


Green Building Rating Systems Do They Lead to Energy **\$avings**



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Agenda

- Green Building Rating Systems perceived as a panacea for energy conservation
 - What energy conservation benefits do we get from using a GBRS
 - This presentation emphasizes the LEED GBRS
- Case Study
 - Compared a LEED building to a non-LEED building
- Can we make improvements?

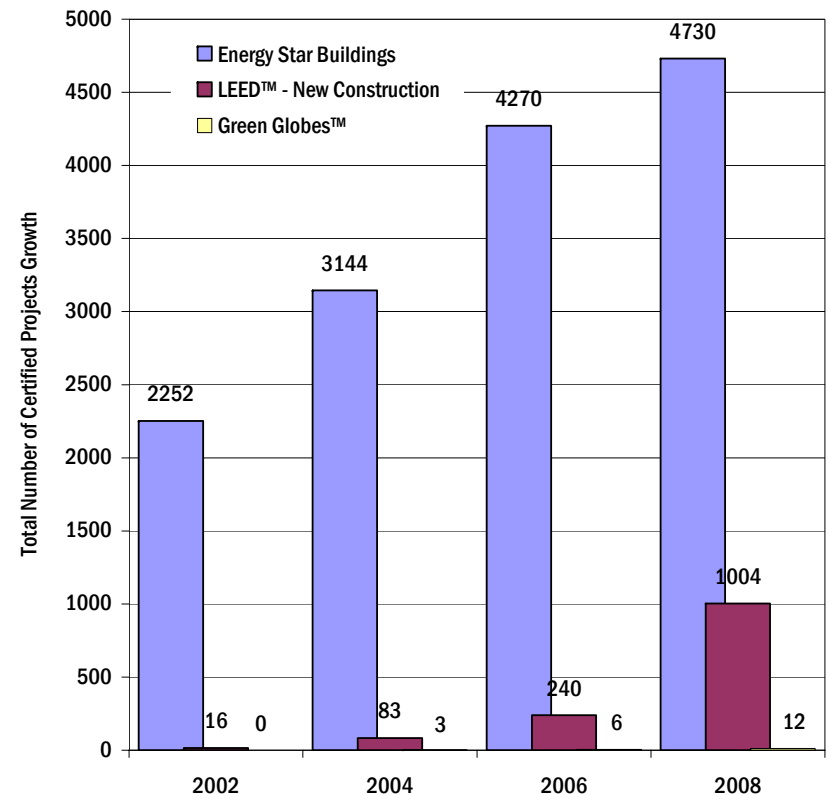
My Background

- Ameresco
 - Team Leader
- University of Illinois at Chicago
 - Principal Engineer
- Energy Management Consultant
 - Principal

- Disclaimer

Popularity of Building Green is Booming!

- Major Players in Green Building Rating
 - US EPA Introduced Energy Star in 1992
 - USGBC Introduced LEED™ in 1999
 - GBI Introduced Green Globes in 2000
- Many Others
 - Local Municipalities
 - State Based systems



What is the Value Proposition of Building Green?

- It is possible to construct buildings to minimize:
 - Energy and Water Conservation
 - Use of Natural Resources
- While maximizing:
 - IAQ which leads to increased productivity
 - Sustainability
- But at what cost?

Cost Comparisons

- Energy Star
 - Average of \$0.01/sq.ft.

- Cost Premium of LEED™

	Avg.	Range
American Chemistry Council 2003	2.30%	1.5-3.1%
Sustainable Building Task Force 2003	1.84%	0.7-6.5%
What Does Green Really Cost? Morris 2007	1.0-2.0%	1.0-6.0%

- Green Globes
 - \$4-5K

Energy Star-First Rating System

- ❑ Developed by US Environmental Protection Agency
- ❑ Initially with consumer products
 - Expanded into buildings
 - ❑ Commercial
 - ❑ Homes
 - ❑ Facilities
- ❑ Ratings points based on:
 - Occupancy (Hours/week, # of people, # of computers)
 - Energy consumption
 - EIA CBECS data as benchmark
- ❑ Energy Star stamp (no certification levels)

Evaluation of Energy: Energy Star

- Building compared to the CBECS database
- Must be more efficient than 75% of building stock for a certain building type

LEED- Setting the Standard for Green?

