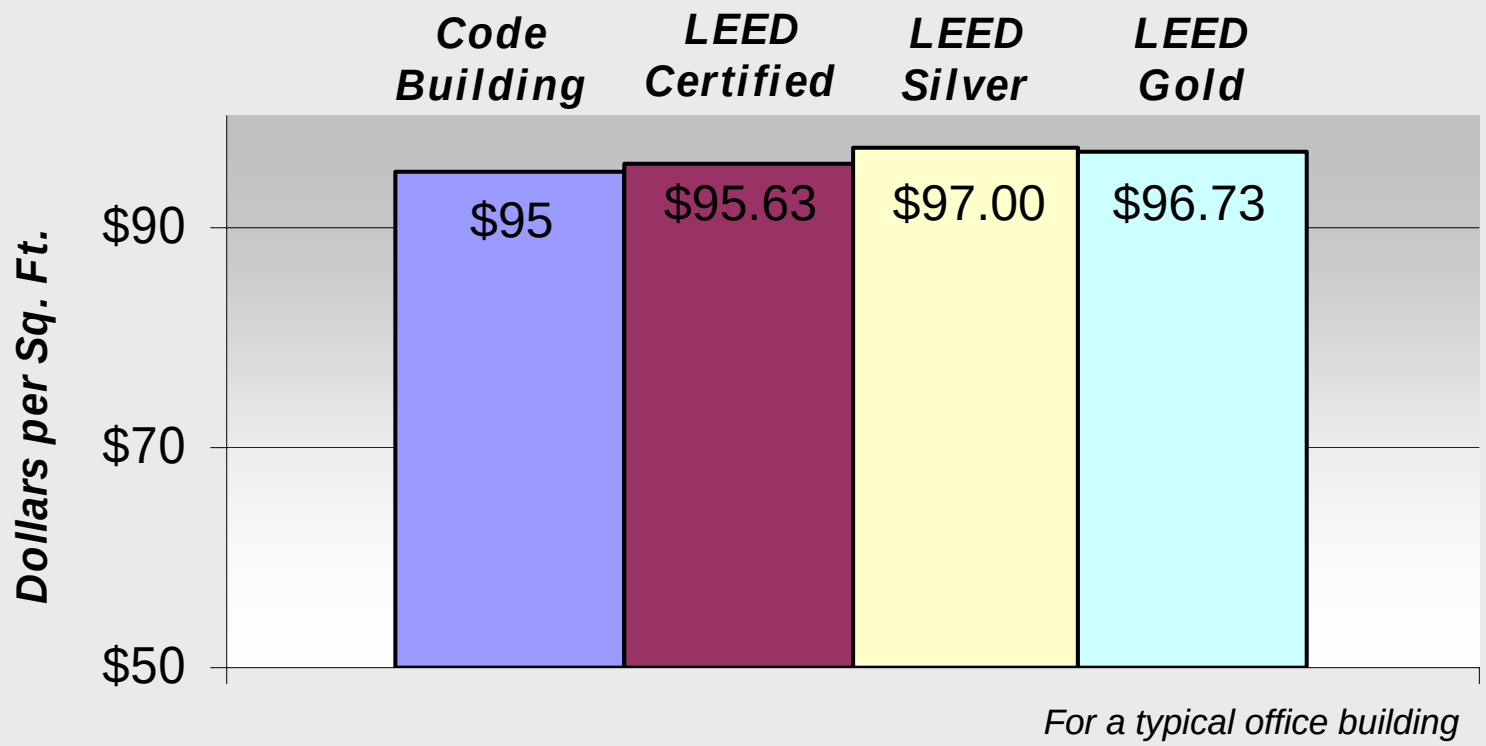
CLAIM OF CREDIT STATUS

Displays status information and team member assigned to credit. A project administrator can also unattempt a credit in this section.

Attempted On:	7/12/2006	
Attempted Point Status	Credit 1.1 Optimize Energy Performance, 10.5% New / 3.5% Existing	Attempted
	Credit 1.2 Optimize Energy Performance, 14% New / 7% Existing	Attempted
	Credit 1.3 Optimize Energy Performance, 17.5% New / 10.5% Existing	Attempted
	Credit 1.4 Optimize Energy Performance, 21% New / 14% Existing	Attempted
	Credit 1.5 Optimize Energy Performance, 24.5% New / 17.5% Existing	Attempted
	Credit 1.6 Optimize Energy Performance, 28% New / 21% Existing	Attempted
	Credit 1.7 Optimize Energy Performance, 31.5% New / 24.5% Existing	Attempted
	Credit 1.8 Optimize Energy Performance, 35% New / 28% Existing	Attempted
	Credit 1.9 Optimize Energy Performance, 38.5% New / 31.5% Existing	Attempted
	Credit 1.10 Optimize Energy Performance, 42% New / 35% Existing	Attempted
Is Clarification Needed for this Credit?:	No	
Assigned Team Role:	HVAC Engineer	

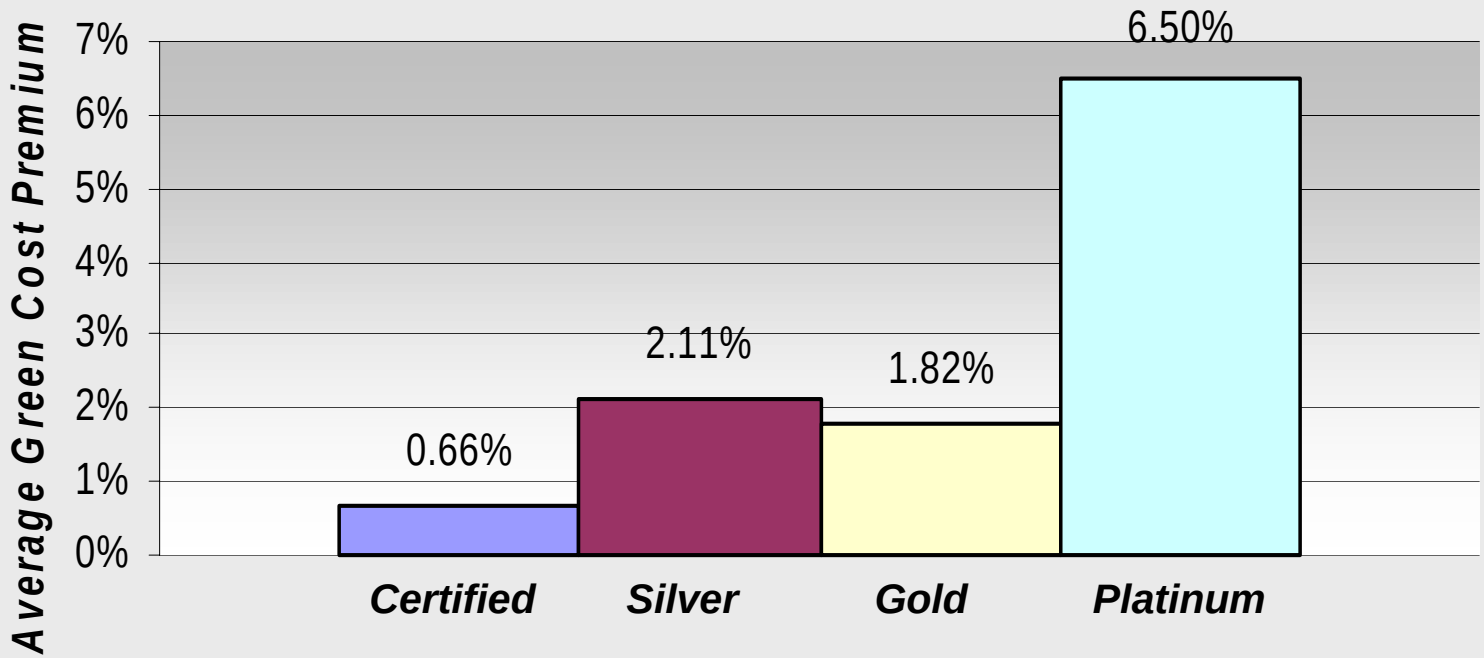
Basic Cost Data related to Green buildings

