Sustainable Building Operations & Upgrades

LEED for Existing Buildings

2010 Energy / Facilities Connections Conference

Brightworks & Glumac

Eric Baxter and Todd McGuire

12 May, 2010

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•The Value Proposition

Your facility is an asset – make it work for you.

More than all of the other LEED products, LEED EB O&M forces us to monitor our practices over time and provides us the opportunity to save – and make – money.

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Armstrong Headquarters Lancaster, PA

LEED-EB Platinum Certification, 2007

- Reduction in water usage from 800,000 gallons to 420,000 gallons per year… with fixtures and humidification process
- Lighting power density of 1.5 watts/sf, which is half the nationwide average; building automation system provides feedback on the energy consumption measures
- $138,000 invested; 3 year payback

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Adobe Headquarters San Jose, PA

Working with their facility management partner, Cushman & Wakefield, over the last five years they have:

- invested $1.4 million on energy and energy-related projects
- received $389,000 in rebates
- saving $1.2M annually

- electricity usage by 35 percent
- natural gas by 41 percent
- domestic water by 22 percent
- landscape irrigation by 76 percent
- CO2 emissions by more than 20 percent
- and achieved diversion of solid waste nearly 90 percent *DOLLARS ANNUALLY*

…and are enjoying a 121% return on investment with a 9.5 month average payback

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Confidential Project Oakland, CA

1970's 22-story tower

Changing out plumbing fixtures to low-flow fixtures (received small rebate from East Bay MUD for doing so…)

Saving 1-1.2 million gallons of water per year

$4500/year in water savings, not including reduction in sewer fees

Benefits of Greening Your Building

For the private owner:

Market Differentiation

- Increase Lease Rates
- Increase Tenant Retention
- Risk Management

Reduce Capital Expenditures

- Lengthen Equipment Life
- Strengthen Durability of Building Envelope
- Increase Education: Use of Preventive Maintenance
- Decrease in Tenant Improvement Cost

Reduce Operating Costs

- Less Turnover Costs
- Government Incentives and Tax Credits
- Utilities expenses*

Benefits of Greening Your Building

For the public owner:

Reduce Capital Expenditures

- Lengthen Equipment Life
- Strengthen Durability of Building Envelope
- Increase Education: Use of Preventive Maintenance
- Decrease in Tenant Improvement Cost

Reduce Operating Costs

- Utilities expenses (energy, water, sewer)
- Maintenance staff or contractor $
- More efficient use of supplies or materials
- Waste removal expenses

Perception About Your Facilities – Health + Well Being

- State employees
- Public using or visiting your facilities

Other Benefits

Employee Productivity

- 15 international case studies demonstrate that ventilation strategies increase individual productivity between 0.48-11%.
- 8 international case studies demonstrate that providing individual temperature control for each worker increases individual productivity by 0.2-3%

Other Benefits

Employee Productivity

- CBRE/USD study shows across 154 buildings, sick days and self-reported productivity changes in an ES or LEED facility
- 45% reported they had 2.88 fewer sick days, which directly translate into more dollars

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Other Benefits

Insurance Premium Reductions

- March 2009: Insurance regulators adopted mandatory climate-risk discloser standards for insurance companies with annual premiums of $500 million or more, requiring firms to report to regulators and investors payout risks they may face due to climate change
- New products for “climate friendly customers” – coverage for wind and solar production shortfalls and premium discounts for green buildings

- According to Fireman’s Fund:
  - Risk of obsolescence
  - Reputational and transactional risk
  - Regulatory risk
  - Pollution

Benefits of LEED EB

Structured System

- Prescriptive Requirements
- Measurable Metrics
- System to Track Performance

Third Party Verification

- Legitimacy to Your Project
- Structure to Ensure Rigor

Save

- Natural Resources
- Ecosystem
- Carbon Emissions

LEED EB O&M Framework

LEED- EB O&M

	Prerequisites	Credits	Possible points
Sustainable Sites	-	**8**	**26**
Water Efficiency	1	**4**	**14**
Energy & Atmosphere	3	**6**	**35**
Materials & Resources	2	**9**	**10**
Indoor Environmental Quality	3	**3**	**15**
Innovation in Operations	-	**6**	**6**
Regional Credits		**6**	**4**
		Total	**110**

LEED EB O&M v2009 Scorecard

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Yes	?Y	?N	No
0	0	0	0

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 or 110

Total Project Score

Sustainable Sites (26 points)

Y	?Y	?N	N		
0	0	0	0		**Sustainable Sites (26 points)**
				Credit 1	**LEED Certified Design and Construction (4 points)**
				Credit 2	**Building Exterior and Hardscape Management Plan**
				Credit 3	**Integrated Pest Management, Erosion Control, and Land Mgmt Plan**
				Credit 4.1	**Alternative Commuting Transportation,** 10% **(3 points)**
				Credit 4.2	**Alternative Commuting Transportation,** 25% **(4 points)**
				Credit 4.3	**Alternative Commuting Transportation,** 50% **(4 points)**
				Credit 4.4	**Alternative Commuting Transportation,** 75% or greater **(4 points)**
				Credit 5	**Site Development,** Protect or Restore Open Space
				Credit 6	**Stormwater Quantity Control**
				Credit 7.1	**Heat Island Reduction,** Non-Roof
				Credit 7.2	**Heat Island Reduction,** Roof
				Credit 8	**Light Pollution Reduction**

Water Efficiency (14 points)