- ❑ Developed by US Green Building Council
- ❑ Ratings points based in 5 categories
- ❑ Certification Levels (certified 26-32, silver 33-38, gold 39-51, platinum 52-69)
- ❑ Eight different rating systems based on building types
 - ❑ Commercial
 - Existing Buildings, Commercial Interiors, Core & Shell
 - ❑ Schools
 - ❑ Retail
 - ❑ Healthcare
 - ❑ Residential (Homes)
 - ❑ Neighborhood Development





Evaluation of Energy: LEED

- Based on Points – 69 points total
 - 40 percent of total points are energy related
 - Energy and Atmosphere Category – 17 points possible
 - Fundamental commissioning of building energy systems (additional point for enhanced commissioning)
 - Minimum energy performance (up to 10 additional points for increased energy efficiency)
 - Fundamental refrigerant management (additional point for enhanced refrigerant management)
 - Measurement & Verification (1 point) not required

Other Rating Systems-Alternatives to LEED and Energy Star

- Green Globes, by Green Building Initiative
 - On-line assessment tool (questionnaire) set in 3 Stages
 - Goal Setting (Pre-design)
 - Preliminary Assessment (Design)
 - Final Assessment (Construction)
 - Reports Identifying Opportunities Provided at each Stage
 - New Construction Rating System
 - Must achieve 35% of 1000 available points
 - Seven main categories – Energy=36% of points possible
 - No minimum point requirements for categories
 - Energy Star Target Finder integrated
 - Existing Buildings Rating System
 - 12-24 months after occupancy of new buildings, Green Globes recommends the Existing Buildings process
 - Green Globes recommends recertification in 3 years

Green Globes™ Ratings

85-100%		Reserved for select building design and delivery processes which serve as national or world leaders in design and delivery focused on reducing environmental impacts.
70-84%		Demonstrates leadership in design and delivery of energy and environmentally sensitive buildings and a commitment to continual improvement.
55-69%		Demonstrates excellent progress in reducing environmental impacts by applying best practices in energy and environmental design and delivery.
35-54%		Demonstrates movement beyond awareness and a commitment to good energy and environmental design and delivery practices.

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Other Rating Systems-Alternatives to LEED and Energy Star

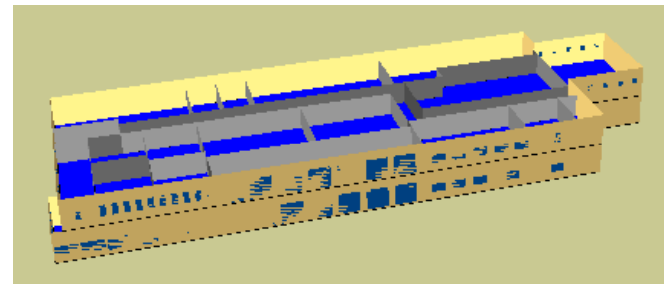
- Federal Sustainable Buildings Principles
 - Federal Buildings
 - Own 445,000 buildings with total floor space of over 3.0 billion square feet,
 - Lease an additional 57,000 buildings comprising 374 million square feet of floor space
 - Areas of focus:
 - Integrated Design and Commissioning
 - Optimize Energy Performance
 - Energy Efficiency-30% better than ASHRAE 90.1-2004
 - Measurement & Verification 1year post occupancy
 - Preserve and Conserve Water
 - Enhanced Indoor Environmental Quality
 - Reduce Environmental Impact of Materials

LEED Case Study



Case Study

- ❑ Goal-compare energy performance of LEED and non-LEED buildings
- ❑ Funded by NCEMBT
- ❑ Team included UIC, CPD and City DOE
 - Results are preliminary
 - Final results should be available in late July
 - ❑ Download at www.ncembt.org



Building Characteristics

- Two nearly identical facilities evaluated
 - One LEED Silver, one Non-LEED
 - Continuous operation police stations
 - Layout on site: LEED Silver faced South, Non-LEED faced East
- Methodology
 - 12-month monitoring
 - Sub-system energy usage
 - Interior conditions
 - Annual building simulation model
 - Normalized data



LEED-NC

22nd District Police Station, LEED® Project # 0355

LEED Version 2 Certification Level: SILVER

May 16, 2005

34 Points Achieved

Possible Points: 69

Certified: 38 of 32 points; Silver: 1,130-38 points; Gold: 28 of 31 points; Platinum: 12 of 16 points

7 Sustainable Sites Possible Points: 14

Y	Req	Description	Points
Y	1	Erosion & Sedimentation Control	1
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 Refueling Stations	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 5.3	Stormwater Management, Rate and Quantity	1
1	Credit 5.4	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