Initial Cost of Code vs. LEED Buildings



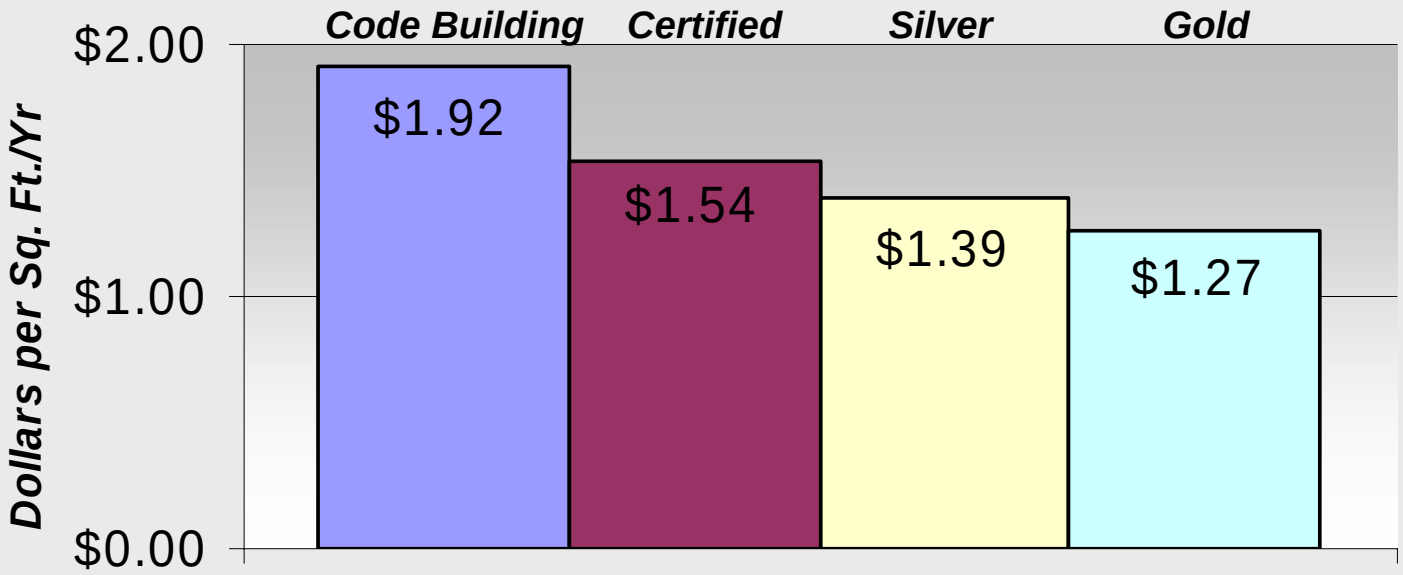
Source: USGBC

Initial Cost of Code vs. LEED Buildings



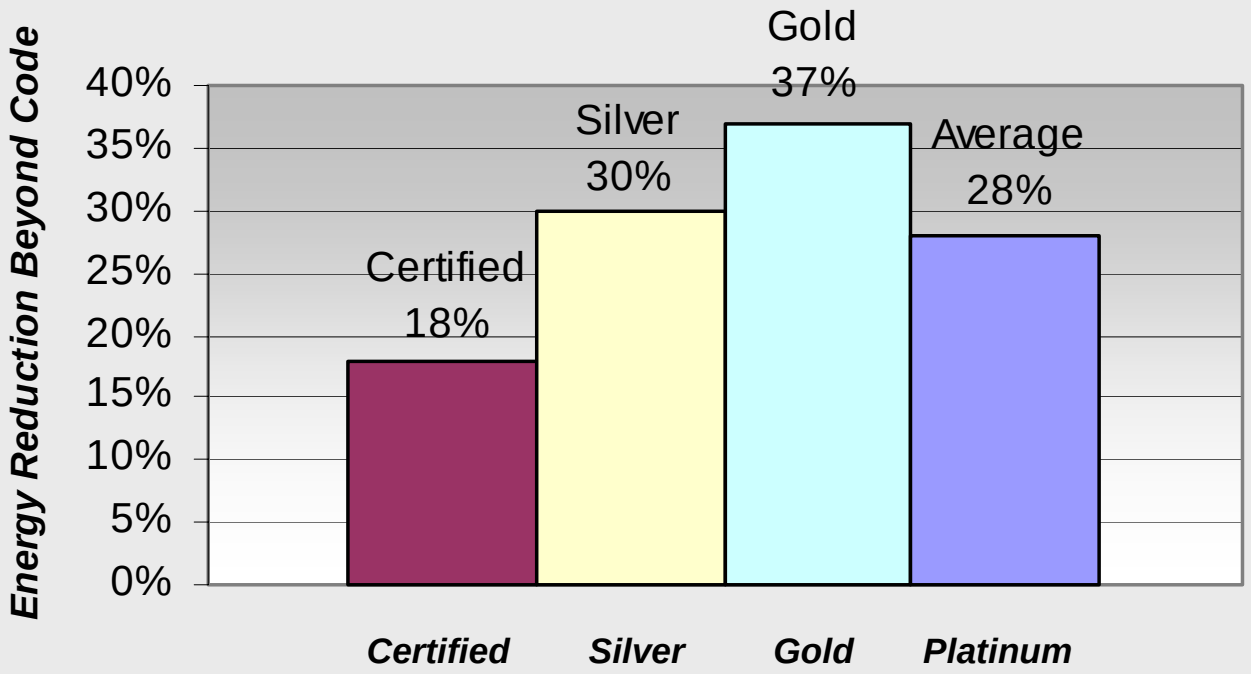
Source: USGBC

Cost of LEED Buildings Annual Energy Costs



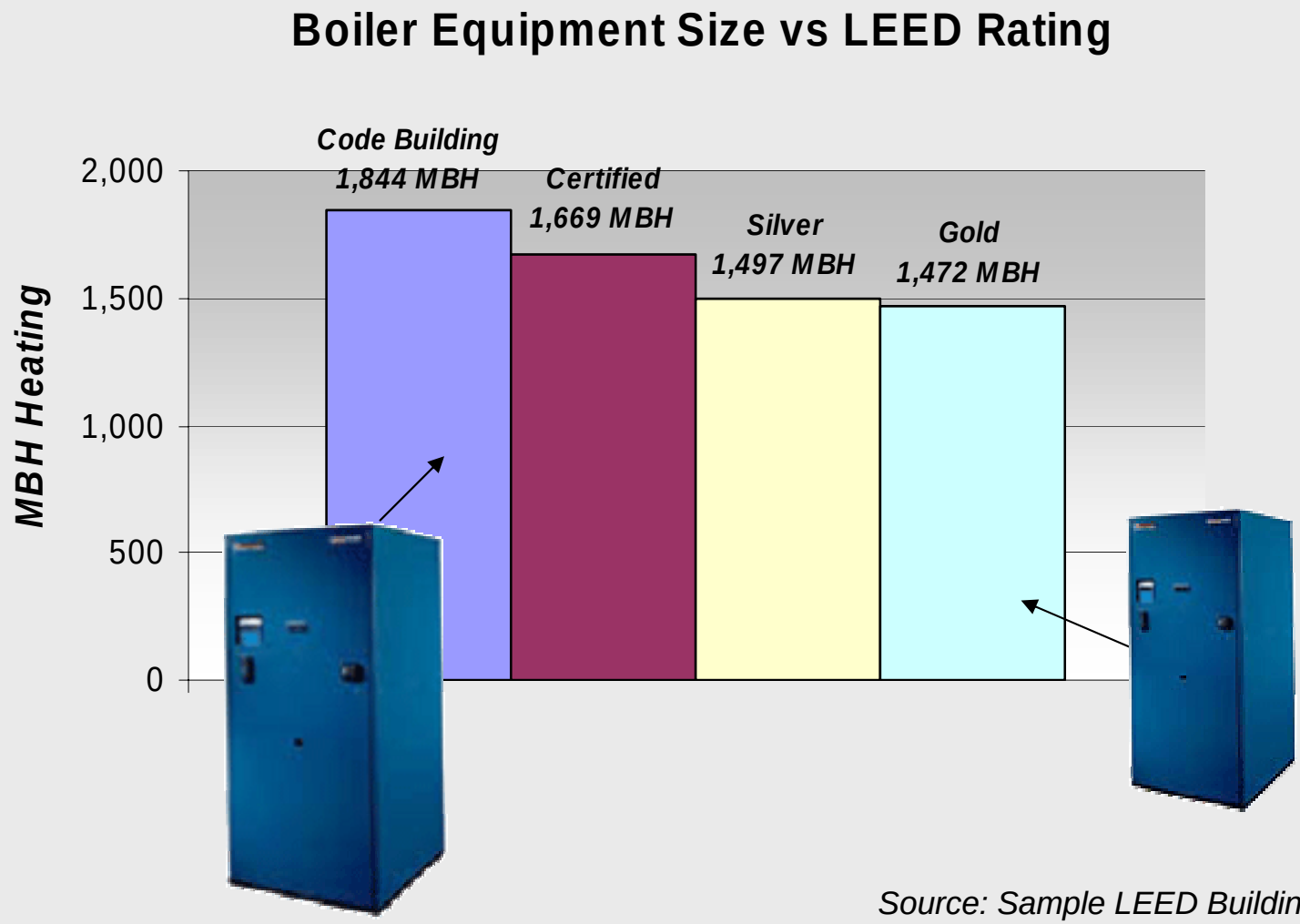
Source: USGBC

Energy Reduction in LEED Rated Buildings



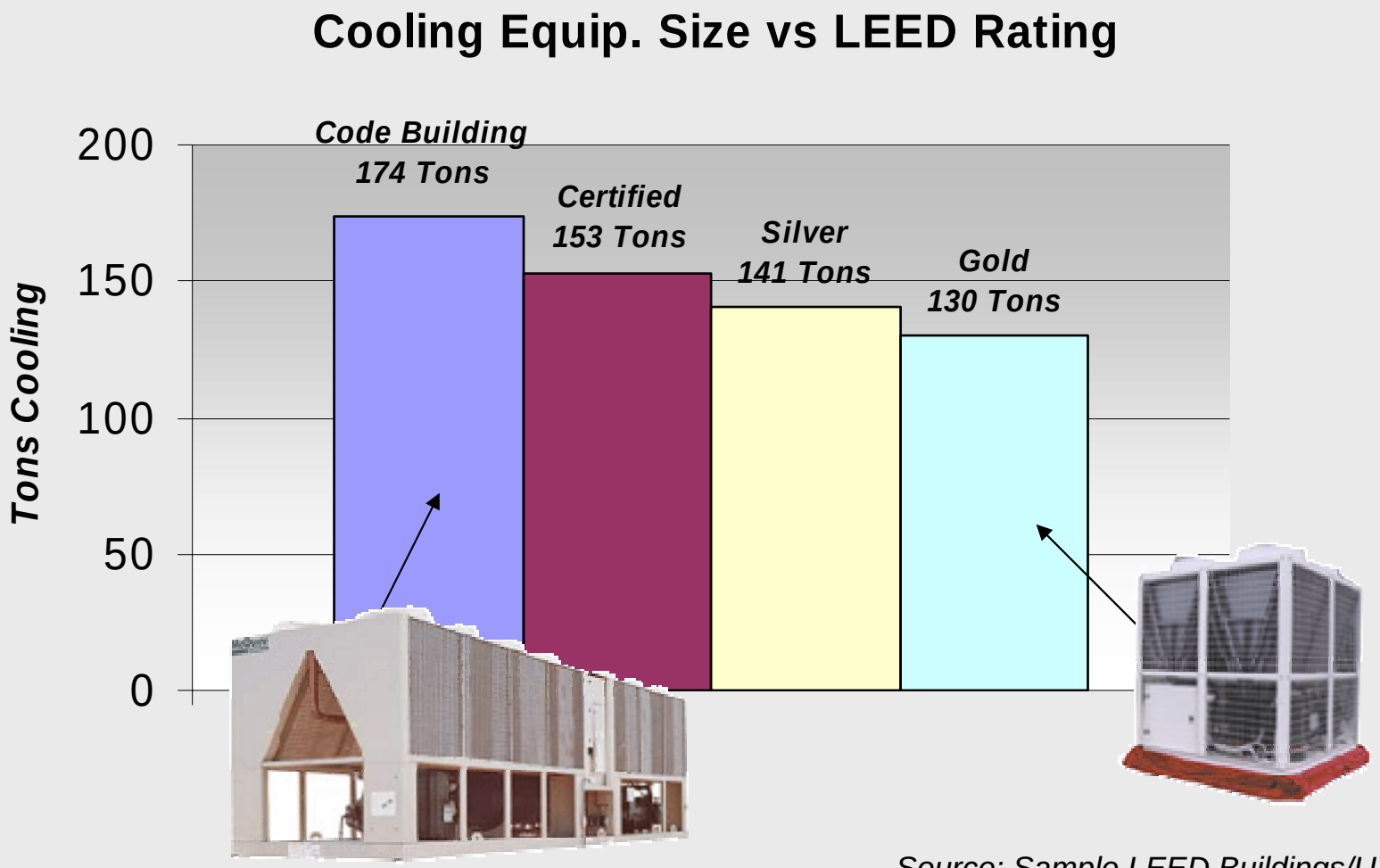
Source: USGBC

Impact of LEED on Heating



Source: Sample LEED Buildings/USGBC

Impact of LEED on Cooling



Source: Sample LEED Buildings/USGBC

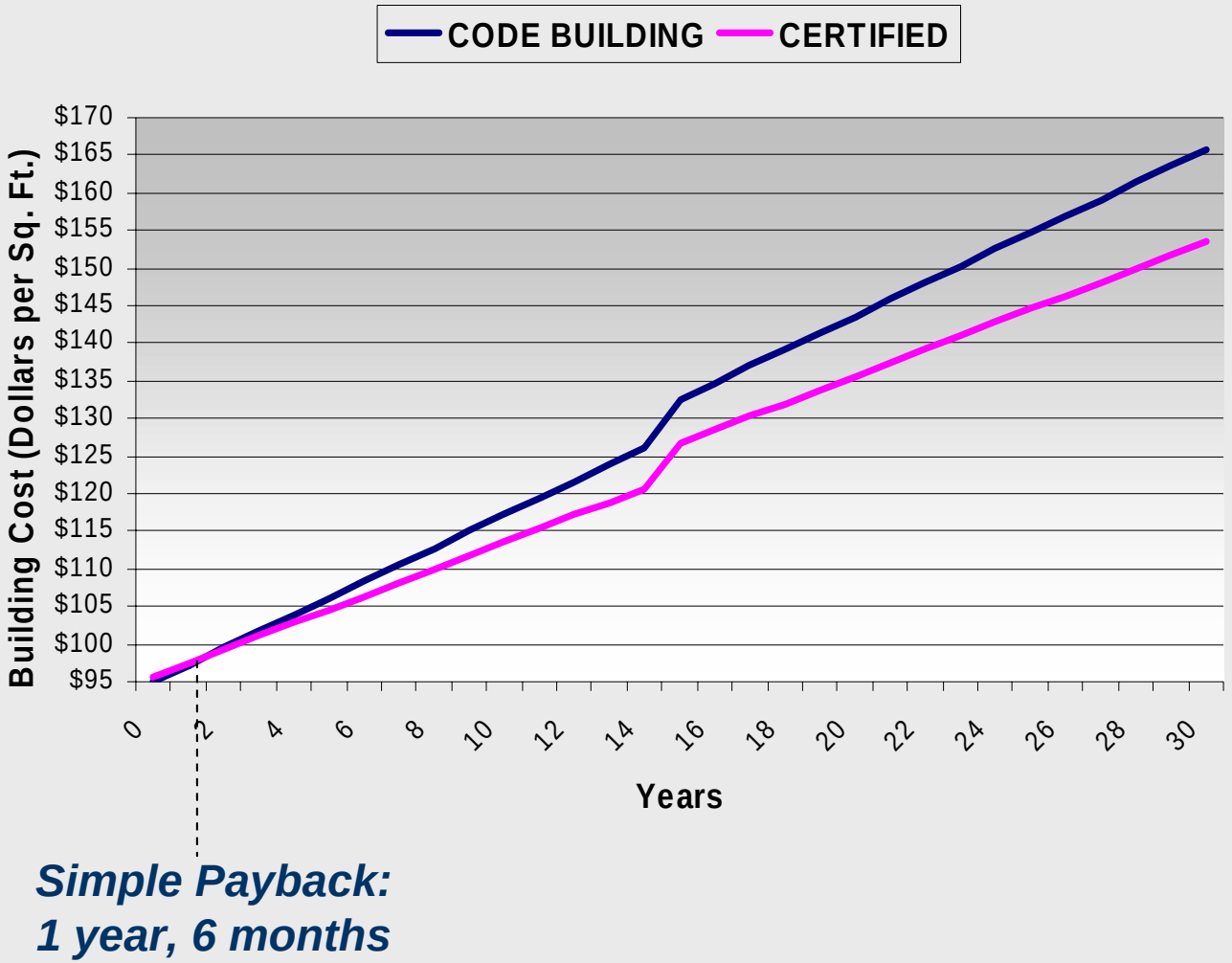
Simple Payback of LEED Buildings

Supporting Data
Cost Breakdown by Sq. Ft.

	Code Building	Certified	Silver	Gold
Building First Cost	**$95.00**	**$95.63**	**$97.00**	**$96.73**
Rooftop Replacement *(15 yrs. +)*	**$4.19**	**$4.19**		
Chiller/Tower Replacement *(20 yrs. +)*			**$3.92**	**$3.92**
Operating Cost	**$2.22/SF/YR**	**$1.79/SF/YR**	**$1.60/SF/YR**	**$1.44/SF/YR**
Maintenance	.30 / SF / YR	.25 / SF / YR	.20 / SF / YR	.18 / SF / YR
Electric	1.70 / SF / YR	1.34 / SF / YR	1.24 / SF / YR	1.11 / SF / YR
Gas	.22 / SF / YR	.20 / SF / YR	.16 / SF / YR	.15 / SF / YR

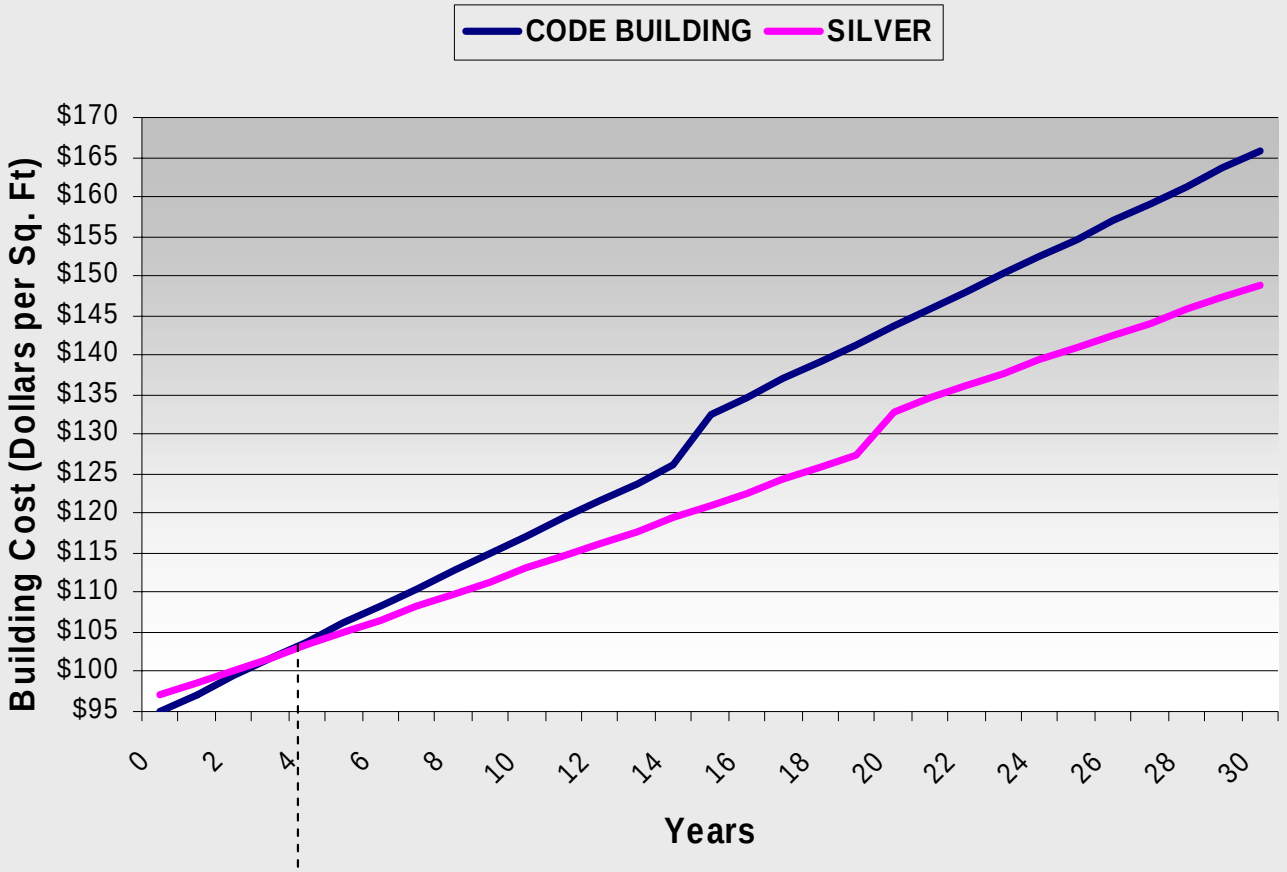
Source: USGBC and ASHRAE

Simple Payback of LEED Buildings



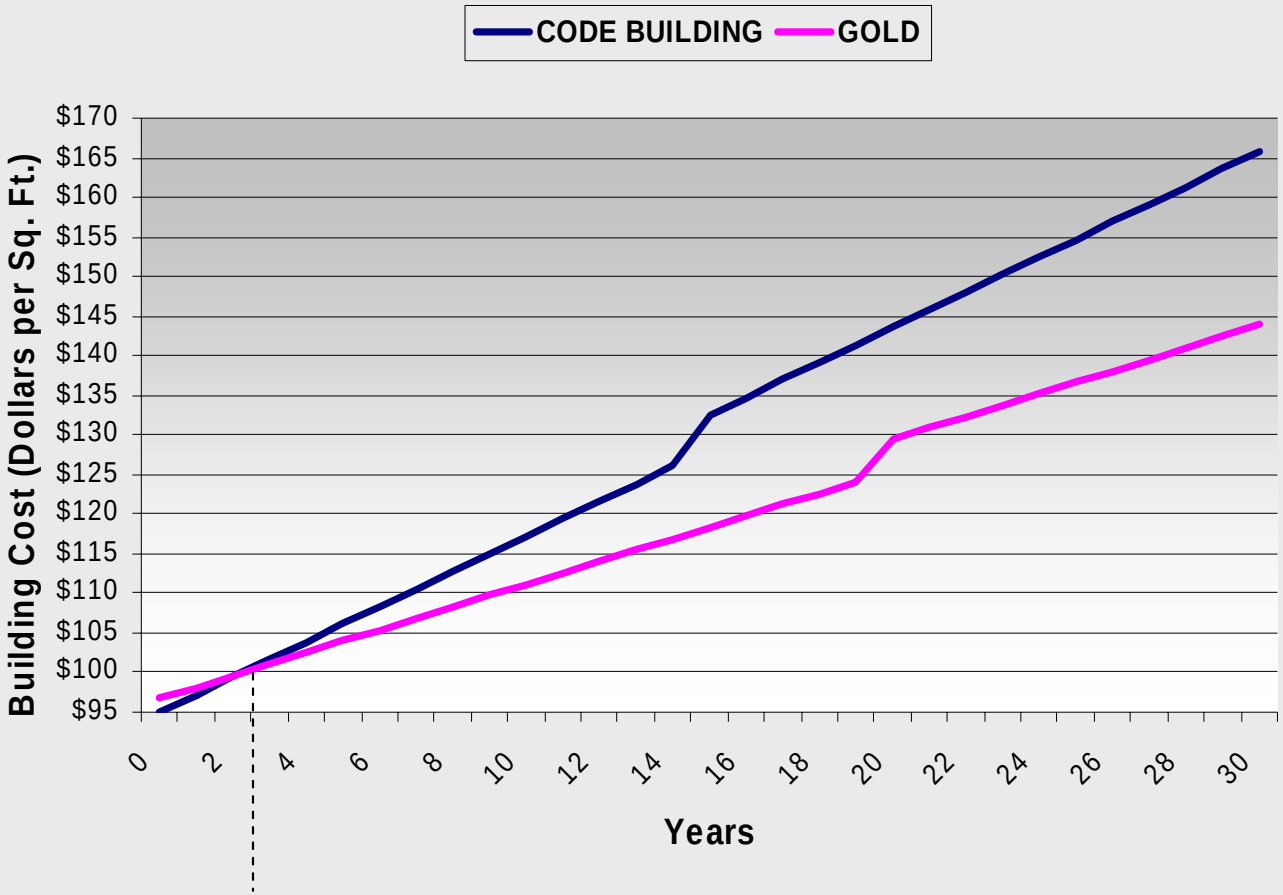
Simple Payback:
1 year, 6 months

Simple Payback of LEED Buildings



Simple Payback:
4 years, 3 months

Simple Payback of LEED Buildings



Simple Payback:
3 years, 3 months