Y	?Y	?N	N		
0	0	0	0		**Water Efficiency (14 points)**
Y				Prereq 1	**Minimum Indoor Plumbing Fixture and Fitting Efficiency**
				Credit 1.1	**Water Performance Measurement,** Whole Building Metering
				Credit 1.2	**Water Performance Measurement,** Submetering
				Credit 2.1	**Additional Indoor Plumbing Fixture and Fitting Efficiency,** 10%
				Credit 2.2	**Additional Indoor Plumbing Fixture and Fitting Efficiency,** 15%
				Credit 2.3	**Additional Indoor Plumbing Fixture and Fitting Efficiency,** 20%
				Credit 2.4	**Additional Indoor Plumbing Fixture and Fitting Efficiency,** 25%
				Credit 2.5	**Additional Indoor Plumbing Fixture and Fitting Efficiency,** 30%
				Credit 3.1	**Water Efficient Landscaping,** Reduce by 50%
				Credit 3.2	**Water Efficient Landscaping,** Reduce by 62.5%
				Credit 3.3	**Water Efficient Landscaping,** Reduce by 75%
				Credit 3.4	**Water Efficient Landscaping,** Reduce by 87.5%
				Credit 3.5	**Water Efficient Landscaping,** Reduce by 100%
				Credit 4.1	**Cooling Tower Water Management,** Chemical Management
				Credit 4.2	**Cooling Tower Water Management,** Non-Potable Water Source Use

Energy & Atmosphere (35 points)

Y	?Y	?N	N		
0	0	0	0		**Energy & Atmosphere (35 points)**
Y				Prereq 1	**Energy Efficiency Best Management Practices**
Y				Prereq 2	**Minimum Energy Efficiency Performance**
Y				Prereq 3	**Refrigerant Management,** Ozone Protection
				Credit 1	**Optimize Energy Performance** (1 to 18 points available)
				Credit 2.1	**Existing Building Commissioning,** Investigation and Analysis (2 points)
				Credit 2.2	**Existing Building Commissioning,** Implementation (2 points)
				Credit 2.3	**Existing Building Commissioning,** Ongoing Commissioning (2 points)
				Credit 3.1	**Performance Measurement,** Building Automation System
				Credit 3.2	**Performance Measurement,** System-Level Metering, 40%
				Credit 3.3	**Performance Measurement,** System-Level Metering, 80%
				Credit 4.1	**Renewable Energy,** On-site 3% / Off-site 25%
				Credit 4.2	**Renewable Energy,** On-site 4.5% / Off-site 37.5%
				Credit 4.3	**Renewable Energy,** On-site 6% / Off-site 50%
				Credit 4.4	**Renewable Energy,** On-site 7.5% / Off-site 62.5%
				Credit 4.4	**Renewable Energy,** On-site 9% / Off-site 75%
				Credit 4.4	**Renewable Energy,** On-site 12% / Off-site 100%
				Credit 5	**Refrigerant Management**
				Credit 6	**Emissions Reduction Reporting**

Materials & Resources (10 points)

Y	?Y	?N	N		
0	0	0	0		**Materials & Resources (10 points)**
Y				Prereq 1	**Sustainable Purchasing Policy**
Y				Prereq 2	**Solid Waste Management Policy**
				Credit 1	**Sustainable Purchasing,** Ongoing Consumables, 60%
				Credit 2.1	**Sustainable Purchasing,** Durable Goods, electric, 40%
				Credit 2.2	**Sustainable Purchasing,** Durable Goods, furniture, 40%
				Credit 3	**Sustainable Purchasing,** Facility Alterations and Additions, 50%
				Credit 4	**Sustainable Purchasing,** Reduced Mercury in Lamps, 90 pg/lum-hr, 90%
				Credit 5	**Sustainable Purchasing,** Food, 25%
				Credit 6	**Solid Waste Management,** Waste Stream Audit
				Credit 7	**Solid Waste Management,** Ongoing Consumables, 50% Waste Diversion
				Credit 8	**Solid Waste Management,** Durable Goods, 75%
				Credit 9	**Solid Waste Management,** Facility Alterations and Additions, 70%

Indoor Environmental Quality (15 points)

Y	?Y	?N	N		
0	0	0	0		**Indoor Environmental Quality (15 points)**
Y				Prereq 1	**Minimum IAQ Performance**
Y				Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**
Y				Prereq 3	**Green Cleaning Policy**
				Credit 1.1	**IAQ Best Management Practices,** IAQ Management Program
				Credit 1.2	**IAQ Best Management Practices,** Outdoor Air Delivery Monitoring
				Credit 1.3	**IAQ Best Management Practices,** Increased Ventilation
				Credit 1.4	**IAQ Best Management Practices,** Reduced Particulates in Air Distribution
				Credit 1.5	**IAQ Best Management Plan,** During Construction
				Credit 2.1	**Occupant Comfort,** Occupant Survey
				Credit 2.2	**Occupant Comfort,** Occupant Controlled Lighting, 50%
				Credit 2.3	**Occupant Comfort,** Thermal Comfort Monitoring
				Credit 2.4	**Occupant Comfort,** Daylight and Views, 50% Daylight / 45% Views
				Credit 3.1	**Green Cleaning,** High Performance Cleaning Program
				Credit 3.2	**Green Cleaning,** Custodial Effectiveness Assessment, < 3
				Credit 3.3	**Green Cleaning,** Sustainable Cleaning Products and Materials Purchases, 30%
				Credit 3.4	**Green Cleaning,** Sustainable Cleaning Equipment
				Credit 3.5	**Green Cleaning,** Indoor Chemical & Pollutant Source Control
				Credit 3.6	**Green Cleaning,** Indoor Integrated Pest Management

