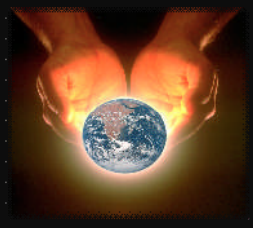
Newman Consulting Group, LLC

Consultants for Energy-Efficient and Sustainable Buildings …
and a Sustainable Planet

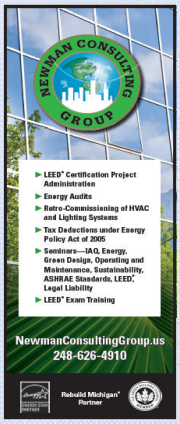


LEED-EB O&M: Being More Sustainable in Existing Buildings

NFM&T, Baltimore, 3/16/10

Agenda

- Background: General, USGBC & LEED
- LEED-EB O&M – It's not just about energy
- Methods of Reducing Energy
- Energy Audits
- Operation and Maintenance
- Outside Assistance Available (including the Government)
- New Laws & Standards
- References
- Concluding Thoughts



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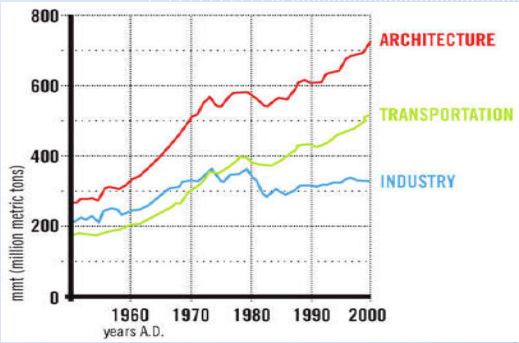
AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
- Trainer, ANSI/ASHRAE/IESNA Energy Standard 90.1
- Past Member, Industrial A/C and Energy Recovery Technical Committees
- Past Board Member; Distinguished Service Award (Local), 2005
- Distinguished Lecturer, 2010-2012

BUILDING OWNERS & MANAGERS ASSOCIATION (BOMA)
- Member, Energy & Environment Committee (National)
- Judge, TOBY Awards (The Office Building of the Year)
- Chair, Energy Education Committee (Local)

ENGINEERING SOCIETY OF DETROIT (ESD)
- Speakers Bureau
- Distinguished Service Award, 2007; Fellow, 2010
- Member, Construction & Design Committee
- Spokesperson on Energy & Environmental Issues

U.S. GREEN BUILDING COUNCIL (USGBC)
- LEED Exam Preparation Trainer
- Past Board Member; Distinguished Service Award (Local), 2008
- Past Co-Chair, Public Policy Committee (Local)
- Member, Green Schools Advocacy Committee (Local)

U.S. CO_2 Emissions by Sector



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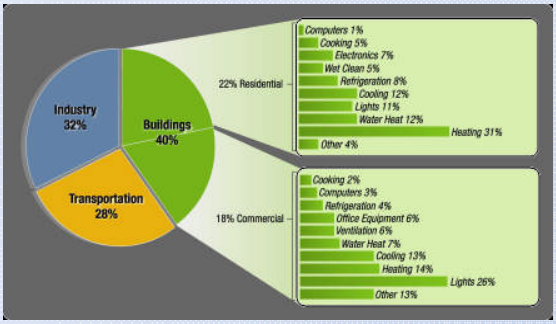
Why Energy Efficiency and Sustainable Buildings?

Buildings Represent :

- 17% - fresh water consumption
- 25% - wood consumption
- 33% - CO2 emissions
- 30% - waste generation
- 40% - energy use
- 55% - natural gas use
- 72% - electrical energy use

Total Energy Consumption



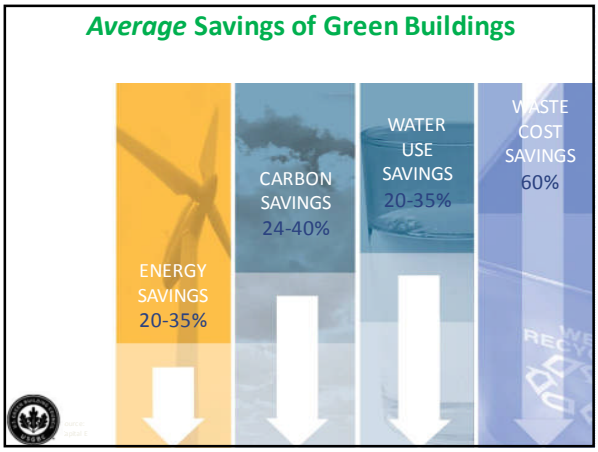
www.highperformancebuildings.gov

Buildings Consume 40% of US Primary Energy

Sustaining our Future by Rebuilding our Past

Our Greatest Opportunities?