Process for evaluating energy reduction options

Energy Use

Issue: Energy Efficiency

Achieve increased level of energy performance above the minimum energy performance baseline. Executive Order 111 requires new buildings owned, leased or operated by State agencies to achieve at least a 20% improvement in energy efficiency levels as prescribed by the New York State Energy Conservation Construction Code.

Performance Criteria

Reduce aggregate building energy consumption by 25% relative to ASHRAE 90.1-2004 using the Building Performance rating Method in Appendix G of the Standard as well as the requirements of the Labs21 Laboratory Modeling Guidelines Using ASHRAE 90.1-2004.

Reduce aggregate building energy consumption by a minimum 20% relative to levels required by New York State Energy Conservation Construction Code (2002 references ASHRAE/IESNA Standard 90.1-1999). Equivalent to a 14% reduction for regulated energy components as defined by ASHRAE Standard 90.1 –2004

Benchmark

ASHRAE 90.1-2004; Labs21 Laboratory Modeling Guidelines Using ASHRAE 90.1-2004

Applicable LEED Credit

		Point Probability		
		Y	?	N
EAc1	Optimize Energy Performance	○	◉	○

Demonstrate a percetage improvement in the energy performance for regulated energy components described in the requirements of ASHRAE/IESNA Standard 90.1-2004, as demonstrated by a whole building simulation using the Building Performance Rating Method in Appendix G of the Standard.