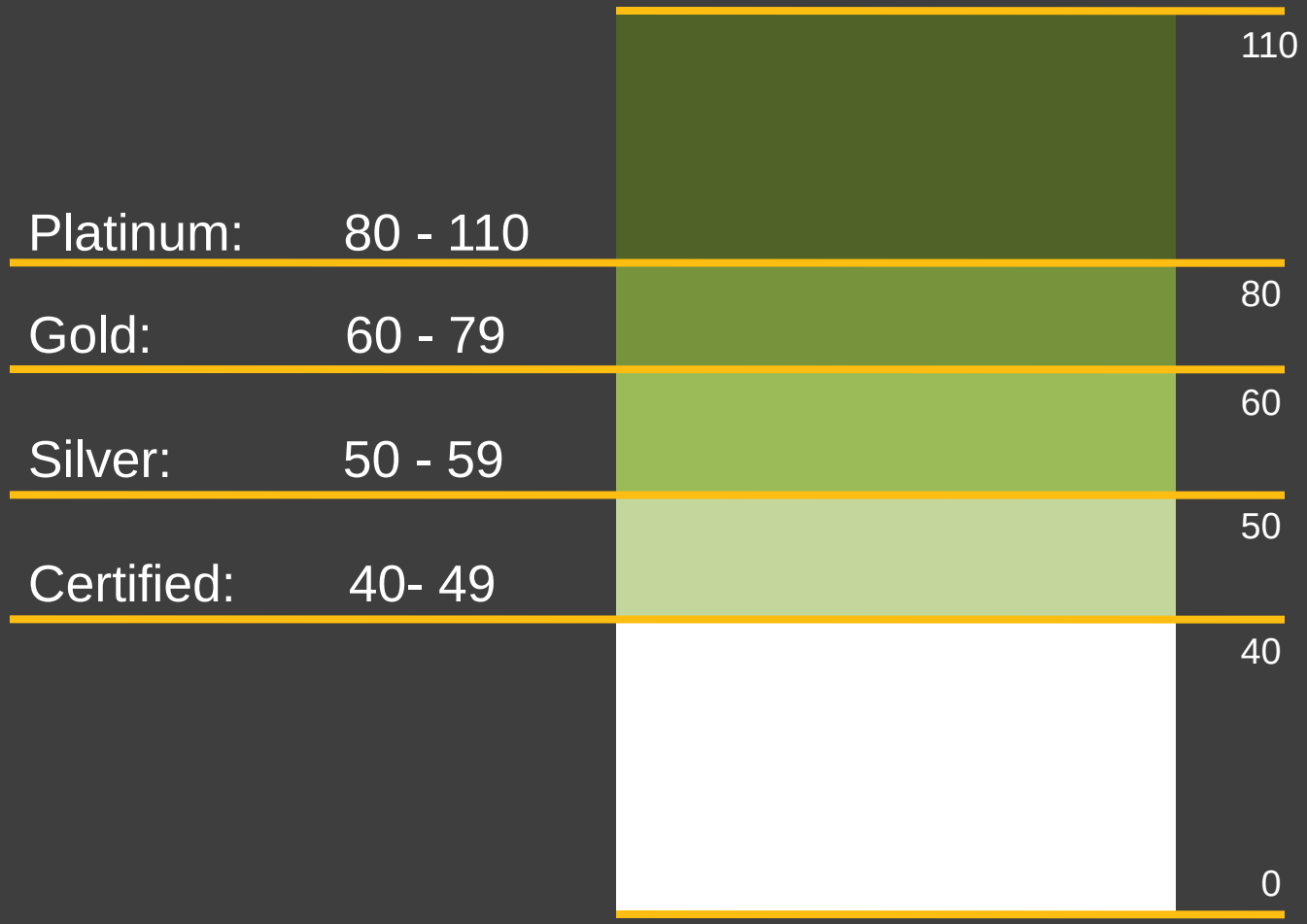
Innovation in Operations (6 points)

0	0	0	0		
				Credit 1.1	**Innovation in Operations**
				Credit 1.2	**Innovation in Operations**
				Credit 1.3	**Innovation in Operations**
				Credit 1.4	**Innovation in Operations**
				Credit 2	**LEED™ Accredited Professional**
				Credit 3	**Documenting Sustainable Building Cost Impacts**

Regional Priority (4 points maximum)

0	0	0	0		
				Credit 1.1	**Regional Priority**
				Credit 1.2	**Regional Priority**
				Credit 1.3	**Regional Priority**
				Credit 1.4	**Regional Priority**

LEED EB O&M Certification Levels



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LEED - O&M Eligible Buildings

Can your building participate?

Occupancy

- At least 12 continuous months of full occupancy; **50% adjustment (effective Sept. 2009.)**

Scope of LEED-EB Program

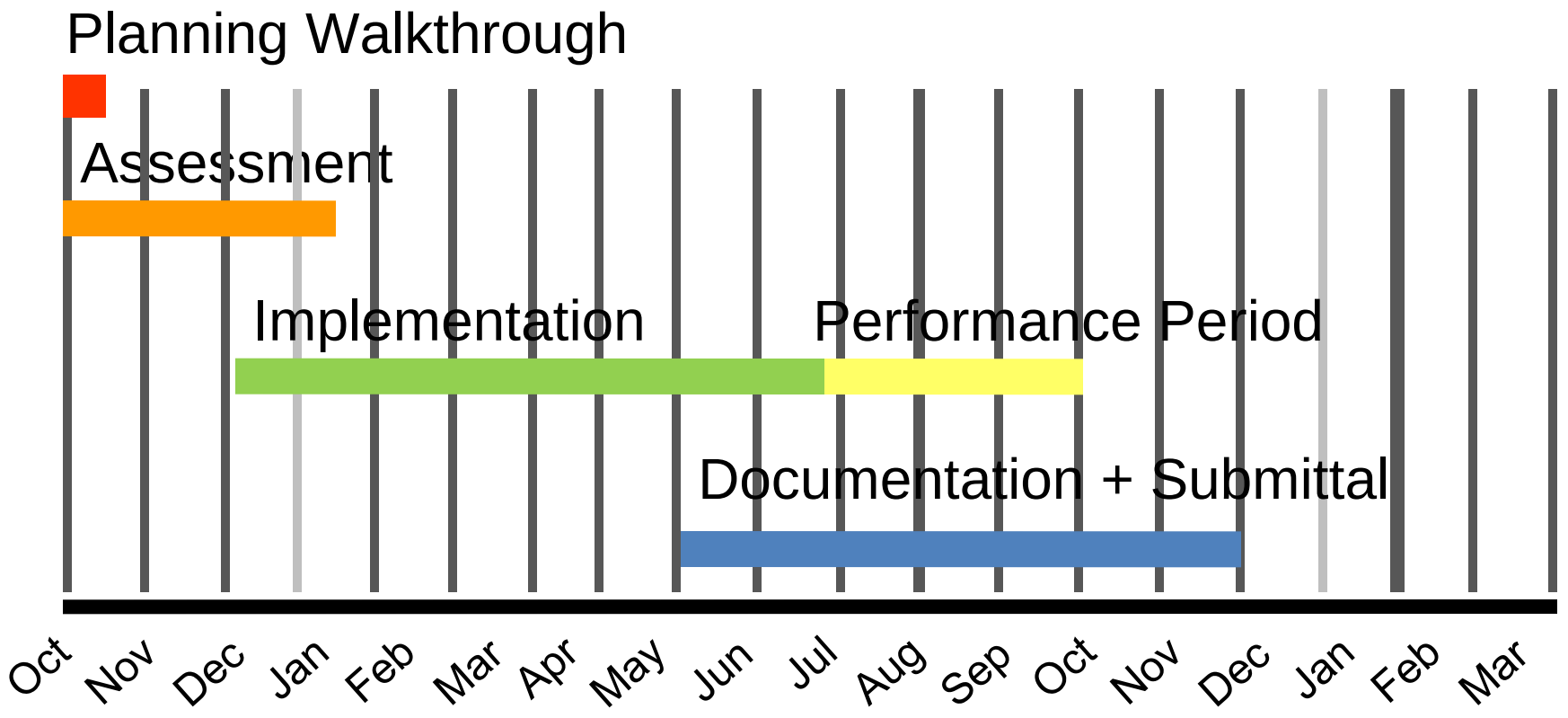
- Covers 100% of building; 10% exceptions allowed for spaces not controlled by the owner