Average Savings of Green Buildings



Q: What is a "Green" Building?

A. Intelligent, Integrated Systems

B. Beyond Standards

C. Costs Less to Operate & Maintain

What are the Benefits of Green Design

Benefits of Green Design

- **Environmental Benefits**
  - Reduce the Impacts of Natural Resource Consumption
- **Health and Safety Benefits**
  - Enhance Occupant Comfort and Health
- **Community Benefits**
  - Minimize Strain on Local Infrastructure and Improve Quality of Life
- **Economic Benefits**
  - Improve the Top and Bottom Lines

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Why Design Green Buildings?

A. Meet Needs of Today

1. Operating Costs/Energy
2. Building Marketability
3. Occupant Health/Productivity
4. Return on Investment (ROI)
5. Potential Liability

B. Don't Compromise Ability of Future Generations to Meet Their Needs

1. Environmental Responsibility
2. Optimize Resource Efficiency

(The Definition of "Sustainability")

What is the LEED System?

LEADERSHIP in ENERGY and ENVIRONMENTAL DESIGN

A leading-edge system for certifying DESIGN, CONSTRUCTION and OPERATIONS of the greenest buildings in the world

Scores are tallied for different aspects of efficiency and design in appropriate categories

For instance, LEED assesses in detail:

1. Sustainable Site
2. Water Efficiency
3. Energy & Atmosphere
4. Material & Resource
5. Indoor Environmental Quality
6. Innovation & Design Process

USGBC has Four Levels of LEED

Green Buildings worldwide are certified with a voluntary, consensus-based rating system.

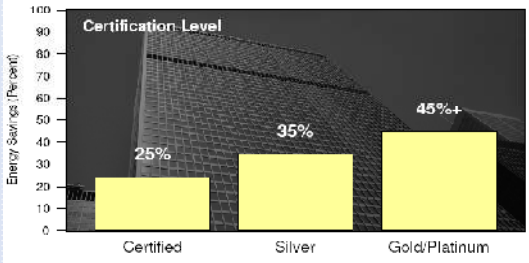
Levels of LEED Certification are based on points achieved on a checklist.

LEED CERTIFIED 40 | LEED SILVER 50 | LEED GOLD 60 | LEED PLATINUM 80

Number of points for each level of certification for LEED
Total points available = 110

Note: *Certain prerequisites must be met*

What are Green Building Energy Savings Compared with Typical Buildings?



*Source: New Building Institute Report

Results…Increased Productivity, Healthier Environments

LEED-EB O & M – Point Breakdown

Area	No. Points
Sustainable Sites (SS)	26
Water Efficiency (WE)	14
Energy and Atmosphere (EA)	35
Materials and Resources (MR)	10
Indoor Environmental Quality (IEQ)	15
Subtotal	100
Innovation in Operations (IO)	6
Regional Priority (RP)	4
Total	110

