Improving Real Property Assets through Energy Audits, Retro-Commissioning and LEED EB Analysis

By: Beaudin Ganze Consulting Engineers, Inc.
Agenda

• Why undertake asset improvement?
• What are the benefits and who receives them?
• How do I start?
• Who do I hire?
• What is the process?
• What are the deliverables?
• When can I start?
Introduction

Steve Alschuler P.E. MBA
• Mechanical Engineer and Licensed Real Estate Broker
• 20 years training & experience with HVAC Systems
• Commissioning Services Manager for Beaudin Ganze Consulting Engineers, Inc.

Beaudin Ganze Consulting Engineers
• 18 Year old Consulting Engineering Firm
• 55 Employees across 5 offices around the country
• Provides existing building services including:
  – Energy Audits
  – Retro Commissioning
  – LEED EB Feasibility Studies
Why Spend the Money?

- #1 Building Performance Issues
- #2 Energy Savings
- #3 Sustainability Recognition

Asset Value
Objectives for Improvement

1. Improve building *performance*.
   • Performance return on investment as measured with satisfaction.

2. Reduce *operating costs*.
   • Operating return on investment as measured with direct savings.

3. Increase *asset value* through sustainability.
   • Return on investment as measured by increased market value.
   • USGBC LEED certification metric.
Top 2 Tenant Complaints?

Roof Leaks

Too Hot or Cold
#1 Building Performance

HVAC System not being effective

1. Designed incorrectly
2. Supplied incorrectly
3. Installed incorrectly
4. Balanced incorrectly
5. Controlled incorrectly
6. Operated incorrectly
7. Maintained incorrectly
#2 Energy Savings

<table>
<thead>
<tr>
<th>Management</th>
<th>Legal</th>
<th>Insurance</th>
<th>Accounting</th>
<th>Janitorial</th>
<th>Taxes</th>
<th>Supplies</th>
<th>Maintenance</th>
<th>Energy</th>
<th>Water</th>
<th>Total OE</th>
</tr>
</thead>
</table>
#3 Sustainability

green buildings worldwide are defined and certified with consensus-based standards.

USGBC has four levels of LEED

- PLATINUM
- GOLD
- SILVER
- CERTIFIED
How do I start?

First: Find the right consultant

1. Architect?
   • Pros:
     – Existing relationship
     – May have strong LEED experience
   • Cons:
     – Limited understanding of HVAC systems
     – Limited understanding of Energy Calculations
     – Limited understanding of Energy Audits

2. Mechanical Engineer?
   • Pros:
     – Strong technical understanding of HVAC & Energy
   • Cons:
     – Limited “3 Dimensional” abilities after a project is constructed
     – May or may not be in the energy and commissioning business
How do I start?

Find the right consultant

3. Contractor?
   • Pros:
     – May offer “Performance Contracting Business Model”
     – Often experienced in HVAC systems and commissioning
   • Cons:
     – Typically limited engineering staff to calculate actual savings and associated paybacks
     – May be trying to sell a product along with a service
     – Often charge higher margins hidden in Energy Conservation Measures

4. Energy Savings Corporation ESCO?
   • Pros:
     – May be able to obtain financing for improvements
     – Has a strong experience record providing energy savings
   • Cons:
     – Typically charges maximum margins for any work performed
     – Is best suited for government entities not able to self finance
How do I start?

Find the right consultant

5. Professional Consultant?
   • Pros:
     – Is paid for his or her time, so no project is required
     – No agenda to sell a product disguised as an ECM
     – Provides unbiased analysis of what is best for the client
   • Cons:
     – Typically cannot obtain financing for the client
     – Typically does not perform improvements
How do I start?

Next: Define the Goal

1. Improve Building Performance

2. Save Energy and Associated Utility Expenses

3. Obtain a LEED EB Certification
How do I start?

Next: Define the Goal

1. Improve Building Performance
2. Save Energy and Associated Utility Expenses
3. Obtain a LEED EB Certification
Next Step: Benchmarking

- Building Based
  - Annual Utility Consumption from Billings
  - Calculate Energy Usage Index [EUI] per SF
  - Compare to Available Databases (CBECS)
- Consider any unique differences between building being investigated and as compared to buildings in the benchmark database
- Use EUI to calculate Energy Star score as a significant prerequisite for LEED certification.
  - Project must score minimum of 69.
Project Viability Check

Energy Star Score

- Less than 40: Significant tune up needed
- 40 to 69: Retro-CX
- More than 69: LEED-EB Scorecard

Exit?
Retro-Cx Defined

- Retro-Cx is a systematic process for improving the current conditions and operations of an existing building.
- Building Systems most commonly addressed include:
  - HVAC
  - Lighting Controls
  - Building Envelope
- Retro-Cx evaluates the conditions of the buildings energy related systems, and optimizes the operation, performance, and maintenance in accordance with the original design intent and the owner’s operational needs.
A Building “Tune Up”

- Retro-Cx is analogous to a tune up for your building, restoring the building’s operation to the design intent.
Not a Quick Fix