1 year of Utility Bill Data

Facility Alterations

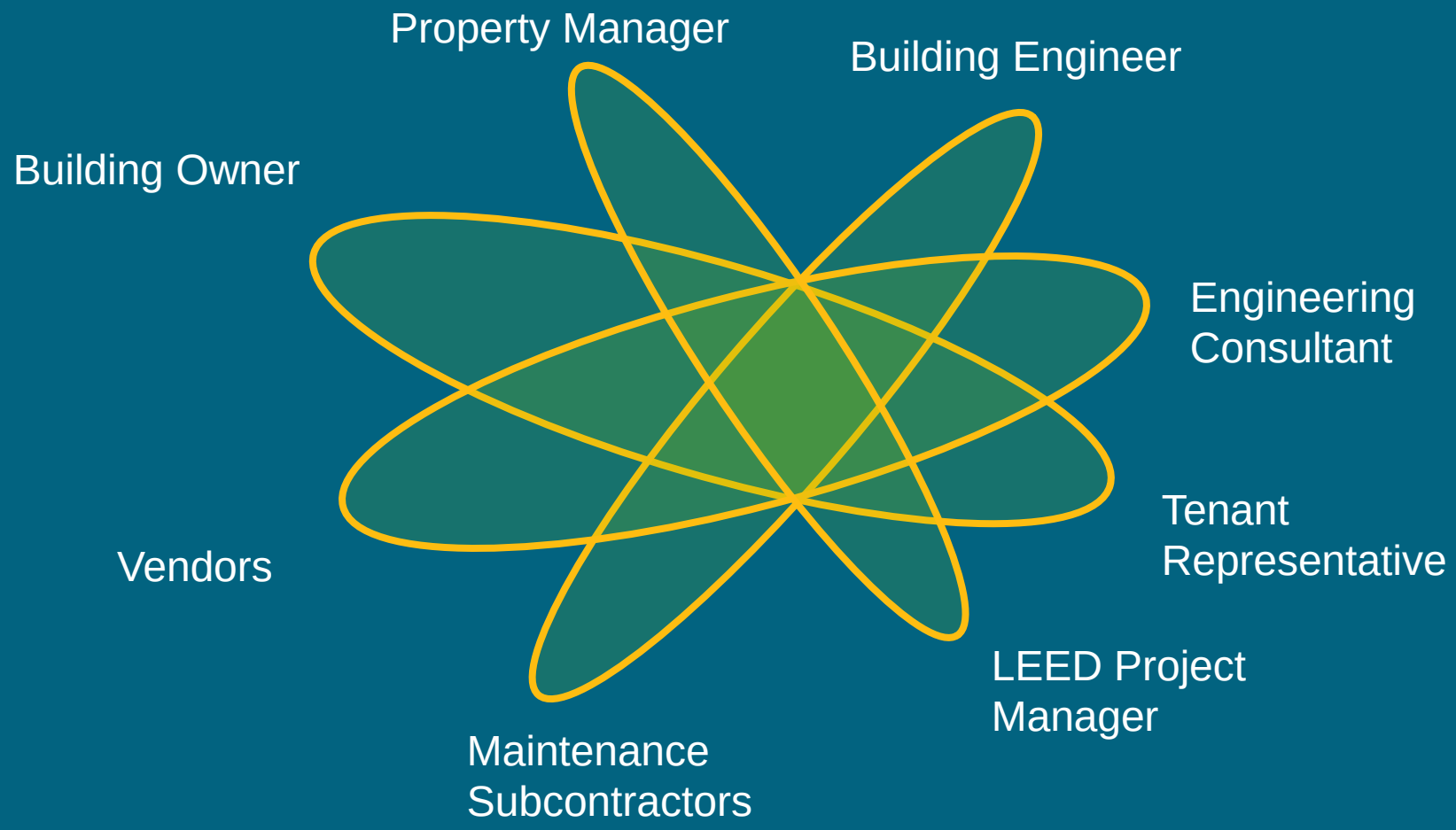
- Up to 50% of floor area or 50% tenant population allowed. Total MEP system improvements allowed if they don't interrupt tenants