Sustainable Sites

26 Points Possible

LEED for Existing Buildings: Operations & Maintenance 2009 Project Scorecard

LEED Certified Design and Construction

Building Exterior and Hardscape Management Plan

Integrated Pest Mgmt, Erosion Control, and Landscape Mgmt Plan

Alternative Commuting Transportation

Site Development - Protect or Restore Open Habitat

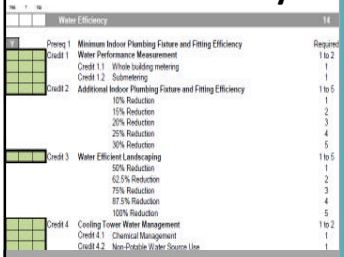
Stormwater Quantity Control

Heat Island Reduction - Non-Roof

Heat Island Reduction – Roof

Light Pollution Reduction

Water Efficiency



14 Points Possible

LEED for Existing Buildings: Operations & Maintenance 2009 Project Scorecard

Prereq 1: Minimum Indoor Plumbing Fixture & Fitting Efficiency

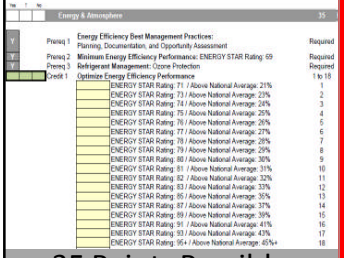
Water Performance Measurement

Addl. Indoor Plumbing Fixture & Fitting Efficiency

Water Efficient Landscaping

Cooling Tower Water Mgmt
- Chemical Management
- Non-Potable Water Source Use

Energy & Atmosphere



35 Points Possible

LEED for Existing Buildings: Operations & Maintenance 2009 Project Scorecard

Prereq 1: Energy Efficiency Best Mgt Practices

Prereq 2: Min Energy Efficiency Performance

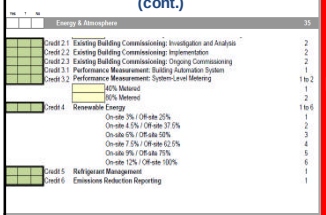
Prereq 3: Refrigerant Management

……

Optimize Energy Efficiency Performance

Energy & Atmosphere

(cont.)



35 Points Possible

LEED for Existing Buildings: Operations & Maintenance 2009 Project Scorecard

(cont.)

Exist Bldg Commissioning
- Investigation & Analysis
- Implementation
- Ongoing Commissioning

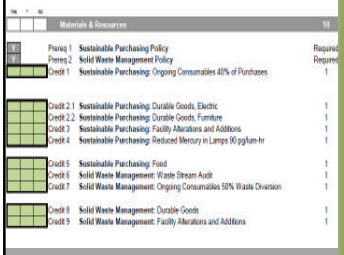
Performance Measurement
- Bldg Automation System
- System-Level Metering

Renewable Energy

Refrigerant Management

Emissions Reduction Reporting

Materials & Resources



10 Points Possible

LEED for Existing Buildings: Operations & Maintenance 2009 Project Scorecard

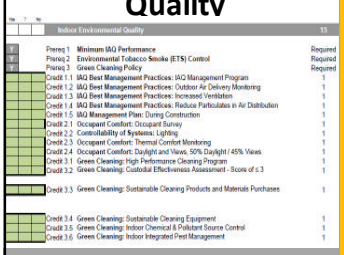
Prereq 1: Sustainable Purchasing Policy

Prereq 2: Solid Waste Mgt Policy

Sustainable Purchasing:
- Ongoing Consumables
- Electric
- Furniture
- Facility Alts & Additions
- Reduced Mercury in Lamps
- Food

Solid Waste Management
- Waste Stream Audit
- Ongoing Consumables
- Durable Goods
- Facility Alterations & Additions

Indoor Environmental Quality



15 Points Possible

LEED for Existing Buildings: Operations & Maintenance 2009 Project Scorecard

Prereq 1: Min IAQ Performance
Prereq 2: ETS Control
Prereq 3: Green Cleaning Policy

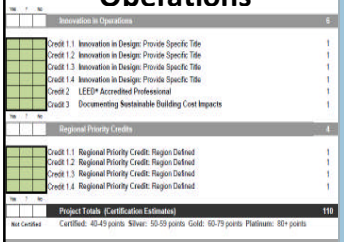
IAQ Best Mgt Practice:
- IAQ Managementt Program
- Outdoor Air Delivery Monitoring
- Increased Ventilation
- Reduce Particulates in Air Distribution
- IAQ Mgmt During Construction

Controllability of Systems

Occupant Comfort:
- Lighting
- Thermal Comfort Monitoring
- Daylight & Views

Green Cleaning
- High Perf Cleaning Program
- Custodial Effectiveness Assessment
- Sust Cleaning Products, Purchases
- Sust Cleaning Equipment
- Indoor Chem & Pollutant Source Control
- Indoor Integrated Pest Management

Innovation in Operations



10 Points Possible

LEED for Existing Buildings: Operations & Maintenance 2009 Project Scorecard

Innovation in Design

LEED AP

Documenting Sustainable Building Cost Impacts

Regional Priority

Low-Cost Measures

- switch to **energy efficient lighting**
- adjust **HVAC temperature controls**
- educate **facilities operations staff**
- install **lighting sensors**
- conduct **'professional' energy audit**

Methods of Reducing Energy (Building Envelope)

Windows
- Replace
- Window film
- Indoor storms

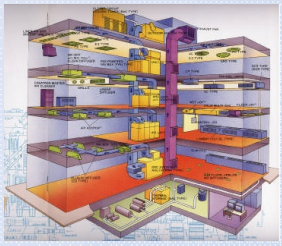
Roof
- Green
- Materials
- Colors

Walls
- Insulation
- Caulking
- Fenestration
- Orientation
- Materials
- Colors

Methods of Reducing Energy (HVAC)