Design Team Action

	Responsibility										
	O	A	LA	ID	SE	CE	ME	EE	Cx	CM	C
Define base energy performance using code minimum model augmented by selected laboratory performance benchmarks	○	●	○	○	○	○	○	○	○	○	○
Analyze availability of on-site renwable resources and identify governmental and/or utility-based incentive programs for renewable energy	○	●	○	○	○	○	○	●	○	○	●
Identify and evaluate performance of energy design alternatives for building envelope, lighting and mechanical systems. Reduce energy requirements through passive site and architectural design strategies first.	○	●	○	○	○	○	●	●	○	○	●
Perform comparative evaluation of individual and combined strategies	○	○	○	○	○	○	○	○	○	○	●
Evaluate performance of renewable energy system strategies.	○	●	○	○	○	○	●	●	○	○	●
Perform LCC analysis of each strategy	○	○	○	○	○	○	○	○	○	○	○
Affirm or modify energy performance goals	○	○	○	○	○	○	○	○	○	○	●

Options Check List

	First Cost
1. Architectural	
Shading Devices	M
High Reflectance/vegetated roof	H
Glazing area reduction	L
Solar Orientation	L
Glazing performance	M
Increased envelope R-value	L
Evaporative-cooled roof	M
2. Loads	
Airflow management	L
Low ambient/task lighting	L
Multilevel lighting control	M
Space occupancy sensors	M
Night setback controls for HVAC & light	L
3. Energy Recovery	
Heat wheel	L
Run around coil	M
Heat pipe	M
Air-to-air heat exchanger	M
Domestic water	M
4. Systems	
Standing column heat pump	M
Vertical borefield heat pump	H
Solar assisted heat pump	H
Underfloor air dist. at office space	M
Radiant heating	M
Static pressure reduction	H
Electrostatic filtration	L
Fan walls	L
5. Misc.	
Auxillary cooling-chilled beam	M
Auxillary cooling-fan coil	L
Airflow monitoring (Optinet or Aircuity)	H
Variable velocity exhaust	M
VFD Motors	M
Thermal storage	H
Load shifting/shredding	M

Simulation programs

Programs

- Transys
- DOE 2
- Energy 10
- eQUEST

Optimizing systems

Boilers

- Use water tube versus fire tube. Flue gas can be colder than entering hot water temperature.
- Use sealed combustion boilers. Condensing still have new product development issues.

Chillers

- Use chilled water with variable speed compressors (screw, scroll, rotary) with cooling tower. Up to 18% savings.
- Second choice use packaged chiller with evaporative spray condenser.

Cooling Towers

- Allow temperature to float. Reset to 5 degrees F below wet bulb. Each 1 degree F offers approximately 1% energy savings. Saves chiller horsepower and tower fan horsepower.
- Run all multiple towers at part load first. Two tower fans at ½ speed consumes ¼ of the power of one fan at full speed.

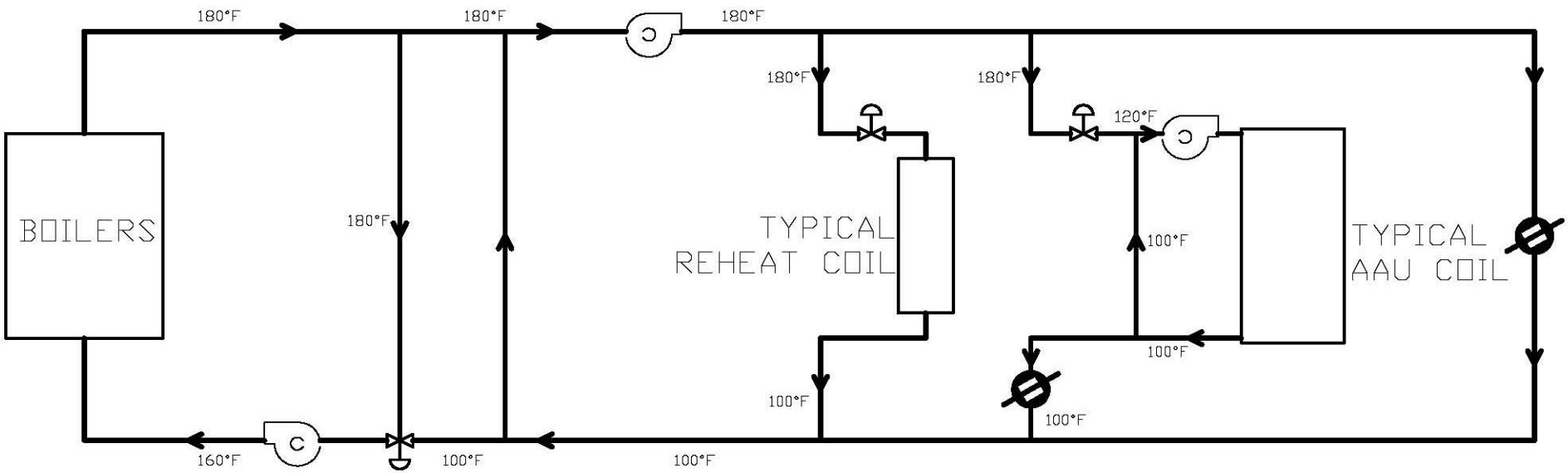
Hot Water

- Use variable flow with variable pressure reset.
- Use constant volume primary, variable volume secondary, pumped coils, reheat off secondary.
- Centrally locate equipment horizontally and vertically. Lower first cost and operating cost.

Set Flow
Set Temp. Drop
(Boiler Safety)

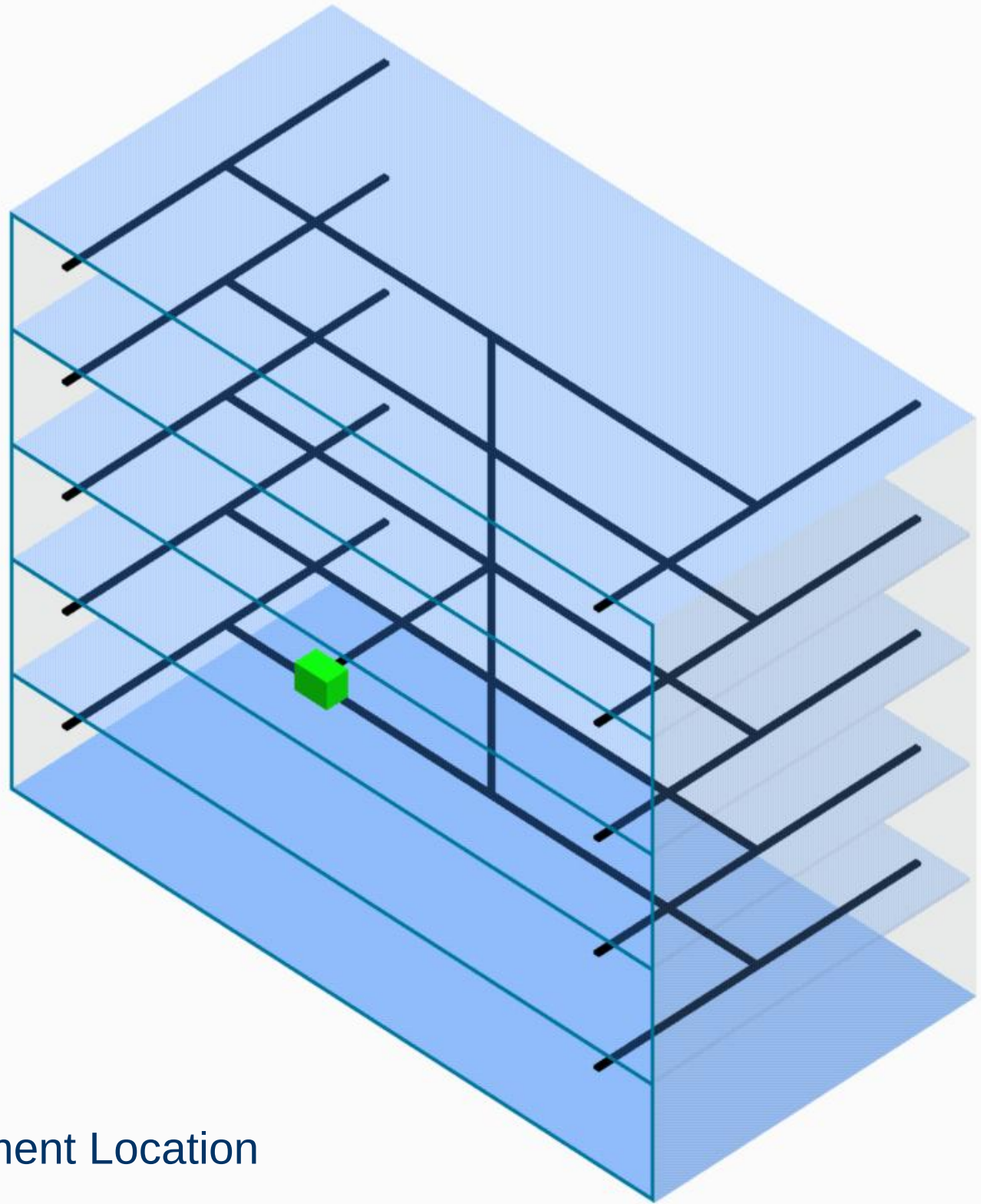
Variable Flow
High Temp. Drop
(Energy Savings/First Cost Savings)

Set Flow
Variable Temp.
(Good Control)

