Newman Consulting Group, LLC

Consultants for Energy-Efficient and Sustainable Buildings

Transforming Older Buildings Into High Performance Facilities

- ASHRAE DL – MS Valley – 05/11/11

"If we do not change our direction, we are likely to end up where we are headed"

- Chinese proverb

James L. Newman

CEM, LEED AP, OPMP, BEAP, FESD

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
- Trainer, ANSI/ASHRAE/IESNA Energy Standard 90.1
- Past Member, Air-to-air Energy Recovery Technical Committee
- Past Vice-Chair, Industrial Air Conditioning Technical Committee
- 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, Sustainability Task Force (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)
- Representative to ESD Council of Affiliate Organizations

What Happens to HVAC Systems as Time Passes?

Green → Grey

Design Charrette /Meeting

- All Stakeholders Engaged In Design Process
- Everyone Going in Same Direction ≡ **Teamwork**
- Experienced Team Leaders
- Entire Team Trained in Holistic Delivery Process

First Step - Identification

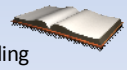
- Intent – Primary Goal
- Requirements – Quantifiable Conditions
- Technologies/Strategies

Design Charrettes (cont.)

- Identify Project Goals & Metrics
- Plan & Execute Charrettes At Critical Phases of Project
- Identify & Resolve Tradeoffs
  - Sustainability
  - First Costs & Life Cycle Costs
  - Mission Requirements

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

Energy Audits

- Purpose: Identify and Develop Modifications to reduce energy use and/or cost of operating a building
- Types:
  - Preliminary: Examine Utility Bills for Information
  - Level I: Walk-Through Analysis
  - Level II: Energy Survey & Analysis
  - Level III: Detailed Analysis of Capital Intensive Modifications

Energy Audits – (2)

- Building Energy Consumption:
  - Envelope (Walls, Windows, Roof)
  - Lighting (Interior & Exterior)
  - HVAC
  - Domestic & Process Water (Hot & Cold)
  - Laundry
  - Food Preparation
  - Conveying Systems
  - Plug Loads
  - Other Systems – Compressed Air, etc.

Energy Audits – (3)

Steps:

1. Collect & analyze historical energy use
2. Study building, operation, characteristics
3. Identify potential modifications to reduce energy use/cost
4. Analyze engineering & economics of potential modifications
5. List rank-order, appropriate modifications
6. Document analysis process, results, report

Methods of Reducing Energy – (1)

- Air & Water Economizers
- Blow-through Constant Volume Systems (not for hospital ORs)
- Optimized Discharge Temperature
- Enthalpy/Energy Recovery Heat Exchangers
- Geothermal Heat Pumps
- Low S.P. Drop, High MERV-Rated Filters
- Microchannel Heat Exchangers

Methods of Reducing Energy – (2)

- Multiple Constant Volume AHUs
- Programmable Thermostats
- VAV Systems
- Cool Storage
- Dedicated Outdoor Air Systems (DOAS)
- Desiccant Systems
- Displacement Ventilation & Underfloor Air Distribution
- Improved Duct Sealing

Methods of Reducing Energy – (3)

- VFDs on Fans, Chillers, Pumps
- Indirect Evaporative Cooling
- Occupancy-Based Control
- Smaller Centrifugal Compressors – Oil-less, With Magnetic Bearings
- Series-Parallel Chillers
- Variable Flow Chilled Water systems
- Natural Ventilation
- Passive Heating/Cooling

Methods of Reducing Energy – (4)

- Solar
- Solar Photo-Voltaic
- Radiant Ceiling Cooling
- Radiant Heating
- Reheat from Waste Energy
- Thermal Chimneys
- Wind Energy
- Wave Energy

Methods of Reducing Energy – (5)

- Lighting
  - Fluorescent Lamps: T-8, T-5 – Electronic Ballast
  - Compact Fluorescent Lamps (CFL)
  - LED Lamps
  - Sensors: Light, Motion
  - Dimming
  - Zoning
- Natural Daylighting
  - Light Shelves
  - Skylights
  - 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
- Interior Water Use Reduction
  - Toilets & urinals (low-flow or waterless)
  - Sinks (low-flow, with or without sensors)
  - Showers (low-flow)

Water Saving, Reuse

Gray Water ≡ Water that can be recycled & reused:

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

Water Savings, Treatment Types

Chemical Treatment ≡ Dangerous to Personnel

Non-chemical Treatment

- Water & Energy Saving
- No Worker Interaction w/ Chemicals
- No Liabilities for Chemical Spills / Tracking
- No Drum Disposal / Chem. Testing Issues
- Environmentally Improved Workplace
- Water Reuse Options (cf. "Gray Water")

Getting Tax Deductions for Improving the Energy Efficiency of a Building

(OR, How to let the Government pay you to save money)

But…They Don't Make It Easy!!

EPAct 2005

Q: What is this? Energy Policy Act of 2005 – extended to 12/31/2013

A: The dream of every building owner & facility manager

Note: A tax *deduction* ***(not a credit)*** for energy efficiency:

Up to $1.80/sq ft

- $0.60 for HVAC
- $0.60 for Lighting
- $0.60 for Building Envelope

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*"

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, Building Envelope

(LEED Certification makes it a shoo-in)

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 (16 2/3% > 90.1, with exceptions)

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

Quality Assurance

- Testing & Balancing – To Ensure *HVAC Systems* are Performing as Designed
- Commissioning – To Ensure ***Building*** is Performing as Designed

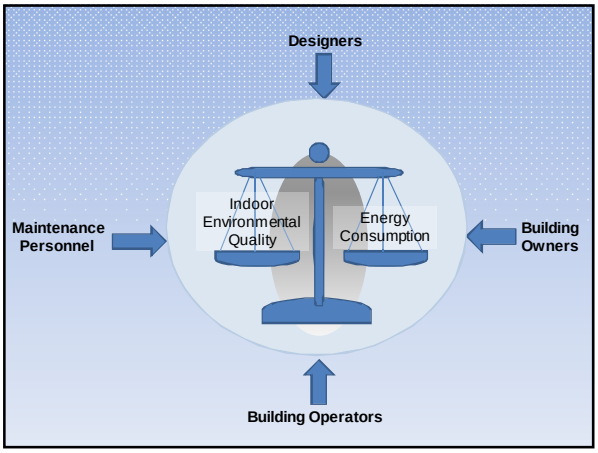
Operation & Maintenance

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

Technology ≠ Performance

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

- Newman



Implementation: Find Creative Solutions

Your #1 Resource: Your People

- Training programs
- Operation & Maintenance Changes
  - Reduce energy consumption
  - Improve IAQ
  - Improve system reliability & performance
  - Simplify maintenance
  - Reduce operating costs
- For each operational measure identified, must do cost/benefit analysis

Your #1 Challenge: Your People

1. Must get *your people* to buy into it
2. Must get *management* to buy into it

How to Sell It to Management

- Simple Payback?? Not a Good Way to Analyze!
- Life Cycle Cost Analysis (LCCA)
- Return on Investment (ROI)
- Internal Rate of Return (IRR)

References & Resources

www.ashrae.org
www.usgbc.org
www.wgbc.org (World Green Building Council)
www.aia.org/cote (AIA Committee on the Environment)
www.eren.doe.gov
www.sustainable.doe.gov
www.energystar.gov
www.nrel.gov (Renewable Energy)
www.rmi.org (Rocky Mountain Institute)

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References & Resources (cont.)

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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"We Do Not Inherit the Earth from Our Ancestors – We Borrow It from Our Children" – *Native American Proverb*

Build Green – Everyone Profits! - USGBC