Building Retro-Commissioning Picture Show

Svein Morner, P.E., Ph.D.
Jamie Campbell, P.E

Sustainable Engineering Group, LLC

May 4, 2007

Region VI Chapter Regional Conference (CRC) 2007
Sailing into the Future
Infuse Innovation, Research, and Development into Sustainability
ASHRAE is a Registered Provider with the American Institute of Architects Continuing Education Systems. Credit earned on completion of this program will be reported to CES Records for AIA members.

This program is registered with the AIA/CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product. Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.
Learning Objectives

- Understand the motivation and methods for accomplishing Retro-Commissioning (R-Cx)
- Appreciate the value of R-Cx by considering 3 case studies
- Recognize some typical issues uncovered by Retro-Commissioning
What Will Be Covered

• The Retro-Commissioning Process
• Case Studies
  – School
  – Office
  – Church
• Interesting Findings from Other Projects
What is Retro-Cx?

The process of optimizing the performance of an existing building
Why Do Retro-Cx?

$
Environmental Impact of Buildings

U.S. Energy Consumption by Sector – 2000
98.5 Quadrillion Btu

- 65.2% of total U.S. electricity consumption
- ~36% of total U.S. primary energy use
- 30% of total U.S. greenhouse gas emissions
When is Retro-Cx Appropriate?

When there is a good chance of success!
Approach - Overview

1. Gather Information
2. Identify improvements
3. Monitor implementation
4. Functional testing
5. Update documentation & train operators
6. Final report
1. Gather Information

From Stakeholders

From Documentation

From Observation
Deliverables

• *Operational Intent*
  – Narratives of facility functional use
  – Verifiable performance criteria
  – Stakeholder requirements for
    • usability, operability, maintainability, functionality

• *Basis of Operation*
  – Documents current building operation
    • Installed equipment database
    • Control sequences
Approach - Overview

☑ 1. Gather Information
☐ 2. Identify improvements
☐ 3. Monitor implementation
☐ 4. Functional testing
☐ 5. Update documentation, train operators
☐ 6. Final report
Building Energy Usage

10,000SF Office Building Energy Use
Mid-West US (Chicago)

- Space Heating, 32%
- Lighting, 26%
- Other, 19%
- Water Heating, 10%
- Ventilation, 5%
- Space Cooling, 8%
School Energy Use

District Avg.

This school

District Avg.

This school

WI Public Schools kWh/s.f.

Number of Buildings:

0 20 40 60 80 100 120 140

kWh/s.f.

0 1.5 2.7 4.0 5.2 6.5 7.7 9.0 10.2 11.5 12.7 14.0 15.2 16.5 17.7

WI Public Schools Fossil Fuel MBtu/sq. foot

Number of Buildings:

0 300

Fossil Fuel MBtu/sq. foot

0 33 66 100 133 166 199
Identify Improvements

• Can the system meet your requirements?
  – If so, tune the system to meet your needs
    • Examples: Calibrate sensors, adjust control sequences, repair or replace equipment
  – If not, re-design the system as required

• Costs and savings for each improvement
  – Prioritize
Deliverable

- **Facility Optimization Study**
  - Narrative and technical evaluation of each improvement opportunity
  - Estimate of project costs
  - Analysis of utility savings and other benefits
  - Includes:
    - Discussion of documentation improvements
    - Discussion of training needs
3. Monitor Implementation

- Cx provider’s role varies depending on
  1. Needs of the client
  2. Number and complexity of improvements
  3. Type of improvements
Approach - Overview

☑ 1. Gather Information
☑ 2. Identify improvements
☑ 3. Monitor implementation
☐ 4. Functional testing
☐ 5. Update documentation, train operators
☐ 6. Final report
4. Functional Testing

• Cx provider’s role varies
• Verify the performance of Cx systems
• May use statistical sampling
5. Documentation & Training

• Update documentation
  – Drawings
  – O & M manuals
  – Operating sequences
  – Equipment database
  – Maintenance schedules

• Schedule training
6. Final Report

• Based on the *Facility Optimization Study*
  – Includes discussion of implemented projects and testing
Common Problems Identified

- Time clocks disabled
- Control sequences not optimized
- Energy Management Systems not understood or fully utilized
- Controls/sensors/actuators out of calibration
- Ventilation excessive
- Documentation & training inadequate
THANK YOU

This concludes the ASHRAE & AIA Continuing Education Systems Program

Please visit the website
www.ashraemadison.org/crc2007

Questions or Comments?

Jamie Campbell
Sustainable Engineering Group
608-628-7252
jcampbell@sustaineng.com
www.sustaineng.com