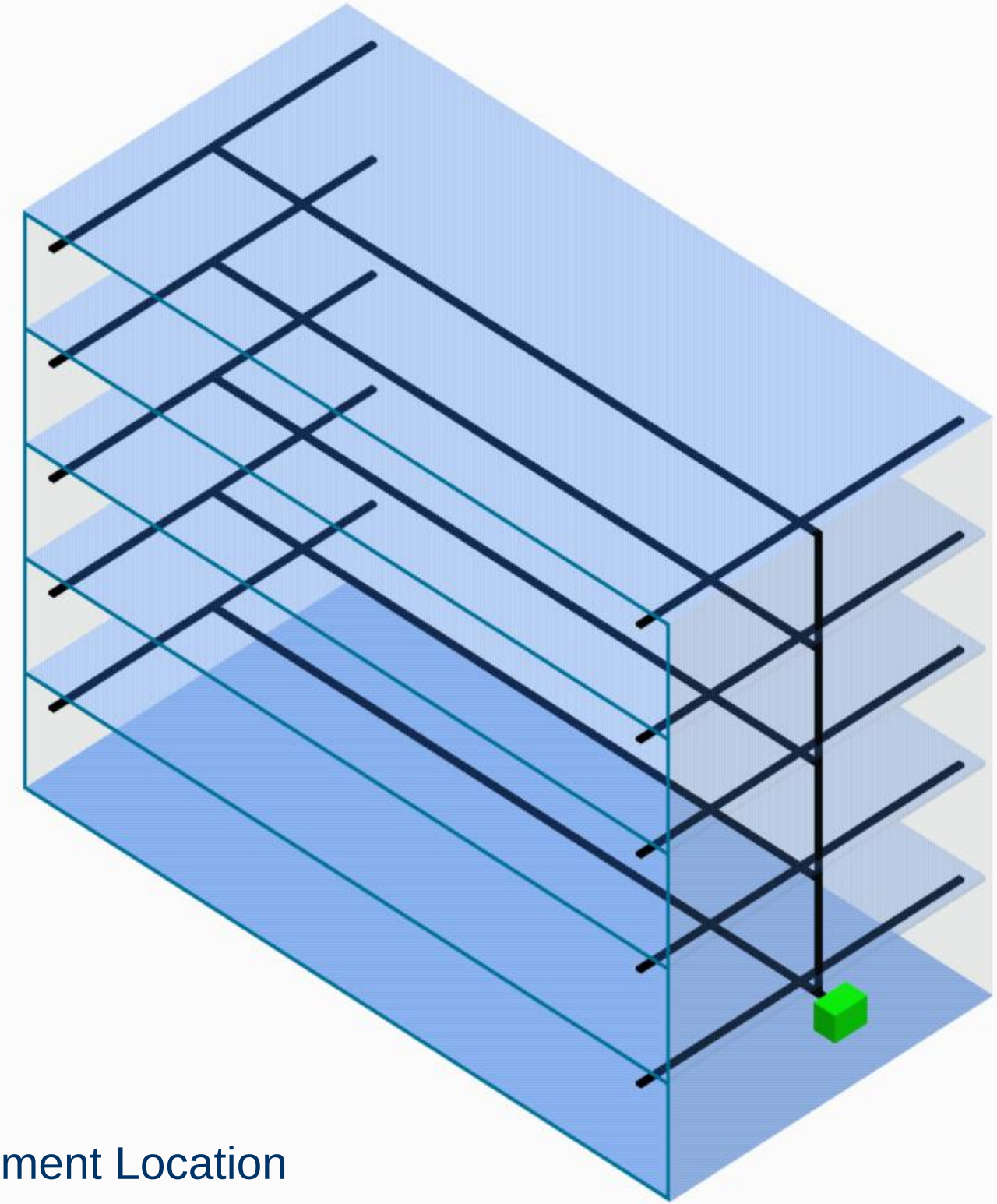


HOT WATER PIPING SYSTEM

Energy Efficient HW System



Central Equipment Location



Remote Equipment Location

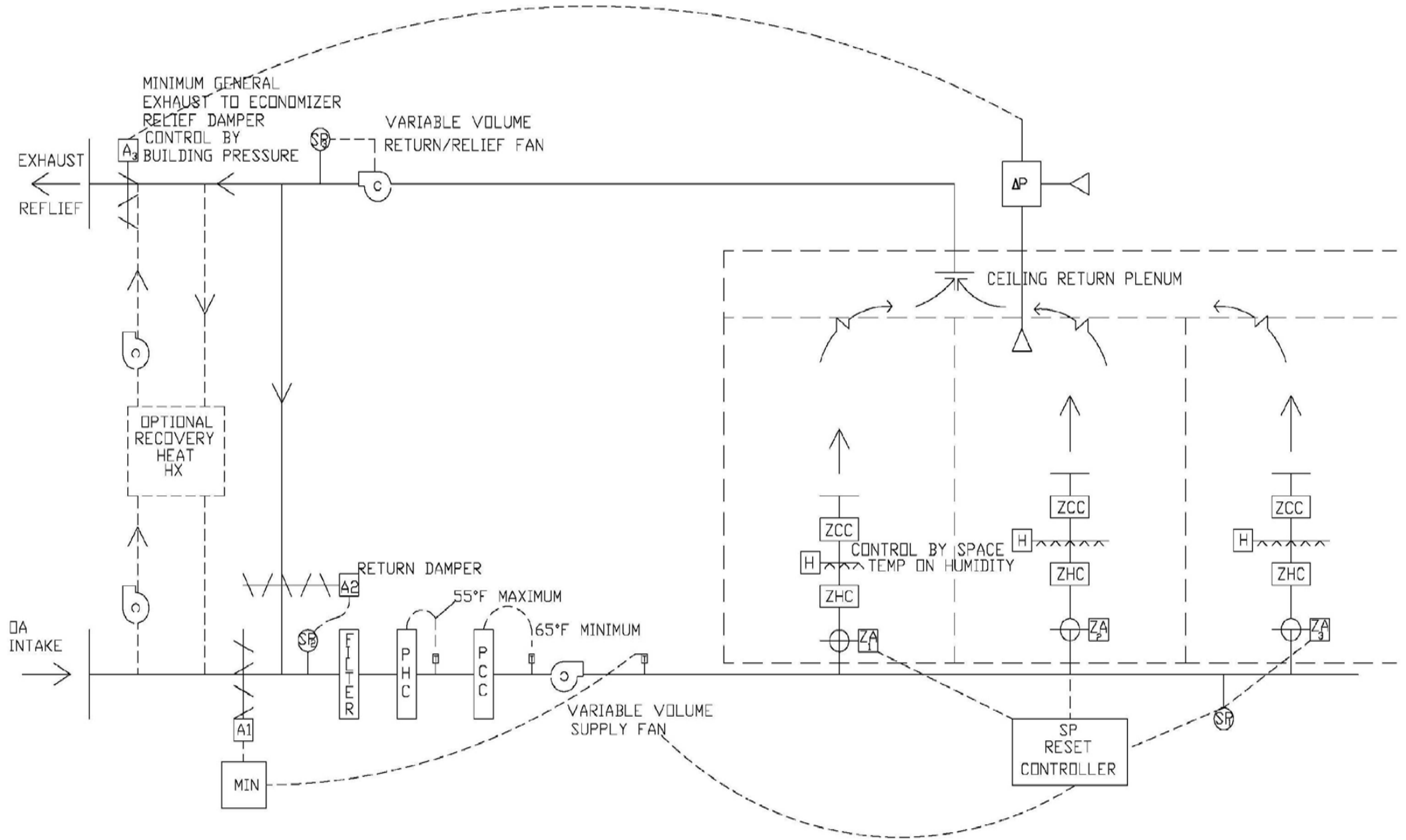
Chilled Water

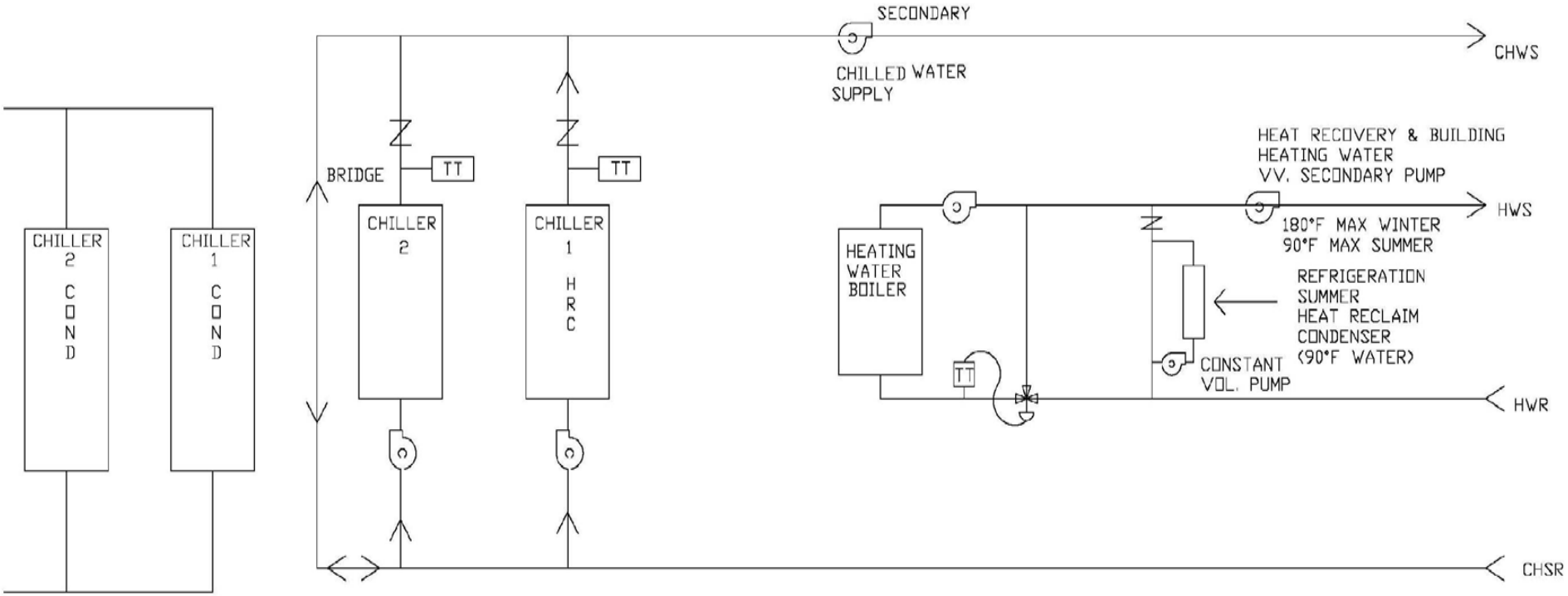
- Keep supply temperature as high as practical. Approximately 1% savings in operating cost for each 1 degree F.
- Select coils with maximum water temperature drop.

Air Systems

- Use variable air volume with variable static reset.
- Use exhaust heat recovery.
- Transfer air for double use where possible.
- Centrally locate equipment horizontally and vertically. Lower first cost, lower operating cost, quieter system.

OPTIMUM HVAC SYSTEM

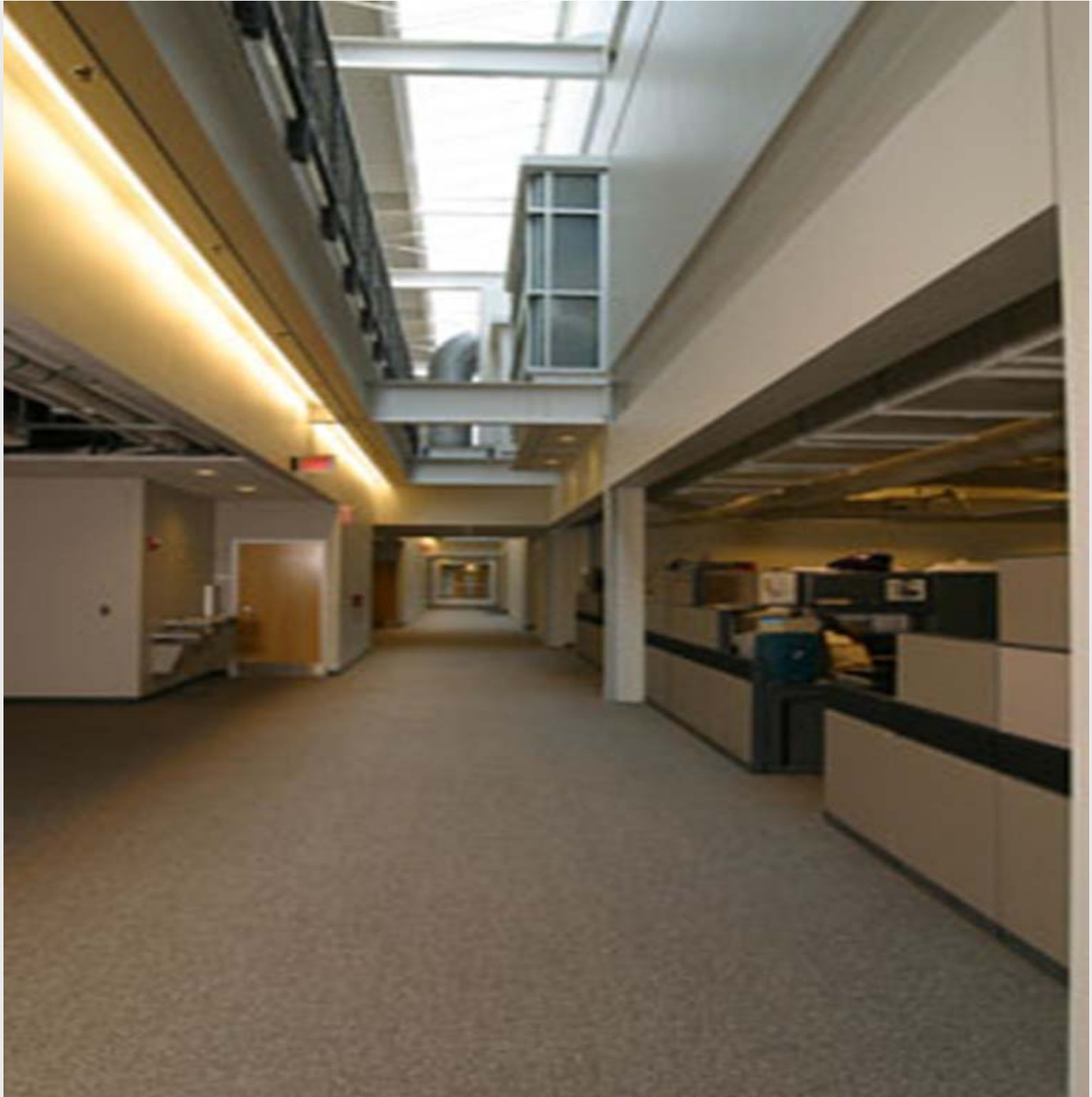



CHILLER 2 COND
CHILLER 1 COND
BRIDGE
TT
TT
CHILLER 2
CHILLER 1 HRC
SECONDARY
CHILLED WATER SUPPLY
CHWS
HEAT RECOVERY & BUILDING HEATING WATER VV. SECONDARY PUMP
HWS
180°F MAX WINTER
90°F MAX SUMMER
HEATING WATER BOILER
REFRIGERATION SUMMER HEAT RECLAIM CONDENSER (90°F WATER)
CONSTANT VOL. PUMP
TT
HWR
CHSR