- Programmable thermostats
- Multiple units, discharge temperature
- Air & water economizers
- Improved duct sealing
- Occupancy-based control systems
- Variable frequency, flow on fans, chillers, pumps
- High, smaller, more efficient motors & compressors
- Power factor correction capacitors
- Indirect evaporative cooling
- Passive heating/cooling
- Dedicated outdoor air systems (DOAS)
- Energy recovery heat exchangers
- Geothermal heat pumps
- Low S.P. drop, high MERV-rated filters
- Cool storage (water or ice)

Why Be So Concerned about HVAC Systems??



HVAC
is
"Heart and Lungs"
of
Building

Why compromise?

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Methods of Reducing Energy (Lighting)

- Fluorescent Lamps: T-8, T-5 – Electronic Ballast
- Compact Fluorescent Lamps (CFL)
- LED Lamps
- Sensors: Light, Motion
- Dimming
- Zoning
- Natural Daylighting
  - o Light Shelves
  - o Skylights
  - o Light Tubes

Smarter Water for a Smarter Planet

Q: How many billion gallons of potable water do Americans use *every day* – just to flush toilets?

A: 4.8 Billion Gallons !!

Water Savings

EXTERIOR
- Irrigation
- Water efficient landscaping
- No potable water use or no irrigation
- Watch out for leaks

INTERIOR
- Toilets & urinals (low-flow or waterless)
- Sinks (low-flow, with or without sensors)
- Showers (low-flow)
- Watch out for leaks

Remember, it also requires electrical energy to move the water…

Water Reuse

Water that can be recycled & reused:

Gray Water
- Condensate from (clean) drain pans
- Water from sinks
- Water from washing machines, dishwashers
- Rainwater
  - o Collection cisterns
  - o "Green" Roofs

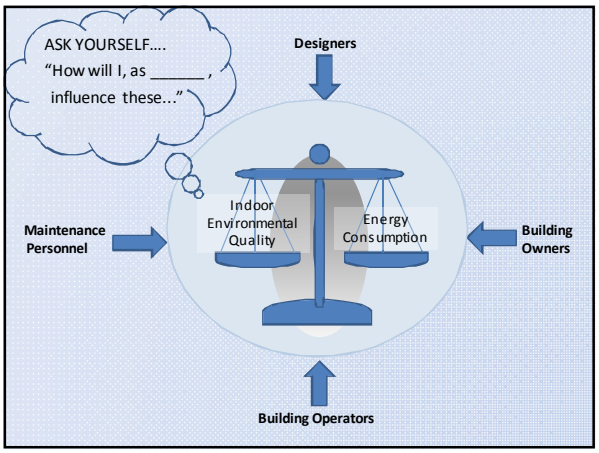
Operation & Maintenance

- **Best Designs & Construction**
  Doomed to Failure Without *Proper* and Ongoing Maintenance
- **Retro-Commissioning**:
  Return to Original Design Concepts and Operation
- **Continuous Commissioning**

Technology ≠ Performance

"An inefficient system run well can perform better than an efficient system run poorly."

- *Newman*



Government Help (Maybe)

- **American Recovery & Reinvestment Act of 2009 (ARRA 2009):**
  Energy Conservation & Greenhouse Gas Emissions Reductions of **$34 Billion**
  - State Energy Program: $3.1 Billion
  - Green Schools: $9.75 Billion
  - Federal Buildings: $8.5 Billion
  - Weatherization for Low-Income Homes: $5 Billion
  - Assisted Housing: $1.76 Billion
- **Energy Policy Act of 2005 (EPAct 2005)**
  - **Up to $1.80/SF Tax Deduction**
  - **Extended to 12/31/2013**

EPAct 2005, Applicability to Commercial Buildings – (1)

1. **Offices, Retail Buildings, Warehouses, etc.**
   - Also Includes Public Buildings, e.g., Schools
   - Rental Housing > 4 stories
   - No Process Loads

Note: For Public Buildings, Credit Can Pass Through to *"Person or Entity Primarily Responsible for Designing the Building (Designer(s) of Record)"*

EPAct 2005, Applicability to Commercial Buildings – (2)