5 Materials & Resources Possible Points: 13

Y	Req	Description	Points
Y	1	Storage & Collection of Recyclables	1
1	Credit 1.1	Building Reuse, Maintain 75% of Existing Shell	1
1	Credit 1.2	Building Reuse, Maintain 100% of Existing 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	1
1	Credit 4.2	Recycled Content	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

3 Water Efficiency Possible Points: 5

Y	Req	Description	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

8 Indoor Environmental Quality Possible Points: 15

Y	Req	Description	Points
Y	1	Minimum IAQ Performance	1
Y	2	Environmental Tobacco Smoke (ETS) Control	1
1	Credit 1	Carbon Dioxide (CO ₂) Monitoring	1
1	Credit 2	Increase 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

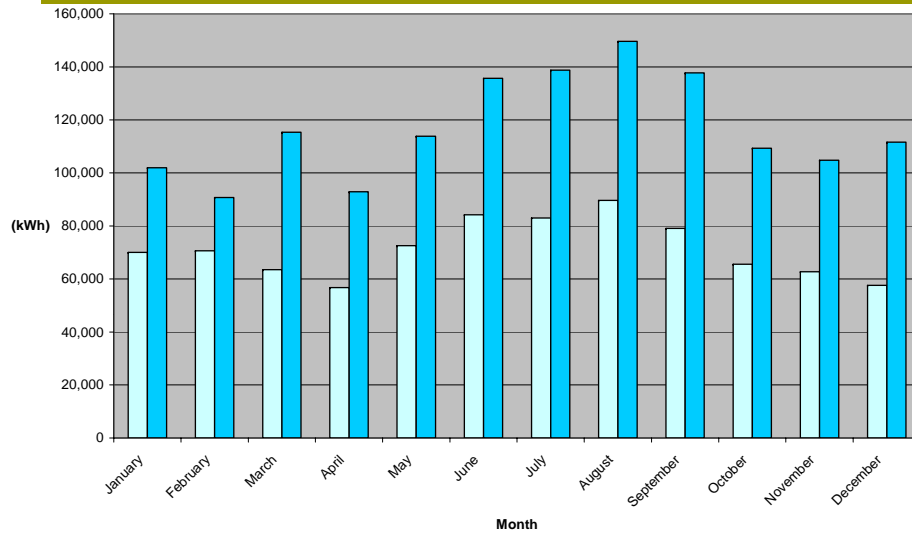
6 Energy & Atmosphere Possible Points: 17

Y	Req	Description	Points
Y	1	Fundamental Building Systems Commissioning	1
Y	2	Minimum Energy Performance	1
Y	3	CFC Reduction in HVAC&R Equipment	1
2	Credit 1.1	Optimize Energy Performance, 20% New / 10% Existing	2
1	Credit 1.2	Optimize Energy Performance, 30% New / 20% Existing	2
1	Credit 1.3	Optimize Energy Performance, 40% New / 30% Existing	2
1	Credit 1.4	Optimize Energy Performance, 50% New / 40% Existing	2
1	Credit 1.5	Optimize Energy Performance, 60% New / 50% Existing	2
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