Project examples

Harley-Davidson

- Product Development Center
- Wauwatosa, WI



LEED Version 2.1 Registered Project Checklist

Harley-Davidson PDC Office Expansion
LEED Project #141

Yes	?	No			
6		**8**	**Sustainable Sites**		**14 Points**
Y			Prereq 1	**Erosion & Sedimentation Control**	Required
		1	Credit 1	**Site Selection**	1
		1	Credit 2	**Urban Redevelopment**	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	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 or 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

Yes	?	No			
2		**3**	**Water Efficiency**		**5 Points**
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

Yes	?	No			
4		**6**	**Energy & Atmosphere**		**17 Points**
Y			Prereq 1	**Fundamental Building Systems Commissioning**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**CFC Reduction in HVAC&R Equipment**	Required
3			Credit 1	**Optimize Energy Performance**	1 to 10
		1	Credit 2.1	**Renewable Energy**, 5%	1
		1	Credit 2.2	**Renewable Energy**, 10%	1
		1	Credit 2.3	**Renewable Energy**, 20%	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

Yes	?	No			
5		8	**Materials & Resources**		13 Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Shell	1
		1	Credit 1.2	**Building Reuse**, Maintain 100% of Shell	1
		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
		1	Credit 3.1	**Resource Reuse**, Specify 5%	1
		1	Credit 3.2	**Resource Reuse**, Specify 10%	1
1			Credit 4.1	**Recycled Content**, Specify 5% p.c. or 10% (p.c. + ½ p.i.) – VERSION 2.0	1
1			Credit 4.2	**Recycled Content**, Specify 10% p.c. or 20% (p.c. + ½ p.i.) – VERSION 2.0	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
		1	Credit 6	**Rapidly Renewable Materials**	1
		1	Credit 7	**Certified Wood**	1

Yes	?	No			
11		4	**Indoor Environmental Quality**		15 Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
1			Credit 1	**Carbon Dioxide** (CO_2) **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	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

Yes	?	No			
2			**Innovation & Design Process**		5 Points
1			Credit 1.1	**Innovation in Design**: Exemplory Performance: Credits MR 4.1/4.2	1
			Credit 1.2	**Innovation in Design**: Provide Specific Title	1
			Credit 1.3	**Innovation in Design**: Provide Specific Title	1
			Credit 1.4	**Innovation in Design**: Provide Specific Title	1
1			Credit 2	**LEED™ Accredited Professional**	1

Yes	?	No		
30		29	**Project Totals** (pre-certification estimates)	69 Points

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points

EA Prerequisite 2 / EA Credit 1 / EA Credit 2

ECB Table

Energy Summary by End Use

End Use	Energy Type	Proposed Building Energy [10^3 Btu/h]	Proposed Building Peak [10^3 Btu/h]	Budget Building Energy [10^3 Btu/h]	Budget Building Peak [10^3 Btu/h]	Optimized Energy Performance [%]
Lighting - Conditioned	Electricity	823		1,335		62%
Lighting - Unconditioned						
Space Heating	Electricity	87		114		76%
Space Heating	Gas	4,578		6,371		72%
Space Cooling	Electricity	392		373		105%
Pumps	Electricity	228		286		80%
Heat Rejection						
Fans - Interior Ventilation	Electricity	972		1,085		90%
Fans - Interior Exhaust						
Fans - Parking Garage						
Service Water Heating	Gas	138		138		100%
Office Equipment	Nonregulated					
Elevators & Escalators	Electricity					
Refrigeration (food, etc.)	Electricity					
Cooking (commercial)	Electricity					
TOTAL BUILDING CONSUMPTION		**7,217.4**		**9,702.9**		**74%**

Energy and Cost Summary by Fuel Type

Type	DEC' Use [10^3 Btu/hr]	DEC' Cost [$]	ECB' Use [10^3 Btu/hr]	ECB' Cost [$]	DEC' / ECB' Energy %	DEC' / ECB' Cost %
Electricity	2,273	$ 35,468	3,193	$ 45,286	71%	78%
Natural Gas	4,945	$ 29,382	6,510	$ 40,554	76%	72%
Other	-	$ -	-	$ 0	-	0%
Total Nonrenewable	7,218	64,850	9,703	85,840		
Renewable					-	-
Total including Renewable	14,436	$ 64,850	19,406	$ 85,840		
Percent Savings = (ECB' $ -DEC' $)/ECB' $ =						24%

Harley-Davidson PDC Office
Energy Distribution %

Lighting	12
Heating	65
Cooling	5
Pumps	3
Fans	13
Dom. Wtr Heat	2
	100

Harley-Davidson PDC Office
Energy/Cost Distribution %

	Energy	Cost
Electricity	31	54
Gas	69	46
	100	100

Kettle Foods

- Chip Manufacturing Plant
- Beloit, WI

Architecture - Engineering - Planning - Interiors

Flad & Associates

AEI Affiliated Engineers

ACS Affiliated Construction Services, Inc.

KETTLE FOODS - BELOIT PLANT

BELOIT, WISCONSIN

APRIL 27, 2006

Architecture - Engineering - Planning - Interiors

Flad & Associates

AEI Affiliated Engineers

ACS Affiliated Construction Services, Inc.

KETTLE FOODS - BELOIT PLANT

BELOIT, WISCONSIN

APRIL 27, 2006

LEED-NC Version 2.2 Project Checklist

Kettle Foods-Potato Chip Plant
Beloit, WI

Date: 4/25/07

Yes	?	No	
41		28	**Project Totals** (pre-certification estimates) — 69 Points

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points

Sustainable Sites — 14 Points (Yes 9 / ? / No 5)

Y			Prereq 1	**Construction Activity Pollution Prevention** — Required
1			Credit 1	**Site Selection** — 1
		1	Credit 2	**Development Density & Community Connectivity** — 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:** Low Emitting & Fuel Efficient Vehicles — 1
1			Credit 4.4	**Alternative Transportation:** Parking Capacity — 1
1			Credit 5.1	**Site Development:** Protect or Restore Habitat — 1
1			Credit 5.2	**Site Development:** Maximize Open Space — 1
1			Credit 6.1	**Stormwater Management:** Quantity Control — 1
		1	Credit 6.2	**Stormwater Management:** Quality Control — 1
		1	Credit 7.1	**Heat Island Effect:** Non-Roof — 1
1			Credit 7.2	**Heat Island Effect:** Roof — 1
1			Credit 8	**Light Pollution Reduction** — 1

Water Efficiency — 5 Points (Yes 5 / ? / No)

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

Energy & Atmosphere — 17 Points (Yes 4 / ? / No 13)

Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems** — Required
Y			Prereq 2	**Minimum Energy Performance** — Required
Y			Prereq 3	**Fundamental Refrigerant Management** — Required
1		9	Credit 1	**Optimize Energy Performance** — 1 to 10
		1	Credit 2.1	**On-Site Renewable Energy:** 2.5% — 1
		1	Credit 2.2	**On-Site Renewable Energy:** 7.5% — 1
		1	Credit 2.3	**On-Site Renewable Energy:** 12.5% — 1
1			Credit 3	**Enhanced Commissioning** — 1
1			Credit 4	**Enhanced Refrigerant Management** — 1
		1	Credit 5	**Measurement & Verification** — 1
1			Credit 6	**Green Power** — 1

Innovation & Design Process — 5 Points (Yes 5 / ? / No)

1			Credit 1.1	**Innovation in Design:** Exemplary regional materials — 1
1			Credit 1.2	**Innovation in Design:** Exemplary water use reduction — 1
1			Credit 1.3	**Innovation in Design:** Public education program to promote sustainability — 1
1			Credit 1.4	**Innovation in Design:** Process water efficiency — 1
1			Credit 2	**LEED™ Accredited Professional** — 1

Materials & Resources — 13 Points (Yes 7 / ? / No 6)

Y			Prereq 1	**Storage & Collection of Recyclables** — Required
		1	Credit 1.1	**Building Reuse:** Maintain 75% of Existing Walls, Floors & Roof — 1
		1	Credit 1.2	**Building Reuse:** Maintain 95% of Existing Walls, Floors & Roof — 1
		1	Credit 1.3	**Building Reuse:** Maintain 50% of Interior Non-Structural Elements — 1
1			Credit 2.1	**Construction Waste Management:** Divert 50% — 1
1			Credit 2.2	**Construction Waste Management:** Divert 75% — 1
		1	Credit 3.1	**Resource Reuse:** 5% — 1
		1	Credit 3.2	**Resource Reuse:** 10% — 1
1			Credit 4.1	**Recycled Content:** 10% (post-consumer + ½ pre-consumer) — 1
1			Credit 4.2	**Recycled Content:** 20% (post-consumer + ½ pre-consumer) — 1
1			Credit 5.1	**Regional Materials:** 10% Extracted, Processed & Mfr. Regionally — 1
1			Credit 5.2	**Regional Materials:** 20% Extracted, Processed & Mfr. Regionally — 1
		1	Credit 6	**Rapidly Renewable Materials** — 1
1			Credit 7	**Certified Wood** — 1

Indoor Environmental Quality — 15 Points (Yes 11 / ? / No 4)

Y			Prereq 1	**Minimum IAQ Performance** — Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control** — Required
1			Credit 1	**Outdoor Air Delivery Monitoring** — 1
1			Credit 2	**Increased Ventillation** — 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 & Coatings — 1
1			Credit 4.3	**Low-Emitting Materials:** Carpet Systems — 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:** Lighting — 1
		1	Credit 6.2	**Controllability of Systems:** Thermal Comfort — 1
		1	Credit 7.1	**Thermal Comfort:** Design — 1
		1	Credit 7.2	**Thermal Comfort:** Verification — 1
		1	Credit 8.1	**Daylight & Views:** Daylight 75% of Spaces — 1
1			Credit 8.2	**Daylight & Views:** Views for 90% of Spaces — 1

Energy Cost Budget

2007

Project Name: Kettle Foods	Date: May 02, 2007
City: Beloit	Weather Data: Rockford, IL TMY2

Note: The percentage displayed for the "Proposed/ Base %" column of the base case is actually the percentage of the total energy consumption