- Retro-Cx goes beyond a quick fix
- Determines root cause of the problem
- Optimizes building systems
- Modifies control sequences for more efficient operation
- Often reduces or eliminates the need for capital improvements
Retro Cx Benefits

- Corrections are typically low cost measures to implement
- Improvement in temperature control, indoor air quality, and energy efficiency
- Paybacks are typically 6 months to 2 years
- Allows for training of Operations and Maintenance staff to sustain ongoing building performance improvement
Retro Cx Addresses

• Indoor Environmental Quality
  – Temperature Control
  – Air Quality (i.e. inadequate ventilation)
  – Lighting

• Energy Efficiency
  – Electrical Consumption
  – Natural Gas Consumption
  – Opportunities for Renewable Energy

• Deferred Maintenance
Who Performs Retro-Cx?

There are a number of companies which are qualified and able to perform commissioning services, and unfortunately several that are not. Unlike the practice of engineering where each state tests and subsequently licenses individuals to practice, commissioning is still too new and there is not a universally accepted standard or agency one can depend on to verify the capabilities of a provider.
Who is *trying* to License Cx Practitioners?

- Building Commissioning Association (BCA)
  - CCP Certified Commissioning Professional
- University of Wisconsin
  - QCxP Qualified Cx Process Provider
  - CxAP Accredited Cx Process Authority
  - CxM Accredited Cx Process Manager
  - CxTS Accredited CX Process Technical Support Provider
- Association of Energy Engineers
  - CBCP Certified Building Cx Professional
- National Environmental Balancing Bureau
  - BSC Building System Cx Certification
- ASHRAE -- Forthcoming
How much does Retro-Cx Cost?

The cost of commissioning varies widely depending on the type of building being commissioned, which systems within the building are being commissioned. Typical fees range between 30 cents and 70 cents a square foot depending on systems commissioned, building type and size.
What is the Retro-Cx Process?

- Planning
- Investigation
- Implementation
- Operation
Planning

- Kick Off Meeting
- Obtain Building Data
  - Utility Bills
  - Comfort Complaints
- Benchmark Performance
- Review Building Operational Issues
- Develop Retro-Cx Plan
Benchmarking

• Building Based
  – Annual Utility Consumption from Billing
  – Calculate Energy Usage Index [EUI] per SF
  – Compare to Available Databases (SIC, NAICS, Green Building)

• Use EUI to calculate Retro-Cx potential and best candidates for Retro-Cx

• Consider any unique differences between building being investigated and as compared to buildings in the benchmark database
Retro Cx Plan

• Building Issues
  – Energy Usage
  – Comfort
  – Indoor Air Quality
  – Noise

• Planned Approach
  – Trending
  – Design
  – Maintenance
  – Tab
Investigation

- What is the equipment actually doing?
- Validate the Control System (i.e. Functional Performance Testing)
- Trend Data
- Document Conditions
- Identify changes to setpoints, schedules, sequences and their corresponding cost/benefit
Investigation (examples)

RM 116 Temperature vs. Time

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<th>Thermostat</th>
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Investigation (examples)

Geo Loop Temps to Bldgs

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<td>181</td>
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<tr>
<td>190</td>
<td>66</td>
</tr>
</tbody>
</table>

Legend:
- Museum Supply
- Lodge Supply
- Pond Temperature
Investigation (examples)

- Scheduling not implemented on HVAC system and/or on lighting controls
- Economizer function has been overridden or disconnected
- Automatic control function has been overridden to manual (i.e. discharge air reset, or hot water reset)
Implementation

- Implement recommended opportunities and correct operational deficiencies to achieve improved performance and energy savings

- Performed by:
  - Internal Maintenance Staff
  - 3rd party Service Companies
  - Test & Balance Contractor
Implementation

- Verify modifications are made
- Perform functional performance testing [FPT] to assure modifications are operating as designed
- Trend performance to verify energy savings
Operation

• Provide onsite training showing how the building is suppose to operate to sustain improvements
• Update O & M Data
• Provide a Systems Manual
  – One Line Diagrams of Systems
  – Documentation of Setpoints
  – Sample FPT Forms for Future Use
Operation

- Track monthly building energy usage
  - Compare similar months different years
  - Correlate energy usage to Outside air temperature

- Submeter major HVAC systems if possible
  - Cooling Plant
  - Heating Plant
  - Ventilation Systems

- Verify Operation of Energy Conservation Measures (ECMs)
  - Track equipment runtimes (schedules)
  - Track temperatures against setpoints
This graph shows a reduction in overall energy usage between 2005 and 2004 through the implementation of a Retro Cx process.
Hypothetical Bldg Example
What might Retro-Cx Find?