Project Timeline

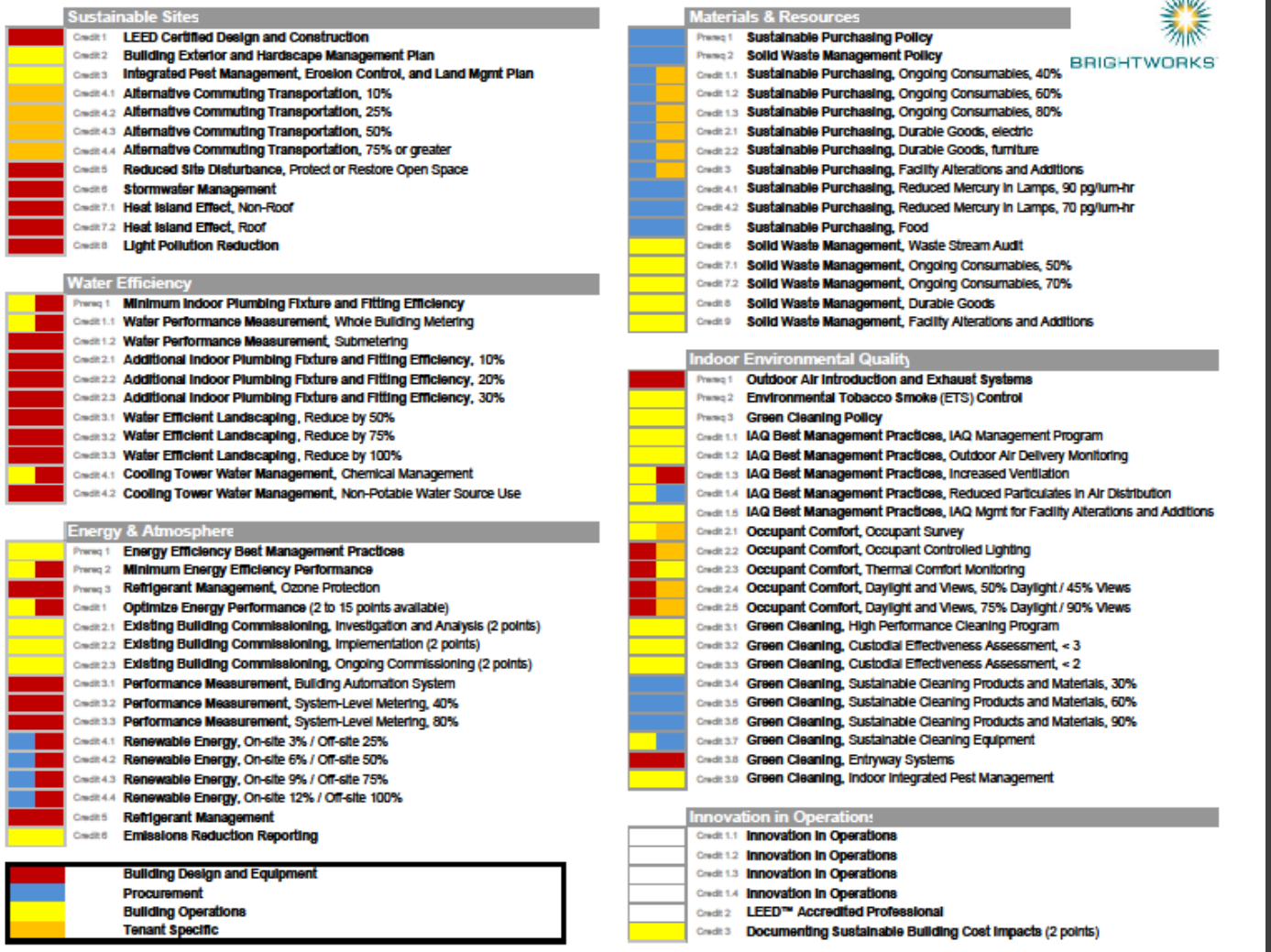


Team Members

Integrated Team Effort



Working Groups in a LEED EB O&M Process



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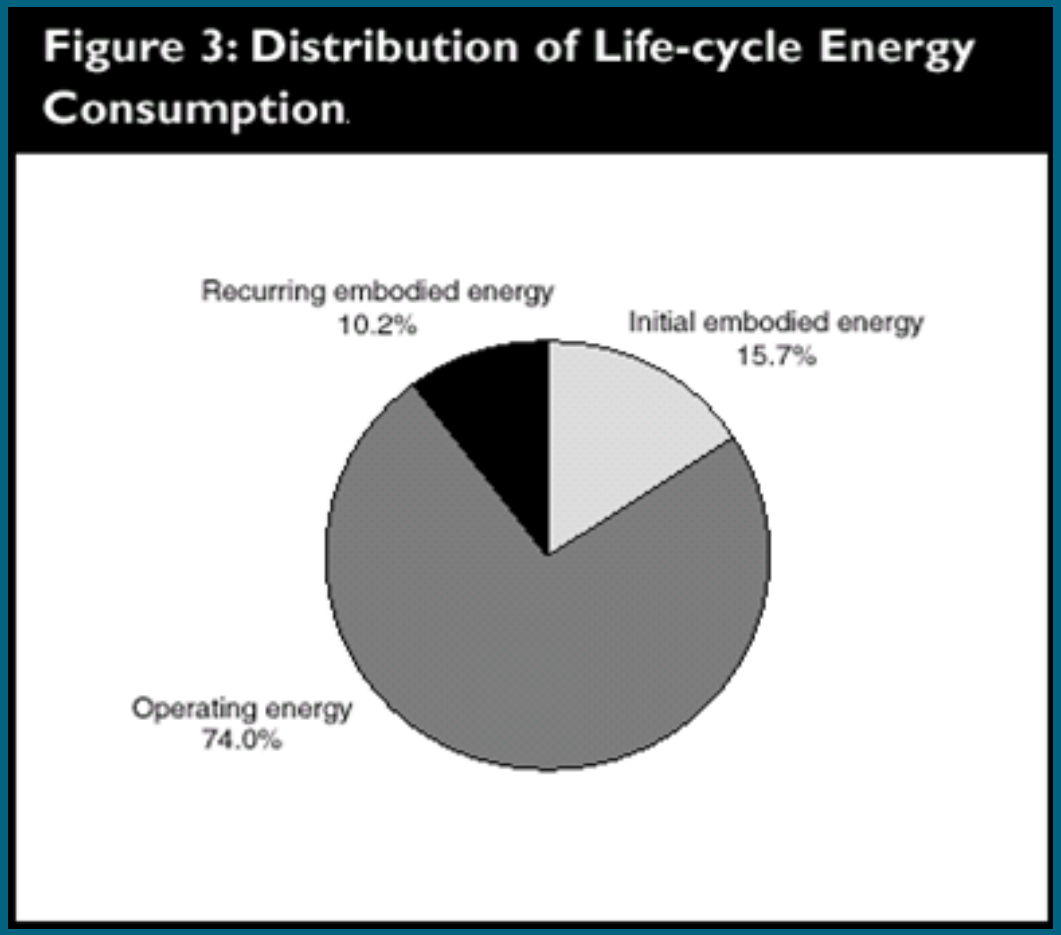
Ongoing Energy Consumption