		Alt-1 Base Case			Alt-2 Envelope - 1st Estimate			Alt-3 Envelope - 1st Estimate &			Alt-4 Envlp-AEI light-AAON ERV		
		Energy 10^6 Btu/yr	Proposed / Base %	Peak kBtuh	Energy 10^6 Btu/yr	Proposed / Base %	Peak kBtuh	Energy 10^6 Btu/yr	Proposed / Base %	Peak kBtuh	Energy 10^6 Btu/yr	Proposed / Base %	Peak kBtuh
Lighting - Conditioned	Electricity	2,301.0	4	278	2,301.0	100	278	1,901.3	83	228	1,901.3	83	228
Space Heating	Electricity	206.7	0	121	147.6	71	86	137.9	67	81	137.9	67	81
	Gas	7,227.0	12	4,753	1,012.6	14	867	1,045.7	14	897	4,958.8	69	2,863
Space Cooling	Electricity	851.6	1	568	842.0	99	533	834.1	98	533	833.9	98	526
Heat Rejection	Electricity	117.2	0	70	116.0	99	65	114.9	98	65	114.8	98	64
Fans - Conditioned	Electricity	1,461.7	2	167	0.0	0	0	0.0	0	0	736.5	50	93
Receptacles - Conditioned	Electricity	158.6	0	27	158.6	100	27	136.3	86	27	146.9	93	29
Stand-alone Base Utilities	Electricity	6,228.8	10	1,249	276.8	4	36	276.8	4	36	5,722.9	92	1,136
	Gas	42,309.9	70	4,830	0.0	0	0	0.0	0	0	42,309.9	100	4,830
Total Building Consumption		**60,862.4**			**4,854.5**			**4,446.9**			**56,862.8**		

		Base Case Alt-1	Alt-2 Envelope - 1st Estimate	Alt-3 Envelope - 1st Estimate &	Alt-4 Envlp-AEI light-AAON ERV
Total	**Number of hours heating load not met**	339	313	320	740
	Number of hours cooling load not met	198	191	143	147

	Base Case Alt-1		Alt-2 Envelope - 1st Estimate		Alt-3 Envelope - 1st Estimate &		Alt-4 Envlp-AEI light-AAON ERV	
	Energy 10^6 Btu/yr	Cost/yr $/yr	Energy 10^6 Btu/yr	Cost/yr $/yr	Energy 10^6 Btu/yr	Cost/yr $/yr	Energy 10^6 Btu/yr	Cost/yr $/yr
Electricity	11,325.5	173,512	3,841.9	59,238	3,401.2	53,471	9,594.1	149,063
Gas	49,536.9	549,859	1,012.6	11,240	1,045.7	11,608	47,268.7	524,683
Total	**60,862**	**723,371**	**4,854**	**70,478**	**4,447**	**65,078**	**56,863**	**673,745**

Kettle Foods
Energy Distribution (10^6 BTU/YR)

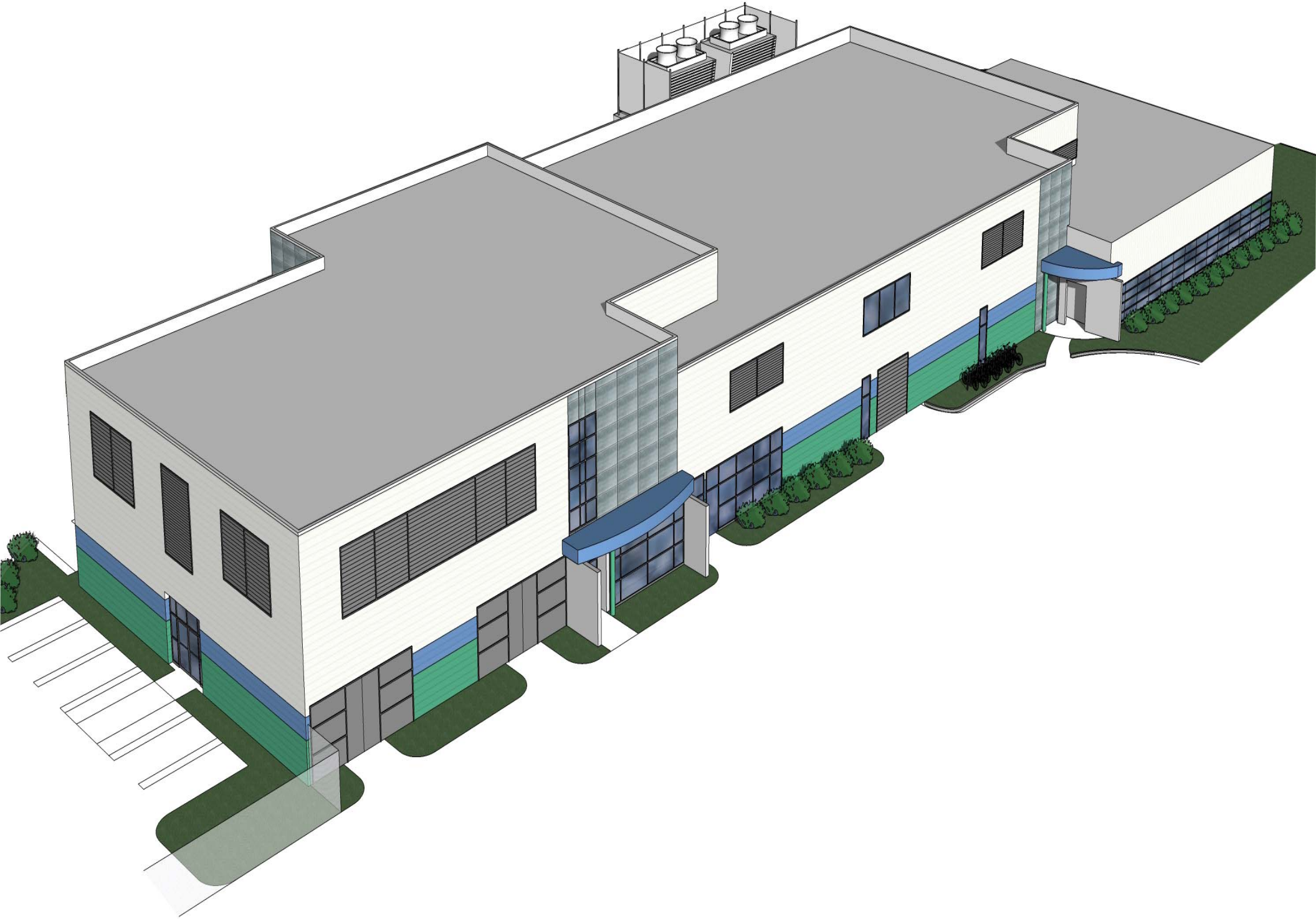
Building	Proposed	Base
Fuel	3,724 39%	5,097 45%
Gas	4,959 10%	7,227 65%
	8,683 100%	12,324 100%

Building Energy Reduction = 30%

Building and Process Energy Reduction = 6.6%

Lab Building

- Heavy-Duty Diesel Lab
- Auburn Hills, MI



Auburn Hills HDD Expansion

ESTIMATE OF COST FOR PHASE I

2007

Estimate Issue Date: 1/10/2007

	Item		
		Title	Cost
1	*Site Work*	Demolition & Relocations	$ 46,870
		Excavation/Grading, Paving, Fence, Landscaping	$ 533,200
		Site Utilities	$ 252,850
		Site Lighting	$ 48,370
		subtotal	*$ 881,290*
2	*General Trades*	Demolition	$ 87,000
		Substructure	$ 500,900
		Superstructure	$ 1,207,100
		Roofing Enclosure	$ 271,500
		Building Enclosure	$ 573,800
		Finishes	$ 321,200
		Specialties	$ 367,200
		subtotal	*$ 3,328,700*
3	*Mechanical - Central Systems*	Chilled Water	$ 378,050
		Cooling Tower Water	$ 276,040
		Process Cooling Water	$ 314,280
		Cooling Coil Condensate	$ 2,510
		Heating Hot Water	$ 298,680
		Humidification Steam & Condensate Drain	$ 62,190
		Insulation for All Central Systems	$ 94,340
		subtotal	*$ 1,426,090*
4	*Mechanical - Test Cell Support Systems*	Cell Ventilation/Cooling - Cells 5, 6, & 7	$ 325,510
		Combustion Air - Cells 5, 6, & 7	$ 97,310
		Engine Exhaust - Cell 5, 6, & 7	$ 112,590
		Scavenge Air System	$ 47,280
		Insulation for Above Systems	$ 15,360
		Fire Suppression - CO2 Systems	$ 179,400
		System Test & Balance	$ 18,580
		subtotal	*$ 796,030*
5	*Mechanical - Building Systems*	Piping/Plumbing	$ 347,260
		Fire Protection	$ 102,480
		HVAC - Office/Labs/Storage/Mezz/Prep/Mech&Elec	$ 327,160
		Insulation for Above Systems	$ 30,100
		Test and Balance	$ 3,920
		subtotal	*$ 810,920*
6	*Fuel Systems*	Engine Lab Fuel Storage	$ 584,210
		Engine Lab Fuel Supply & Distribution	$ 378,950
		Vehicle Lab - Fueling Station and Drum Storage System	$ 120,000
		subtotal	*$ 1,083,160*
7	*Electrical Systems*	Service & Distribution	$ 1,339,330
		Grounding	$ 18,860
		Motor Control	$ 808,570
		Branch Lighting	$ 129,350
		Branch Power	$ 129,350
		Fire Alarm	$ 35,540
		Paging	$ 37,540
		Tele/Data Raceway	$ 24,350
		Security Access Control	$ 15,690
		Testing	$ 9,280
		subtotal	*$ 2,547,860*

Auburn Hills HDD Expansion

ESTIMATE OF COST FOR PHASE I

2007

Estimate Issue Date: 1/10/2007

8	***Control Systems***	BAS Control System	$	579,780
		subtotal	***$***	***579,780***
9	***Test & Emissions Equipment/Systems***	Test Cell 1 - Transient	$	2,969,800
		Test Cell 2 - Transient	$	2,389,000
		Test Cell 3 - Aging	$	997,700
		Bottled Gas	$	387,193
		Gas Detection System	$	103,570
		MEP Contractor Installation (Dyno, DAS, Emissions)	$	331,920
		ACS Integration & Vendor Management	$	355,000
		subtotal	***$***	***7,534,183***
10	***Construction Phase Mgmt/Services/Cost***	Const - full time on site mgmt	$	241,600
		Const site related expenses by CM	$	443,300
		subtotal	***$***	***684,900***
11	***Indirects***	Construction Mgmt, Design & Const & Comm Phases	$	975,500
		Design Sevices	$	542,600
		subtotal	***$***	***1,518,100***
12	***Totals***			
	(rounded to nearest $1000)	Direct Costs - Facility		***$12,139,000***
		Direct Costs - Test Equipment		***$7,534,000***
		Indirect Costs		***$1,518,000***
		TOTAL ESTIMATE OF PROJECT COST		***$21,191,000***

Lab Building

- Alternate Energy Research Building

LEED-NC Version 2.2 Project Checklist

Project Name AERTC Baseline [Silver Rating]

Yes	?	No		
33	18	16	**Project Totals** (pre-certification estimates)	

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points

Yes	?	No			
10	2	2	**Sustainable Sites**		14 Points
Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
1			Credit 1	**Site Selection**	1
		1	Credit 2	**Development Density & Community Connectivity**	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:** Low Emitting & Fuel Efficient Vehicles	1
1			Credit 4.4	**Alternative Transportation:** Parking Capacity	1
1			Credit 5.1	**Site Development:** Protect or Restore Habitat	1
1			Credit 5.2	**Site Development:** Maximize Open Space	1
1			Credit 6.1	**Stormwater Management:** Quantity Control	1
1			Credit 6.2	**Stormwater Management:** Quality Control	1
	?		Credit 7.1	**Heat Island Effect:** Non-Roof	1
1			Credit 7.2	**Heat Island Effect:** Roof	1
1			Credit 8	**Light Pollution Reduction**	1