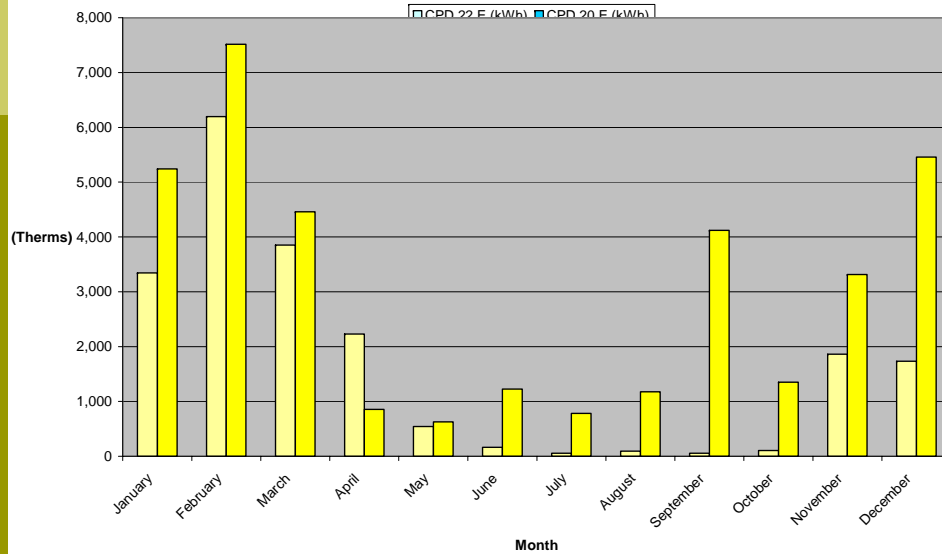
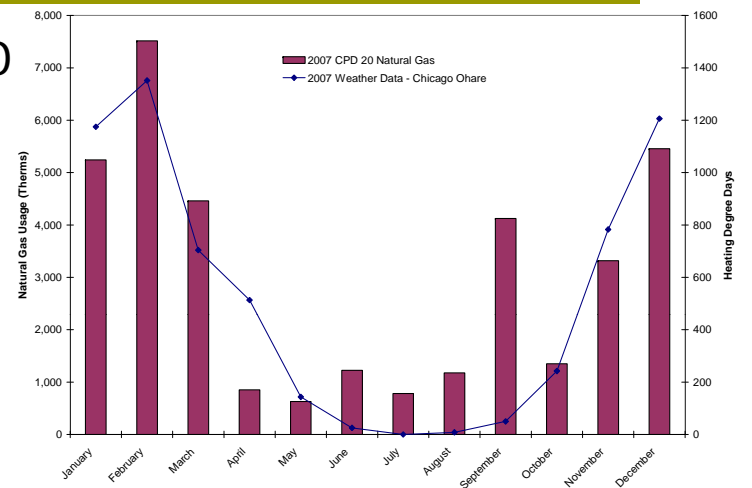
5 Innovation & Design Process Possible Points: 5

Y	Req	Description	Points
1	Credit 1.1	Innovation in Design: Green Housekeeping	1
1	Credit 1.2	Innovation in Design: Exemplary Performance MRc5.1	1
1	Credit 1.3	Innovation in Design: Exemplary Performance MRc5.2	1
1	Credit 1.4	Innovation in Design: Exemplary Performance EAcb	1
1	Credit 2	LEED® Accredited Professional	1

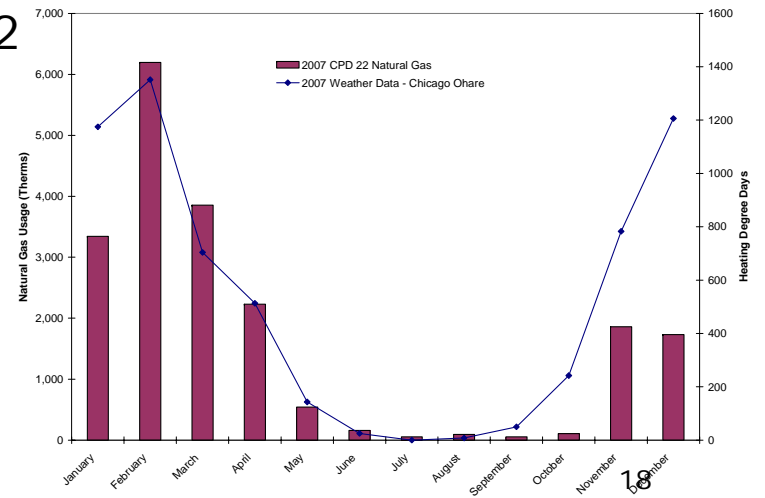
Annual Energy Usage (Gross)



