

# Building Re-Commissioning

Presented By

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- *As Jeff Lyng of the Governors Energy Office was recently quoted, the biggest opportunity we have in the energy field is to tackle the existing building market & the inherent inefficiency of those buildings.*



# Definitions

- *Re-Commissioning (or Existing Building Commissioning) is a systematic process for investigating, analyzing, and optimizing the performance of building systems through operational and maintenance improvement measures and ensuring their continued performance over time.*
- *The Re-Commissioning process assists in making the building systems perform interactively to meet the Owner's current operational needs.*



# Introduction

- Re-Commissioning is commissioning of existing buildings that were originally commissioned when built
- Retro-Commissioning is commissioning of existing buildings that have never been commissioned before
- The process is the same for both, but for ease we call it Re-Commissioning
- We may start to call it EB-Cx



- Experience tells how well / poorly the building has performed
  - Bench mark the building in terms of energy cost
  - *This may be difficult for 7x24 facilities*
- Performance probably has degraded over time for many reasons
  - Change in personnel
  - Change in building purpose
  - Lack of support and training for the BAS
- Most problems start with a control system that was not completed to begin with



- Original system performance data may not exist anymore
- Building function / usage may have changed
- Original construction documentation may / may not exist



- Re-Commissioning focuses on known trouble spots or performance problems / less on equipment that appears to function properly or has not been problematic over the years
- Also, the control system should be thoroughly reviewed for potential improvements for energy efficiency & comfort
- ***Re-Cx does not mean you have to return it to its original state!!***



# Who is the Re-Cx Team?

- Re-Cx provider is the team leader
- Building owner or representative for owner
  - *There must be a Re-Cx champion on staff!*
- Building O&M staff
- Utility Account Manager
- System specialists:
  - BAS contractor
  - TAB
  - Service contractors
  - Manufacturer's representatives



# Re-Commissioning

- Rule #1 – Don't put it back to where it was on day one *(this is also the most common mistake)*
- Typically focuses on:
  - HVAC Systems & Controls (mostly)
  - Lighting Controls
  - Can include other problematic systems
- It is important to check with your utility for Re-Cx rebates – locally Xcel Energy, Platte River Power Authority & Colorado Springs offer rebates
- Evaluates systems operating characteristics and optimizes the operation and performance to meet current operational needs.



# Benchmarking the Facility

- Establish your facility's energy consumption & cost in relation to the area average, taking into account size, type of facility & systems, age of facility & level of automation – ***this is very difficult the more unique a facility is.***
- Re-Cx provider can provide insight here along with a preliminary interview with staff concerning facility operation practices
- ***Remember – being in the average is NOT the goal. There are too many poorly operated buildings that bring the average costs UP!!!***



# EMS/BAS is large part of Re-Cx

- EMS/BAS is the biggest tool to use for Re-Cx
  - Trending and program analysis are most important
- Without EMS/BAS, data loggers and observation can be very helpful
- Make sure the EMS/BAS info is correct before relying totally on it (pressure, CO<sub>2</sub> & flows are generally a calibration problem)
- EMS/BAS support group being cooperative is essential



- 6 phases of Re-Commissioning include:
  - Phase I – Discovery
  - Phase II – Repair and Tuning
  - Phase III – Renovation Planning & Budgeting



- Phase IV – Renovation Design & Construction
- Phase V – Final Test & Tune
- Phase VI – Training



# PHASE I – DISCOVERY

- The first step – become familiar with building and how it actually performs and how it is used
- No two buildings alike – each a custom assembly of pieces and parts
- Most built with budget constraints and equipment and control strategies available at the time



- Familiarization
  - Discussions with Staff, Building Proctors
  - Discussions with original design team
  - Walk-thru
  - Spend time with the BAS
    - TREND, TREND & more TRENDS
    - Trend lots more than you think you'll ever need



- Documentation Review and Analysis
  - Construction Documents
  - Maintenance Histories
  - Control Sequences (may not still be in place)
  - Balancing Reports (original & any subsequent)
  - Utility Usage



- Measurements Required
- Trending (BAS or Dataloggers)
- Metering
- Performance Testing / Part Load / Full Load
- Evaluation



## PHASE II – REPAIR AND TUNING

- This phase focuses on completing needed repairs / correcting lower-cost deficiencies



# PHASE II – REPAIR AND TUNING

- Discoveries can include:
  - Inoperable / degraded equipment
  - Major leaks or restrictions
  - Non-functional controls
  - Controls out of calibration
  - Incorrect or overridden sequences of operation



- If this is true, stop testing – fix obvious problems – then continue testing
  - Inoperable Equipment
  - Cleaning
  - Repair Major Leakage / Blockage
  - Calibration / Verification of Control Inputs and Outputs



- Final Verification and System Tuning
  - Spot Re-testing
  - Performance Testing / Part-Load / Full-Load
  - Control System Loop Tuning
  - On-the-Job Management and Staff Training
  - Seasonal Re-testing and Tuning
  - Report



# PHASE III – RENOVATION PLANNING & BUDGETING

- Scoping and Budgeting
- Prioritization
- Final Report / Master Plan



# PHASE IV – RENOVATION / UPGRADE

- Design needed
- Construction follows
- Equipment may change



- Application of equipment must be re-engineered
- Construction documents
- Bidding / proposing process



## PHASE V – FINAL TEST & TUNE

- Last phase – involves testing the final product
- Start of “preventative maintenance only”
- Final verification / system tuning during seasonal and peak season performance



- Systems with summer and winter operation – test at time of changeover
- As-built documentation finalized
- Equipment programmed into maintenance management system



## PHASE VI – TRAINING

- Summary of past efforts and confirmation of positive and negative results
- Training by system, with operators understanding how maintenance impacts system function



- Training is geared to:
  - Enhance systems knowledge
  - Learn proper maintenance
  - Learn proper operation



- Maintenance is important – often deferred due to higher priorities or lack of staff
- Training geared toward creating a balance of what maintenance should be and how to get it done



# Case Studies

- 1972 Office Building (CBD 520K) \$32K saved/\$6K cost
- 1984 Office Building (CBD 600K) \$58K saved/\$16K cost
- Govt Building (Boulder) \$23K saved/\$32K cost
- Major Hospital (Denver Area) \$66K saved/ \$30K cost
- 1954 Office Building (CBD 450K) \$13K saved/\$12K cost
- 1978 Office Towers (Aurora 290K) \$31K saved/\$10K cost
- 1984 Office Building (CBD 1.2M) \$54K saved/ \$23K cost
- 1998 Office Building (DTC 275K) \$93K saved/\$77K cost
- 2003 Office Building (CBD 450K) \$56K saved/\$27K cost
- Average payback of 19 Xcel Energy projects is 0.7 yrs



# Re-Cx Examples of Measures

- Corrupted BAS programming for garage EF's
- CHW valve control not connected to SF status
- Garage temperature control setpoint up at night
- Return fans inlet vanes not hooked up
- Reduce minimum outdoor air for actual population
- ***Every building will offer different opportunities***



# “Top 10” Typical Re-Cx Opportunities

10. Improve boiler efficiency/controls
9. Reset supply air static pressure set-points
8. Terminal unit tune-ups – dampers & valves
7. Return VFDs to variable speed operation
6. Lower condenser water temps/improve chiller sequencing
5. Calibrate sensors and instrumentation
4. System level test & balance (over air, over pumping)
3. Optimize/restore economizer operation
2. Eliminate simultaneous heating and cooling
1. Turn off equipment when not needed (Scheduled S/S)





**Thank you for the opportunity to  
present our views of this important topic**

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