Yes	?	No			
2	3	0	**Water Efficiency**		5 Points
1			Credit 1.1	**Water Efficient Landscaping:** Reduce by 50%	1
	?		Credit 1.2	**Water Efficient Landscaping:** No Potable Use or No Irrigation	1
	?		Credit 2	**Innovative Wastewater Technologies**	1
1			Credit 3.1	**Water Use Reduction:** 20% Reduction	1
	?		Credit 3.2	**Water Use Reduction:** 30% Reduction	1

Yes	?	No			
3	6	8	**Energy & Atmosphere**		17 Points
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**Fundamental Refrigerant Management**	Required
2		8	Credit 1	**Optimize Energy Performance**	1 to 10
	?		Credit 2.1	**On-Site Renewable Energy:** 2.5%	1
	?		Credit 2.2	**On-Site Renewable Energy:** 7.5%	1
	?		Credit 2.3	**On-Site Renewable Energy:** 12.5%	1
	?		Credit 3	**Enhanced Commissioning**	1
1			Credit 4	**Enhanced Refrigerant Management**	1
	?		Credit 5	**Measurement & Verification**	1
	?		Credit 6	**Green Power**	1

Yes	?	No			
3	0	0	**Innovation & Design Process**		5 Points
1			Credit 1.1	**Innovation in Design:** Exemplary Recycled Content	1
1			Credit 1.2	**Innovation in Design:** Green Housekeeping Program	1
			Credit 1.3	**Innovation in Design:** TBD	1
			Credit 1.4	**Innovation in Design:** TBD	1
1			Credit 2	**LEED™ Accredited Professional**	1

69 Points

Yes	?	No			
4	3	6	**Materials & Resources**		**13** Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	**Building Reuse:** Maintain 75% of Existing Walls, Floors & Roof	1
		1	Credit 1.2	**Building Reuse:** Maintain 95% of Existing Walls, Floors & Roof	1
		1	Credit 1.3	**Building Reuse:** Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	**Construction Waste Management:** Divert 50%	1
	?		Credit 2.2	**Construction Waste Management:** Divert 75%	1
		1	Credit 3.1	**Resource Reuse:** 5%	1
		1	Credit 3.2	**Resource Reuse:**10%	1
1			Credit 4.1	**Recycled Content:** 10% (post-consumer + ½ pre-consumer)	1
1			Credit 4.2	**Recycled Content:** 20% (post-consumer + ½ pre-consumer)	1
1			Credit 5.1	**Regional Materials:** 10% Extracted, Processed & Mfr. Regionally	1
	?		Credit 5.2	**Regional Materials:** 20% Extracted, Processed & Mfr. Regionally	1
		1	Credit 6	**Rapidly Renewable Materials**	1
	?		Credit 7	**Certified Wood**	1

Yes	?	No			
11	4	0	**Indoor Environmental Quality**		**15** Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
	?		Credit 1	**Outdoor Air Delivery Monitoring**	1
1			Credit 2	**Increased Ventillation**	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 & Coatings	1
1			Credit 4.3	**Low-Emitting Materials:** Carpet Systems	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:** Lighting	1
	?		Credit 6.2	**Controllability of Systems:** Thermal Comfort	1
1			Credit 7.1	**Thermal Comfort:** Design	1
1			Credit 7.2	**Thermal Comfort:** Verification	1
	?		Credit 8.1	**Daylight & Views:** Daylight 75% of Spaces	1
	?		Credit 8.2	**Daylight & Views:** Views for 90% of Spaces	1

LEED-NC Version 2.2 Project Checklist

Project Name: AERTC Gold Rating

Yes	?	No		
39	15	15	**Project Totals** (pre-certification estimates)	

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points

Yes	?	No			
10	2	2	**Sustainable Sites**		14 Points
Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
1			Credit 1	**Site Selection**	1
		1	Credit 2	Development Density & Community Connectivity	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:** Low Emitting & Fuel Efficient Vehicles	1
1			Credit 4.4	**Alternative Transportation:** Parking Capacity	1
1			Credit 5.1	**Site Development:** Protect or Restore Habitat	1
1			Credit 5.2	**Site Development:** Maximize Open Space	1
1			Credit 6.1	**Stormwater Management:** Quantity Control	1
1			Credit 6.2	**Stormwater Management:** Quality Control	1
	?		Credit 7.1	**Heat Island Effect:** Non-Roof	1
1			Credit 7.2	**Heat Island Effect:** Roof	1
1			Credit 8	**Light Pollution Reduction**	1

Yes	?	No			
4	1	0	**Water Efficiency**		5 Points
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
	?		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

Yes	?	No			
4	6	7	**Energy & Atmosphere**		17 Points
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**Fundamental Refrigerant Management**	Required
3		7	Credit 1	**Optimize Energy Performance**	1 to 10
	?		Credit 2.1	**On-Site Renewable Energy:** 2.5%	1
	?		Credit 2.2	**On-Site Renewable Energy:** 7.5%	1
	?		Credit 2.3	**On-Site Renewable Energy:** 12.5%	1
	?		Credit 3	**Enhanced Commissioning**	1
1			Credit 4	**Enhanced Refrigerant Management**	1
	?		Credit 5	**Measurement & Verification**	1
	?		Credit 6	**Green Power**	1

Yes	?	No			
5	0	0	**Innovation & Design Process**		5 Points
1			Credit 1.1	**Innovation in Design:** Exemplary Recycled Content	1
1			Credit 1.2	**Innovation in Design:** Green Housekeeping Program	1
1			Credit 1.3	**Innovation in Design:** Exemplary Water Use Reduction	1
1			Credit 1.4	**Innovation in Design:** Process Water Reduction	1
1			Credit 2	**LEED™ Accredited Professional**	1

69 Points

Yes	?	No			
5	2	6	**Materials & Resources**		13 Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	**Building Reuse:** Maintain 75% of Existing Walls, Floors & Roof	1
		1	Credit 1.2	**Building Reuse:** Maintain 95% of Existing Walls, Floors & Roof	1
		1	Credit 1.3	**Building Reuse:** Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	**Construction Waste Management:** Divert 50%	1
1			Credit 2.2	**Construction Waste Management:** Divert 75%	1
		1	Credit 3.1	**Resource Reuse:** 5%	1
		1	Credit 3.2	**Resource Reuse:**10%	1
1			Credit 4.1	**Recycled Content:** 10% (post-consumer + ½ pre-consumer)	1
1			Credit 4.2	**Recycled Content:** 20% (post-consumer + ½ pre-consumer)	1
1			Credit 5.1	**Regional Materials:** 10% Extracted, Processed & Mfr. Regionally	1
	?		Credit 5.2	**Regional Materials:** 20% Extracted, Processed & Mfr. Regionally	1
		1	Credit 6	**Rapidly Renewable Materials**	1
	?		Credit 7	**Certified Wood**	1

Yes	?	No			
11	4	0	**Indoor Environmental Quality**		15 Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
	?		Credit 1	**Outdoor Air Delivery Monitoring**	1
1			Credit 2	**Increased Ventillation**	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 & Coatings	1
1			Credit 4.3	**Low-Emitting Materials:** Carpet Systems	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:** Lighting	1
	?		Credit 6.2	**Controllability of Systems:** Thermal Comfort	1
1			Credit 7.1	**Thermal Comfort:** Design	1
1			Credit 7.2	**Thermal Comfort:** Verification	1
	?		Credit 8.1	**Daylight & Views:** Daylight 75% of Spaces	1
	?		Credit 8.2	**Daylight & Views:** Views for 90% of Spaces	1

LEED-NC Version 2.2 Project Checklist

Project Name: AERTC Platinum Rating

Yes	?	No		
52	4	13	**Project Totals** (pre-certification estimates)	

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points

Yes	?	No			
11	1	2	**Sustainable Sites**		14 Points
Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
1			Credit 1	**Site Selection**	1
		1	Credit 2	Development Density & Community Connectivity	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:** Low Emitting & Fuel Efficient Vehicles	1
1			Credit 4.4	**Alternative Transportation:** Parking Capacity	1
1			Credit 5.1	**Site Development:** Protect or Restore Habitat	1
1			Credit 5.2	**Site Development:** Maximize Open Space	1
1			Credit 6.1	**Stormwater Management:** Quantity Control	1
1			Credit 6.2	**Stormwater Management:** Quality Control	1
	?		Credit 7.1	**Heat Island Effect:** Non-Roof	1
1			Credit 7.2	**Heat Island Effect:** Roof	1
1			Credit 8	**Light Pollution Reduction**	1

Yes	?	No			
5	0	0	**Water Efficiency**		5 Points
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

Yes	?	No			
10	2	5	**Energy & Atmosphere**		17 Points
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**Fundamental Refrigerant Management**	Required
5		5	Credit 1	**Optimize Energy Performance**	1 to 10
1			Credit 2.1	**On-Site Renewable Energy:** 2.5%	1
	?		Credit 2.2	**On-Site Renewable Energy:** 7.5%	1
	?		Credit 2.3	**On-Site Renewable Energy:** 12.5%	1
1			Credit 3	**Enhanced Commissioning**	1
1			Credit 4	**Enhanced Refrigerant Management**	1
1			Credit 5	**Measurement & Verification**	1
1			Credit 6	**Green Power**	1

Yes ? No

5 0 0 Innovation & Design Process — 5 Points

1			Credit 1.1	**Innovation in Design:** Exemplary Recycled Content 1
1			Credit 1.2	**Innovation in Design:** Green Housekeeping Program 1
1			Credit 1.3	**Innovation in Design:** Exemplary Water Use Reduction 1
1			Credit 1.4	**Innovation in Design:** Process Water Reduction 1
1			Credit 2	**LEED™ Accredited Professional** 1

69 Points

Yes ? No

7 0 6 Materials & Resources — 13 Points

Y			Prereq 1	**Storage & Collection of Recyclables** Required
		1	Credit 1.1	**Building Reuse:** Maintain 75% of Existing Walls, Floors & Roof 1
		1	Credit 1.2	**Building Reuse:** Maintain 95% of Existing Walls, Floors & Roof 1
		1	Credit 1.3	**Building Reuse:** Maintain 50% of Interior Non-Structural Elements 1
1			Credit 2.1	**Construction Waste Management:** Divert 50% 1
1			Credit 2.2	**Construction Waste Management:** Divert 75% 1
		1	Credit 3.1	**Resource Reuse:** 5% 1
		1	Credit 3.2	**Resource Reuse:**10% 1
1			Credit 4.1	**Recycled Content:** 10% (post-consumer + ½ pre-consumer) 1
1			Credit 4.2	**Recycled Content:** 20% (post-consumer + ½ pre-consumer) 1
1			Credit 5.1	**Regional Materials:** 10% Extracted, Processed & Mfr. Regionally 1
1			Credit 5.2	**Regional Materials:** 20% Extracted, Processed & Mfr. Regionally 1
		1	Credit 6	**Rapidly Renewable Materials** 1
1			Credit 7	**Certified Wood** 1

Yes ? No

14 1 0 Indoor Environmental Quality — 15 Points

Y			Prereq 1	**Minimum IAQ Performance** Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control** Required
1			Credit 1	**Outdoor Air Delivery Monitoring** 1
1			Credit 2	**Increased Ventillation** 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 & Coatings 1
1			Credit 4.3	**Low-Emitting Materials:** Carpet Systems 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:** Lighting 1
	?		Credit 6.2	**Controllability of Systems:** Thermal Comfort 1
1			Credit 7.1	**Thermal Comfort:** Design 1
1			Credit 7.2	**Thermal Comfort:** Verification 1
1			Credit 8.1	**Daylight & Views:** Daylight 75% of Spaces 1
1			Credit 8.2	**Daylight & Views:** Views for 90% of Spaces 1

THANK YOU

This concludes the ASHRAE & AIA
Continuing Education Systems Program

Please visit the website
www.ashraemadison.org/crc2007

Questions or Comments??

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