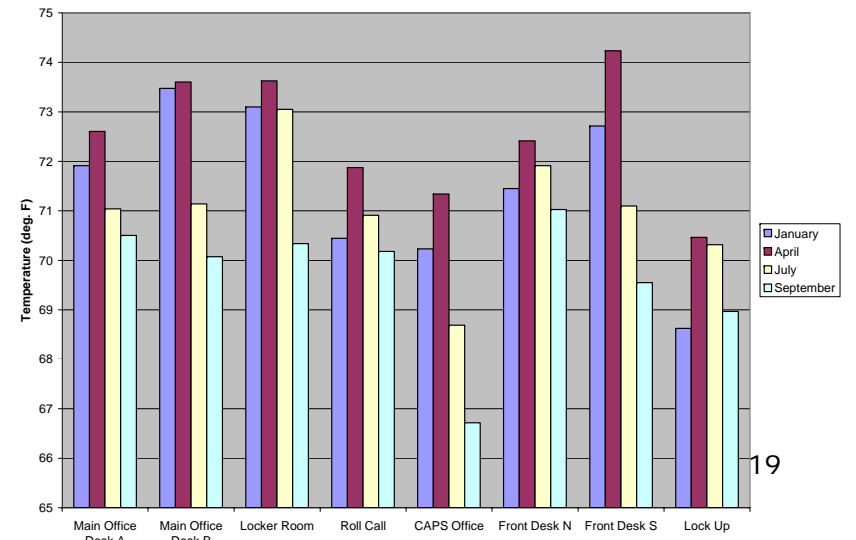
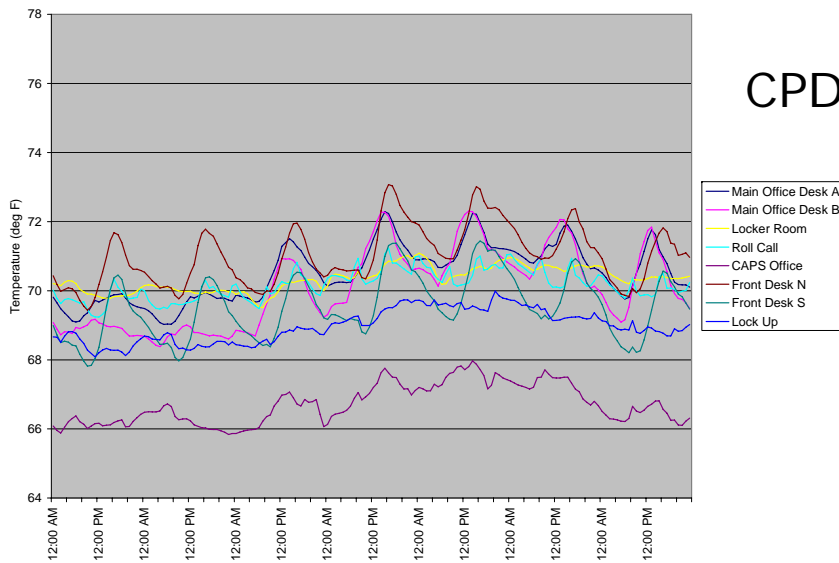
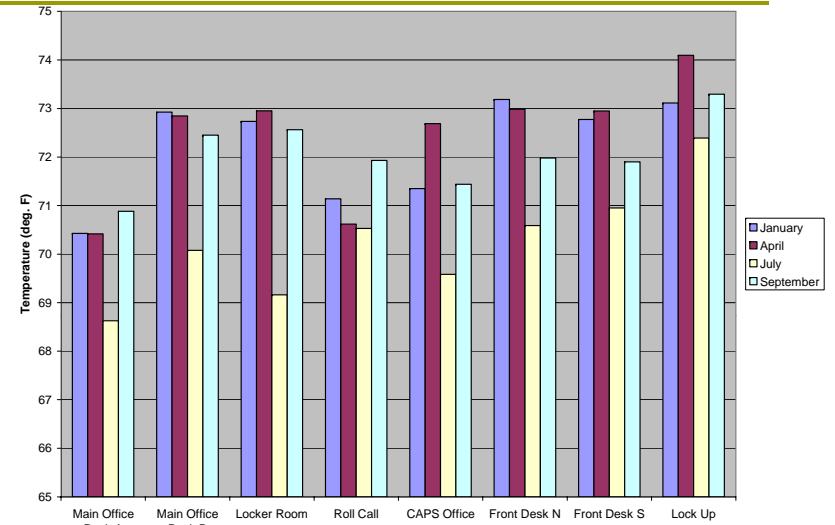
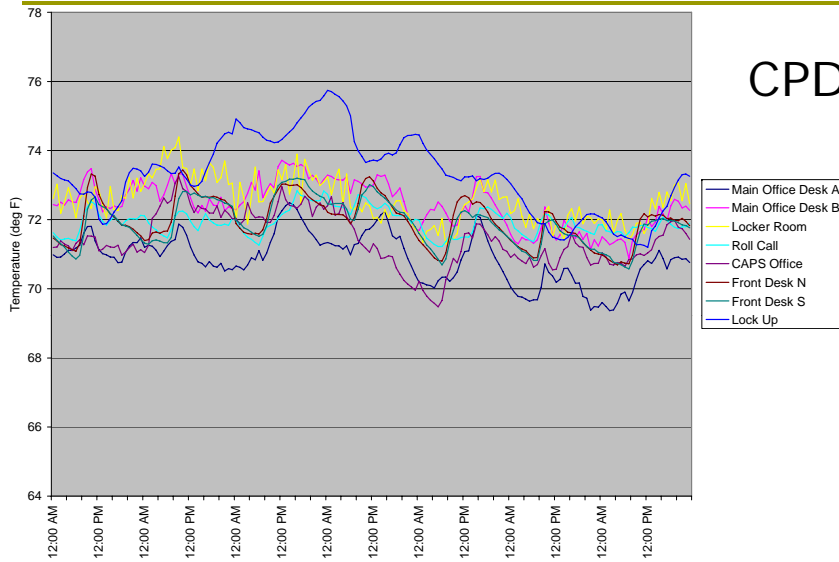
CPD 20