Athena Institute: Operating Energy vs. Initial Embodied Energy

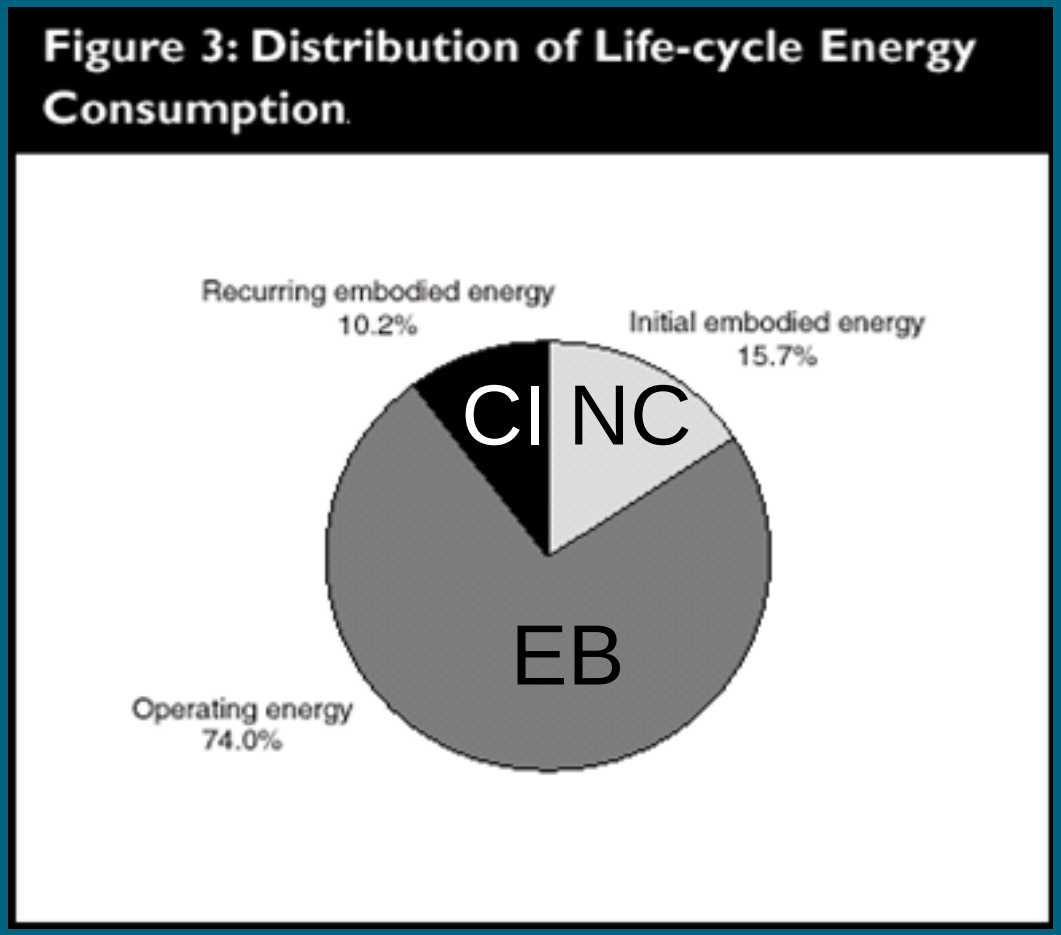
Figure 3: Distribution of Life-cycle Energy Consumption.



Ongoing Energy Consumption

Operating Energy vs. Initial Embodied Energy

Figure 3: Distribution of Life-cycle Energy Consumption.



Energy and Atmosphere Section

3 Prerequisites
6 Credits
35 Possible Points

Intent

Improve and monitor long term energy and operational efficiency of the facility

Project Steps

Assessment . Implementation . Documentation

MEP and Control Systems

Focus on Energy and Operational Performance

Energy Audit and RetroCx
- Low / No – Cost Measures
- Maintenance Items
- Capital Improvements

Costs and Savings

Choosing the Best Approach

Levels of Detail / Accuracy

Owner's Financial Criteria / Delivery Expectations

Simple Payback / Return On Investment
/ Life Cycle Cost

Savings Guarantees / M&V

Choosing the Best Approach

O&M, T/I and Build-out Considerations

EUI and System Usage
(baseline adjustments)

Implementation Approach
(Narrative scopes / Conceptual & Detailed design / Delivery System Considerations)

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Assessment and Implementation Tools

ASHRAE Standard approach

- Level I & II Audits
  - Site and analytic approaches
    - Utility usage profile
    - System operations profiles

Assessment and Implementation Tools

ASHRAE Standard approach

- Level I & II Audits
- ECM's /scopes of work (Iterative approach)
  - Cost and savings estimates
    - Simulations vs hand calcs
    - Engineering budgets vs quotes