2. **<u>New Construction</u> in <u>Existing Building</u> Also Eligible for Deduction**
   Up to $0.60 / sq. ft. for any of the 3 Energy-Using Systems: Lighting, HVAC, Service Water, Building Envelope
   *Based on ASHRAE Energy Standard 90.1-**2001***
   Note: "Plug Loads" Not Included

EPAct 2005, Deduction for Commercial Buildings

3. **Total of Up To $1.80 / sq. ft. of Building Area**
   1/3 of Incentive Available Separately for Each of Main Building Systems:
   - Envelope – Up To $0.60 (16 2/3% > 90.1)
   - HVAC, Water Heating – Up To $0.60 (16 2/3% > 90.1)
   - Lighting – Up To $0.60 (25% > 90.1, with exceptions)

Note: Can do *something* in any of the 3 areas and get *partial* deduction, except for lighting in warehouses

Other Help

- Utility Energy Optimization Programs
- Organizational Grants
- Municipal, county or state energy grants
- Local Tax Reductions (primarily new construction)
- Faster permitting and inspections from some local jurisdictions if building to LEED® (Leadership in Energy & Environmental Design) Guidelines (primarily new construction)
- Better insurance rates

Green to Grey??

Q. How Do You Maintain Sustainability?

A. Energy Audits
B. Re-commissioning and Retro-commissioning

Energy Audits

- Purpose:
  Identify and develop modifications to reduce energy use and/or cost of operating a building
- Type(s):
  - Level I: Walk-Through Analysis (very basic)
  - Level II: Energy Survey & Analysis
  - Level III: Detailed Analysis of Capital Intensive Modifications
- Examine:
  - Envelope (Walls, Windows, Roof)
  - Lighting (Interior & Exterior)
  - HVAC
  - Domestic & Process Water (Hot & Cold)
  - Other: Laundry, Food Preparation, Conveying Systems, Plug Loads, etc.

What To Do After the Audit

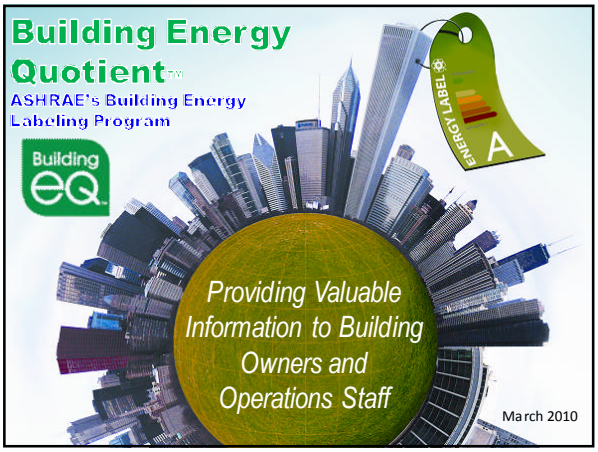
- Re-commissioning or retro-commissioning based on audit results
  - Repair building envelope (walls, windows, roof) as required
  - Ensure HVAC systems are operating properly and most efficiently – beyond simple thermostat adjustments
  - Remove and replace inefficient HVAC and service water systems
- Then, Continuous Commissioning

What's Coming Up (or Here Now)?

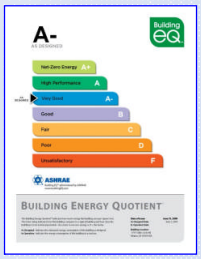
- ASHRAE Building Energy Quotient (bEQ) Label (3rd Qtr. 2010 – in Pilot Now)
- ANSI Standard 189.1 for High Performance Green Buildings (Just Came Out)
- ICC's International Green Construction Code (release in March? – will be published as new code in 2012)
- ASHRAE 90.1 – 2010
- Energy Use Index (EUI) – Btu/sq. ft./ yr.

Building Energy Quotient™

ASHRAE's Building Energy Labeling Program



Building Energy Labels Provide. . .



- Information on the potential and actual energy use of buildings
- Feedback to building owners and operators on how their building is performing
- Insight into the value and potential long-term costs of a building
- Differentiation in the marketplace

Why Now?

Potential utilization outside of North America for areas without existing labeling programs

Mandatory labeling requirements already in place:

- European Union
- California
- Washington, DC
- Austin, TX

Building owners need a technically sound label that can serve as a consistent model for such mandatory programs.

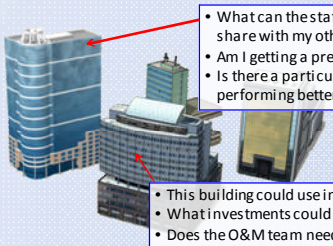
These Buildings are "Green" How Efficiently Do They Use Energy?