CPD 22

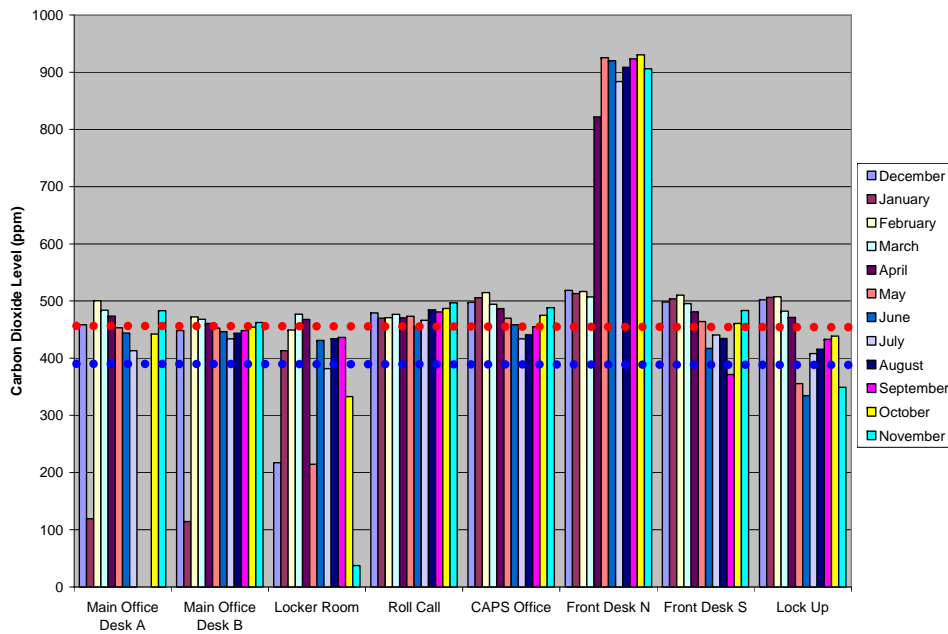


Interior Conditions – Temperature

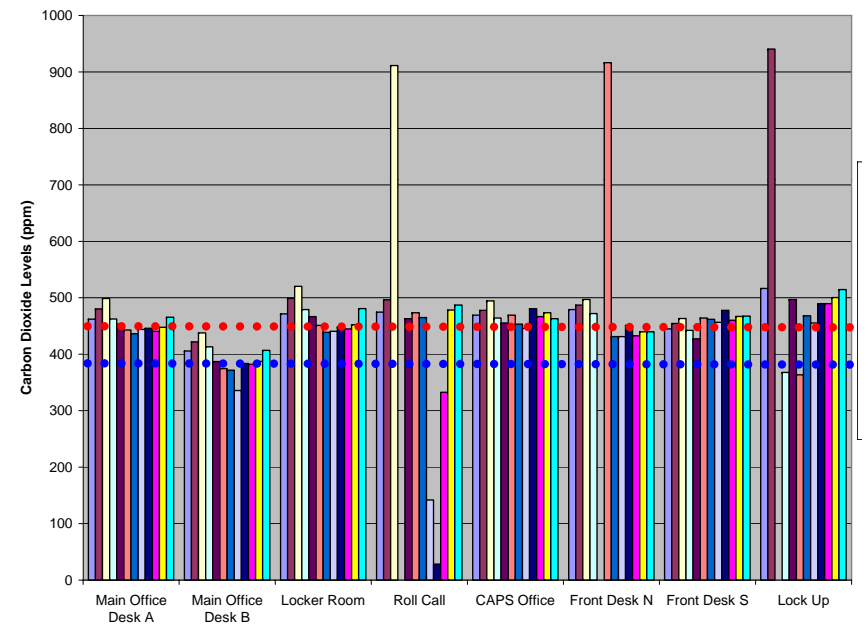


Interior Conditions – Carbon Dioxide

CPD 20



CPD 22



Energy Usage Indices (EUI)

EUI (kBtu/sq.ft.)