Assessment and Implementation Tools

RetroCx approach

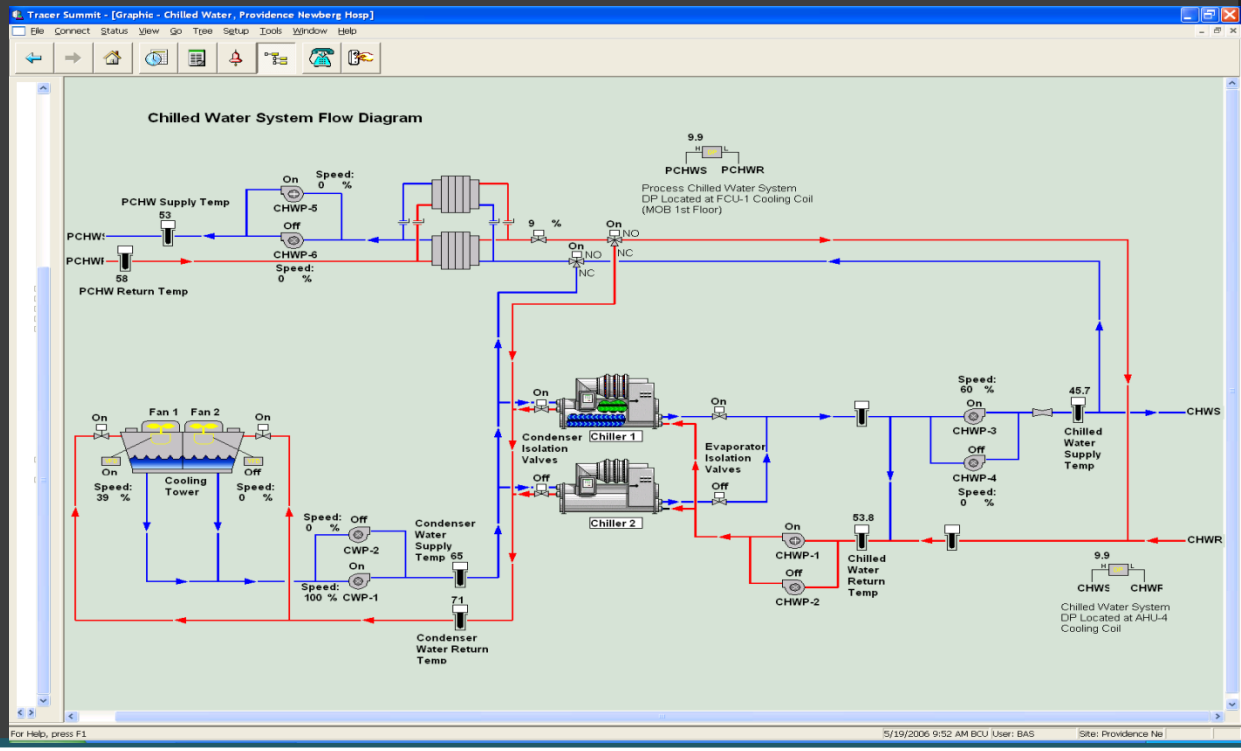
Focus on operations through centralized control

- RCX and Building Operations Plans
- Document current use and identify operational changes

Low / no-cost fixes

Capital Improvements

Training



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Project Team Members

Team Effort

Building Owner
Facilities Management Staff
A/E Consultants
Contractors
Vendors
Building Tenants
Plumber
Mechanical Energy Consultant
Sustainability Advisor

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Case Study Comparisons

Building 1

Conference Center
20,000 SF
1987 construction
4-pipe fan coil units
Air cooled chiller / cast boiler
Pneumatic Controls

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Case Study Comparisons

Building 1 Challenges

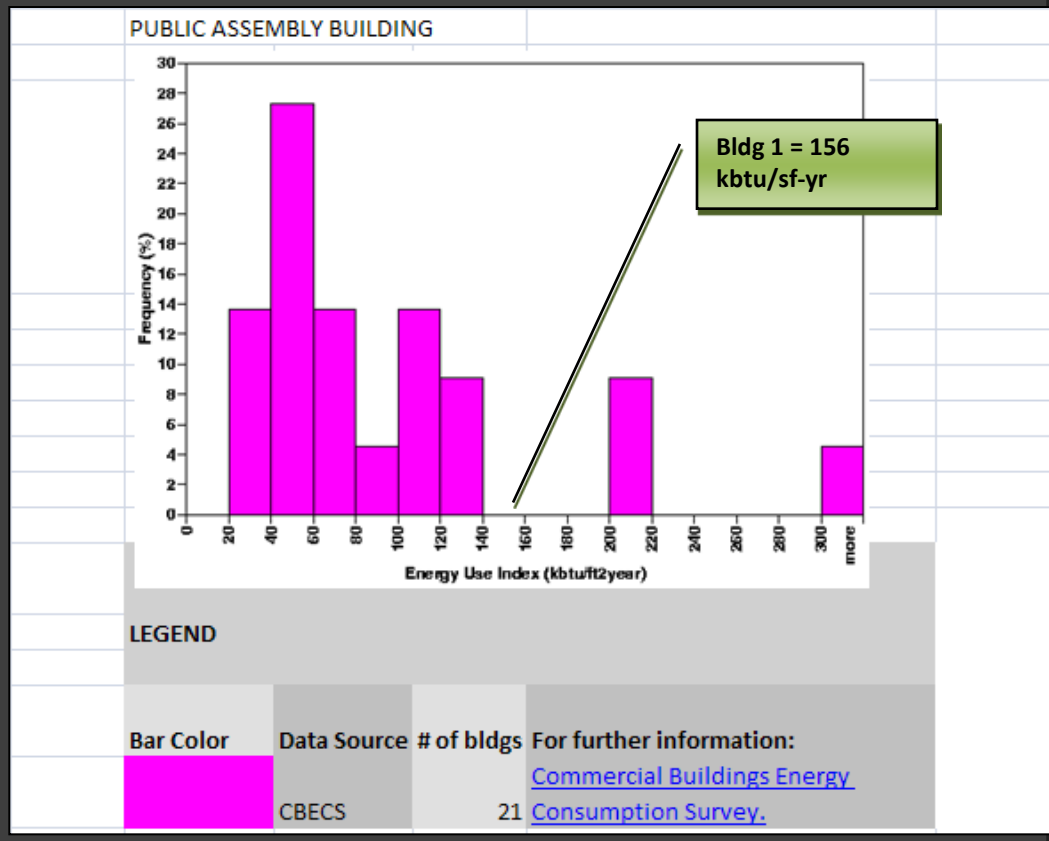
Fan coil unit access
Life cycle replacement
Comfort calls
Controls mysteries
Operational schedule

Building 1 Level 1 Opportunities

Energy Savings
Improved Comfort
O&M Savings

Uses 62% more energy than the median of comparable facilities.