This Building has a Good Energy Quotient

Why Should Owners be Interested?

Manage portfolios and identify investment opportunities

Existing Building Portfolios (*In Operation Rating*):



- What can the staff managing this building share with my other building managers?
- Am I getting a premium for this building?
- Is there a particular reason this building is performing better?

- This building could use improvement.
- What investments could improve energy use?
- Does the O&M team need additional training?
- Can re-commissioning or retro-commissioning address poor performance?

Why Should Owners be Interested?

Make educated decisions on new building design

Design Options for a New Building (*As Designed Rating*):

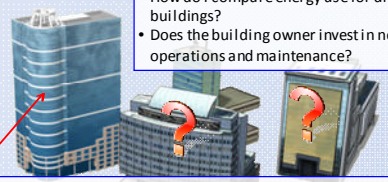
- Which design will be most marketable?
- What can I expect in future energy costs?
- Does the design meet my initial energy use expectations?
- What will I need to do to assure the building performs to its potential?

Why Should Owners be Interested?

Tenants are looking to understand energy use and cost

Potential Lessees:

- Is this a bad building or just not measured?
- What will my energy bills be?
- How do I compare energy use for different buildings?
- Does the building owner invest in necessary operations and maintenance?



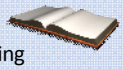
- This is a high-performance building.
- My energy costs will be manageable.
- The building owner pays attention to operations and maintenance.
- I can afford to put more money towards rent.

Benefits for Building Owners

- Measurement-based Indoor Environmental Quality (IEQ) indicators to assure levels of service are maintained
- List of operational features including commissioning activities, energy efficiency improvements
- Provides information on how the building is using energy and how performance can be improved
- ***Differentiate building from peers to attract tenants or potential buyers***

Where To Get Information

- USGBC: LEED®-EB: O & M Guidelines
  Based on EPA Energy Star® Portfolio Manager
  Look at ASHRAE Energy Standard 90.1-2007
- ASHRAE: Advanced Energy Design Guides (AEDG)
- ASHRAE: Procedures for Commercial Building Energy Audits
- BOMA: Preventive Maintenance & Building Operation Efficiency



References & Resources (1)

www.ashrae.org (American Society of Heating, Refrigerating and Air-Conditioning Engineers
www.usgbc.org (U.S. Green Building Council)
www.gbci.org (Green Building Certification Institute)
www.aia.org/cote (AIA Committee on the Environment)
www.eren.doe.gov (Department of Energy)
www.sustainable.doe.gov
www.energystar.gov (EPA Energy Star)
www.nrel.gov (National Renewable Energy Laboratory)
www.rmi.org (Rocky Mountain Institute)
www.peci.org (Portland Energy Council – O & M Techniques)
www.greenseal.org
www.greenguard.org
www.fpl.fs.fed.us/ahrc/mold/mold-methods.html (Forest Products Lab)

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References & Resources (2)

dsireusa.org (Info on federal, state, local, utility incentives and policies)
epa.gov/air/caa/peg (Guide to the Clean Air Act)
facilitiesnet.com (specialized site for facility professionals)
myfacilitiesnet.com (social networking site for facility professionals)
energystar.gov/benchmark (EPA Portfolio Manager)
advancedbuildings.org (energy eff. technologies, strategies for commercial buildings, case studies)
bcxa.org (building commissioning)
newbuildings.org (promotes energy efficiency in bldgs. through technology research, guidelines and codes)
buildingEQ.com (ASHRAE bEQ Program)

Why Do People Change?

Two Reasons:

1. They *realize* it's in their best interests

2. They're forced to

Both of these are happening today

Why Change?

"It's not the strongest who survive, nor the most intelligent – it's those most adaptable to change" - Charles Darwin

Stay flexible

Don't fear difficult moments

Try new things

Educate yourself – ***continually***

Growth comes from change - and so does survival!

So What Now?

- Use what you're learning today – never stop learning
- Think "Outside the Box"
- Keep up-to-date
  - ASHRAE Standards, LEED Guidelines
  - BOMA/IFMA/USGBC
  - Government Regulations
- Join professional organizations
- Get a professional certification
- Be a teacher, not just a student

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"If We Do Not Change Our Direction, We Are Likely To End Up in the Place We Are Headed"

- Chinese Proverb

For Further Information:

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