Police Station 20 (Non LEED)

190.8

Police Station 22 (LEED Silver)

112.3

(41% less)

CBECS 2003 Public Order and
Safety (Police/Fire Station)

90

(78)-31% less

24-hr Public Order and Safety
(average)

50-115

(75)

Outcomes of Study

- ❑ Building orientation had minimal impact
- ❑ Building operations, maintenance and schedules had a great impact
 - Set points and controls were key influence
 - Maintenance or on-going maintenance
- ❑ Bottom Line: The LEED building saved energy
 - Because it's LEED Silver?
 - Other reasons?

Where Do We Go From Here?

- Energy is one of if not the most critical aspect of green building
- Studies in the literature demonstrate that using GBRS save energy
 - Not a guarantee of energy savings
 - Are we leaving money on the table?
- Silver Today, Tarnished Tomorrow?
 - Poor/deferred maintenance
 - Project recertification

Worth a Thousand Words...

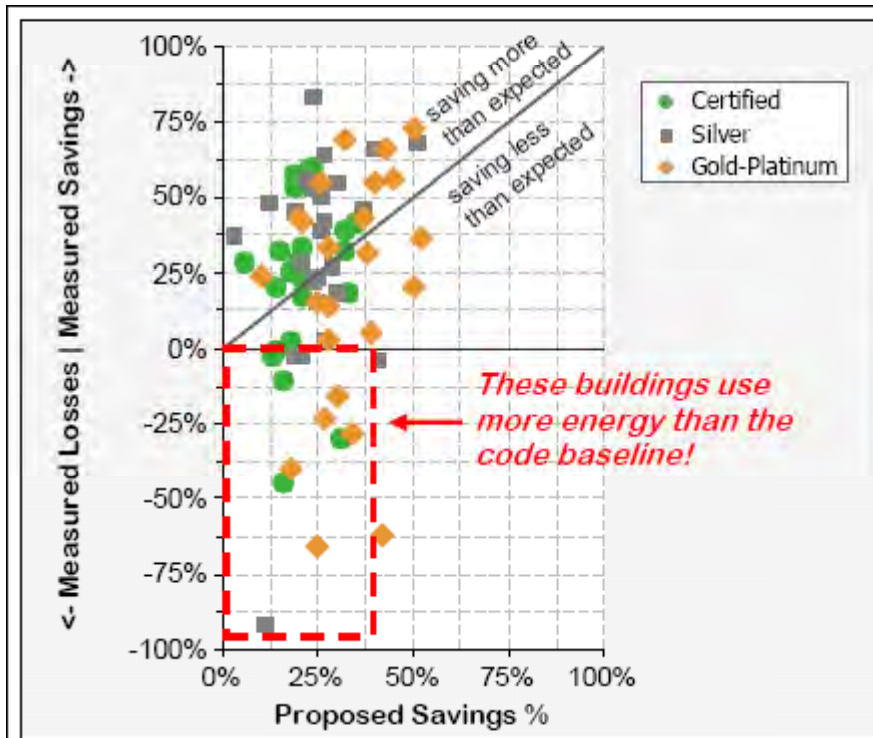


Figure 20: Measured versus Proposed Savings Percentages

Source: Energy Performance of LEED for New Construction Buildings-March 2008

Recommendations

- Want to save energy? Then save energy!
 - Make decisions on LCC not LFC
 - Raise minimum standard for energy performance of buildings
 - GBRS should have an O&M credit(s)
 - More credits for new technologies
- You cannot manage...
- On-going training for owners/operators
- Recertify your buildings
 - Continued commitment to energy conservation

Final Thoughts

- Work to minimize the cost of certifying buildings
- Building modeling GIGO
- The industry needs more field data
 - Too much scatter in the existing data to come to definitive conclusion on energy savings
- Bike racks equal to M&V - **Really?!?**
 - Need better energy-related incentives

Questions?



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