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An Overview of Commercial Building Re-Tuning

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Presentation Outline

- Definition of Re-tuning
- Background of Re-tuning
- Washington State Project Approach to Re-tuning

Definitions

- HVAC Retro-commissioning
- HVAC Re-tuning
- HVAC Re-commissioning
- HVAC Continuous Commissioning^{SM}
- Monitoring-Based Commissioning
- All processes above in part relate to setting up control systems to some known design configurations, verifying set points and adding control algorithms

Origins for Re-Tuning

- In 1990s several researcher organizations were developing automated fault detection and diagnostics (FDD) tools – the researchers found that the FDD tools can indeed be used for commissioning building systems
- Also, at the same time Texas A&M University was using a process called continuous commissioing to retro-commission existing buildings
- In 2000s monitoring-based commissioning was being applied at many California campus

What is Re-Tuning?

- A systematic process to identify and correct building operational problems that lead to energy waste
- Implemented primarily through the building control system at no cost other than the labor required to perform the re-tuning process
- Includes small, low-cost repairs, such as replacing faulty sensors
- Includes identifying other opportunities for improving energy efficiency that require investment
- Might be thought of as a scaled-down retro-commissioning focused on identifying and correcting operational problems

Purpose of Re-Tuning

- Improve the building's energy efficiency through low-cost and no-cost operational improvements (mostly control changes)
- Identify opportunities to further increase the building's energy efficiency
- Identify problems requiring physical repair
- Catch the big energy saving opportunities

Six Primary Steps of Re-Tuning

- Collecting initial building information: Basic building information
- Pre-Re-Tuning Phase: Trend-data collection and analysis
- Building Walk Down: Getting to know the building
- Re-Tuning: Identifying and correcting operations problems
- Post Re-Tuning: Reporting re-tuning findings
- Savings Analysis: Determining and reporting the impacts

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Trend-Data Collection & Analysis: Purpose

- Detect potential operational problems even before visiting the building
- Identify problems that require time histories to detect – incorrect schedules, no use of setback during unoccupied modes, poor economizer operation

Steps for Trend Data Collection

- Develop a monitoring plan – develop forms to guide service providers through this. Plan includes the points to trend and for each point:
  - Planned trend start time
  - Planned trend end time
  - Length of measurement period (2 weeks recommended)
  - Time interval between logged measurements (30 minutes or less recommended)
  - Measurement units (e.g., °F for temperature)
- Implement trend logs in control system

Analyze Trend Log Data – Major Steps

- Download trend log data files from BAS
- Format data files for compatibility with the spreadsheet analysis tool
- Open data files in spreadsheet analysis tool and automatically generate graphs
- Review graphs to identify operational issues
- Record operational issues for reference during re-tuning

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Building Walk Down: Purpose

- Get to know the building better
- Develop a general impression of:
  - Overall building condition
  - Overall building design
  - HVAC system design
- Collect some basic data on the building systems at a level of detail greater than the initial data collection

Building Walk Down: Major Steps

- Review electrical and mechanical prints
- Walk the outside of the building
- Walk the inside of the building
- Walk down the roof
- Walk down the air handlers
- Walk down the plant area
- Review the DDC system (BAS) front end

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Using the knowledge learned from trend-data analysis and building walk through to start the re-tune process

Major Focus Areas in Re-Tuning

- Occupancy scheduling
- Discharge-air temperature control
- Discharge-air static pressure control
- Air-handling unit (AHU) heating & cooling
- AHU outside/fresh air makeup
- AHU economizer operation
- Zone conditioning
- Meter profiles
- Central plant

Highlights of Re-Tuning

- Every set point adjustment made will have an impact of some sort on the utility meter
- Can save energy and keep occupants comfortable
- It takes time to tune a building
- There are no magic set points that work all the time
- Always monitor the utility meters (gas & electric) to see what affect you have had
- Look at the big picture when making adjustments
- Watch the meter profiles weekly
- Learn and know the building's personality

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Measuring Impacts and Successes

- Widespread acceptance of these technologies will depend on electric energy savings and cost-effectiveness of the proposed solutions
  - We will determine electric energy savings impacts based on
    - reported problems and solutions
    - utility data (monthly kWh, weather data, and other important data) and submetered RTU electricity data
- Effectiveness of the service companies in providing the re-tuning is important to ensure that the benefits from this program continue beyond the initial demonstration
  - We will develop metrics to evaluate each technician's performance
  - Number of companies and technicians using the methods and installing the new technologies after participating in the program
- The long-term success of the program will depend on the rate and degree of market penetration of these technologies

Post-Re-Tuning: Calculating Energy Savings – Overview of Approach

- Calculated as the difference between the actual energy use in the post-re-tuning 12 months and the energy use that would have occurred during the same 12 months if the building had not been re-tuned.

$$E_{savings,j} = E_{base,j} - E_{actual,j}$$

$E_{savings,j}$ = energy savings for a specific building (j)

$E_{actual,j}$ = actual measured energy use of the building during the 12 months after re-tuning

$E_{base,j}$ = energy consumption of the building during the 12 months after re-tuning if it had not been re-tuned

Questions?