1. Minimum Position of Outside Air Damper set incorrectly
2. Discharge Air Setpoint in cooling set too low
3. Terminal Unit supply damper linkage broken robbing other terminal units of adequate airflow
4. Condenser Fan on Roof Top Unit has burned out motor making operation inefficient
5. Duct static pressure setpoint set too high, compensating for item 3 above
6. Exhaust fan VFD left in manual operation making building improperly pressurized
7. Supply air duct coming apart in ceiling, leaking significant air into plenum
8. Filters dirty and badly in need of changing
9. Space thermostat out of calibration
10. Unit not schedule to be off during unoccupied hours
Hypothetical Bldg #2
What might Retro Cx Find?

1. Boiler Hot Water reset control strategy removed
2. Boilers not staging on in sequence, all boilers on all of the time
3. The controls stage on the least energy efficient chiller 1st, and the more energy efficient chiller 2nd.
4. Cooling tower condenser water temperature can be lowered for more efficient chiller operation
5. Inlet vane damper actuator linkage on AHU 3 supply fan broken
6. Variable frequency drive can be added to AHU supply fans in lieu of existing inlet vanes
7. Variable frequency drive can be added to cooling tower in lieu of existing bypass valve
8. Cooling tower fill is scaled up making cooling tower inefficient and reducing overall system capacity
9. Combustion air fan coil in boiler room broken making mechanical equipment room dangerous and out of code compliance
10. Flat plate heat exchanger can be added to system for exceptional reduction in energy usage
Example Retro Cx Report

Bureau of Land Management Grand Junction Air Center

Retro-Commissioning Summary Report

Prepared by
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October 31, 2009
## 2.4 RECOMMENDATIONS

<table>
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<tr>
<th>No</th>
<th>Issue</th>
<th>Recommendations</th>
<th>Provider</th>
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<tbody>
<tr>
<td>1</td>
<td>Chilled Water Pump not functioning</td>
<td>Have repaired by HVAC Vendor</td>
<td>Trane</td>
</tr>
<tr>
<td>2</td>
<td>Cooling Tower Bypass Valve Actuator Missing</td>
<td>Have repaired by HVAC Vendor</td>
<td>Trane</td>
</tr>
<tr>
<td>3</td>
<td>Boiler Graphics in the Trane Front End not working correctly</td>
<td>Have repaired by Control System Vendor</td>
<td>Trane</td>
</tr>
<tr>
<td>4</td>
<td>AHU-1 Duct Smoke Detectors not working</td>
<td>Have repaired and verified operational by Fire Alarm system vendor</td>
<td>Fire Alarm Vendor</td>
</tr>
<tr>
<td>5</td>
<td>AHU-3 Duct Smoke Detectors not working</td>
<td>Have repaired and verified operational by Fire Alarm system vendor</td>
<td>Fire Alarm Vendor</td>
</tr>
<tr>
<td>6</td>
<td>AHU-1 Cooling Valve not working</td>
<td>Have cooling valve repaired</td>
<td>Trane</td>
</tr>
<tr>
<td>7</td>
<td>AHU 1-3 humidity sensors not working</td>
<td>Have humidity sensors repaired and recalibrated or replaced and verified operational after repaired</td>
<td>Trane</td>
</tr>
</tbody>
</table>
Incentive Programs for Retro Cx

Recommissioning
Cut your energy costs with a Recommissioning tune-up.
Recommissioning helps you find and solve mechanical system problems that make your facility expensive to operate. Recommissioning can help lower energy costs by an average of 10 percent.

Our Recommissioning covers both commissioning of previously commissioned buildings (Recommissioning) and buildings that were never formally commissioned through our program (Retrofitcommissioning).

Limited-time offer: We’ll pay up to 75% of the cost of a Recommissioning study
Recommissioning is a two-step process that requires preapproval:

Step 1 – Diagnose
- Take advantage of our limited-time offer: We’ll fund up to 75% of the cost of your study, not to exceed $20,000 through Sept. 30, 2008. Normally, we fund up to 50% of your study cost, not to exceed $15,000. Your building must be at least 5,000 square feet or have high-energy use to qualify.
- Select your own contractor or choose from our provider list
- To qualify for the bonus, send us the approval application and your recommissioning study proposal between Jan. 1 and Sept. 30, 2008, and we’ll automatically include the bonus with the pre-approved funding amount. The bonus does not apply for applications received outside of these dates.
- The study includes:
  - An assessment of operating mechanical systems
  - A written report that includes energy-saving recommendations

Step 2 – Implementation
- Your Recommissioning study report becomes the Recommissioning plan
- Earn electric rebates that cover up to half the cost of implementation
- Enjoy immediate and long-term energy savings
- If you did a Recommissioning study with us, you still qualify for implementation rebates using our fast-track Recommissioning form
What are the BENEFITS?

- Reduced Vacancy Rates
  - Hold existing tenants
  - Attract new tenants or buyers
- Reduced Operating Expenses
  - Energy
  - Water
  - Maintenance
- Increased Gross Operating Income (GOI)
  - Higher rental rates
  - Higher property value

All adds up to a SUSTAINABLE INVESTMENT
Questions ???
Thank you for your time!

This concludes The American Institute of Architects Continuing Education Systems Program

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