20% to 30% target



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Building 1 Level 2 Opportunities

System / Measure	Energy Cost Savings Estimates		Implementation Cost Estimates		Estimated Design Costs	Estimated ETO Rebate	O & M Savings
	low	high	low	high			
Control Modifications							
Pneumatic to DDC replacement (w/ valves)	$5,500	$7,500	$88,000	$97,500	$6,500	$23,200	$3,500
Access doors			TBD	TBD			$1,260
Additional valve installation labor			$11,200	$33,600			
OSA control dampers with DDC tie-in	$1,200	$2,000	$25,000	$35,000	$4,000		
Installation labor							
New variable speed heating water pumps	$1,500	$2,200	$20,000	$30,000	$3,500		
Exhaust fan control	$300	$500	$3,500	$4,500	$850		
Domestic hot water control	$200	$300	$1,200	$1,700	$500		
Chiller Replacement	$1,600	$2,400	$75,000	$90,000	$4,500	$7,000	
Boiler Replacement	$2,200	$2,800	$45,000	$55,000	$6,500		
Lighting							
Interior occupancy sensors	$200	$300	$7,500	$9,000	$360		
Incandescent fixture replacement	($200)	($250)	$47,000	$50,000	$3,600		$8,900
Exterior fixture replacement	$100	$250	$32,000	$38,000	$2,900	$200	$265
Computer Monitor Control Modifications	$200	$300	$0	$0	$0		
Provide Emergency Lighting Controls	$100	$150	$600	$800	$150		
Install 10,000 sq ft PV Array	$11,500	$12,600	$910,000	$980,000	$5,200	$402,000	($840)
Testing and Balancing Costs			$3,500	$5,000			
Supplemental Commissioning Costs			$5,500	$7,000			
Reduced Maintenance and Comfort Calls							TBD
Totals	$24,400	$31,050	$1,275,000	$1,437,100	$38,560	$432,400	$13,085

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Case Study Comparisons

Building 2

Hospital

206,920 SF
2001 construction
Full central plant
Roof top AHU's
Full DDC Controls
Commissioned

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Case Study Comparisons

Building 2 Challenges

Space pressurization issues
Fire damper failures
Rogue zones
Boiler standby

Master planning support

Building 2 Level 1 Opportunities

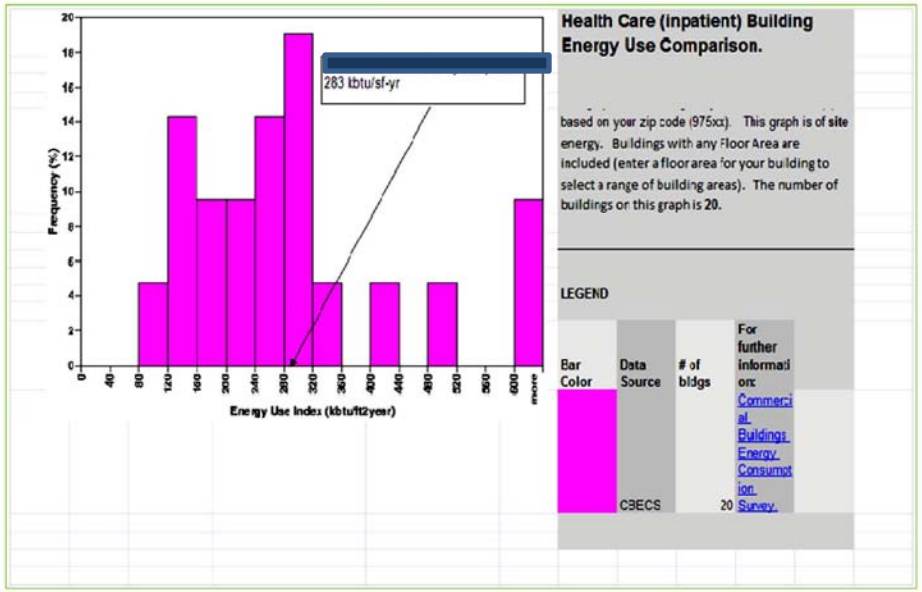
Energy Savings
Improved Control
Master Planning

$64k / yr energy savings target

TRCH Campus Buildings Energ usage Intensity Benchmark

Building Name	Address	Total SF	Bldg Type	Annual Energy Usage: Electricity Usage (kWh)	Annual Energy Usage: Gas Usage (therms)	Annual Energy Usage: Total (MMBtu)	Annual Energy Cost: Electricity Usage ($)	Annual Energy Cost: Gas Usage ($)	EUI kBTU/SF
Hospital, CUP and Cancer Center Buildings		206920	Hospital	7,452,300	330,369	58471	$381,674	$38,333	282.6
		206920							

Unit Conversions
293 kWh=1 MMbtu
10 Therms=1 MMbtu
1000 KBTUs=1 MMbtu



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Building 2 RCx Opportunities

AHU Pre-functional Results

- Damper actuators undersized
- Air flow stations not calibrated
- Static pressure sensors reading improperly
- Multiple OSA temperature inputs
- Airflow total discrepancies
- Multiple static sensor inputs

Building 2 Level 2 Opportunities

Retrofit Measures

Low- / No-Cost

- Air flow volume reductions
- Static pressure control of fans revamp

Capital / PM costs

- Elevator shaft exhaust dampers
- Heating hot water variable flow
- Pony steam boiler (sterilization / DHW)
- Pony scroll chiller (w/ ER addition)
- Emergency generator replacement (mandate)

Steps to Success

Assessment . Implementation . Documentation

More Information…

Websites to Visit

www.USGBC.org

www.costar.com

www.energystar.gov

www.ashrae.org

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Thank you