Transforming the Practices of Building Operation and Maintenance Professionals thru Re-tuning

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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 commissioning to retro-commission existing buildings

▶ In 2000s monitoring-based commissioning was being applied at many California campus

▶ Re-tuning is slightly different from the other approaches as it leverages information collected from the building automation system to analyze the data in semi-automated way to help building operators identify operational issues
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
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
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
Analyze Trend Log Data with ECAM – Major Steps

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

- Semi-automated analysis
- Based on visualization of data
- Analyze trend log data
- Personality of a building
  - How does it act or respond to changing internal conditions?
  - How does it responded to weather changes?
  - What is its balance point? No heat and no cooling required
- Meter Profiles – the heart beat of the building
  - Modes of operations will show up
  - Demand
  - Time of use
  - Occupied/unoccupied periods
  - Weekend events

ECAM was specifically designed to look at data in these ways.
Prior Retuning Spreadsheet

Multiple Tools
- AHU analysis tool
- Zone analysis tool
- Central plan tool

Need to identify filenames for data sources, and columns for specific points

Data stored in multiple files can be analyzed as well

ECAM requires the source data in a single file

ECAM combines multiple tools into a single file

ECAM provides a form-based means to map points, using a standard naming convention
Additional Reasons to Use ECAM as a Platform for Re-tuning Analyses

- Adding Re-tuning functionality to ECAM will help disseminate the Re-tuning process, and allow others to benefit

- ECAM has additional features that can assist advanced Re-tuning practitioners with improving their buildings
Facility Manager Feedback

“The greatest benefit from this program has been the change in how the HVAC technician views the operation of the building. As a group our facilities staff is looking for ways to save energy and meet the needs of the tenants. They are “coming around” to the idea that the two demands, energy efficiency and tenant comfort, are not at odds with each other. This is a great step forward in operating our buildings more efficiently. As you know it is the human factor that has the most impact on building operations.”

Resource Conservation Manager – Washington General Administration

“The opportunities look very good with little cost and effort ~ Steve and Ron [are] doing a great job with the field training, pointing out opportunities to save energy and operate the building more efficiently.”

Chief Engineer – CB Richard Ellis (Group Health)
... Key Lessons Learned...

- Many commercial buildings have an array of operational problems.
- Retuning can yield energy savings of 5 to 20% through no-cost and low-cost measures.
- But, the human factor is a real issue in realizing retuning in practice.
- In the long run, automation is key to persistence of “optimal” building operation.
- Need to engage commissioning providers, energy service providers and application service providers.
U.S. Department of Energy Re-Tuning Training Outreach

- Re-tuning Training was Originally Developed as part of a Project Funded by the Washington State (www.retuning.org)
- Extending Training Outreach Beyond WA State (www.pnl.gov/buildingretuning)
  - Organization with large building stock interested in getting trained in the re-tuning process
- Working with a number of organization to recruit for both the above approaches
Online Interactive Re-Tuning Training

- PNNL is also Converting the Training into an Online Interactive Training
  - Role based training with help of learning management system
  - Modular
  - Interactive with ability to create abnormal conditions
  - Questions and answers at the end each module and at the end of the course

- PNNL is also looking to automate identification of the no-cost/low-cost operational problems
  - To improve persistence and cost of retro-commissioning
U.S. Department of Energy Re-Tuning Training Outreach

- Re-Tuning Training Outreach
  - Looking for organization with large building stock interested in getting trained in the re-tuning process
- Looking for organization interested in adopting re-tuning training
  - Including organization that will training and certify re-tuners
Additional Easy to Remember URLs

- http://www.pnl.gov/buildingretuning
- http://energy-buildings.org (Main page)
- http://retuning.org (Large Commercial Buildings)
- http://largebuildings.org (Large Commercial Buildings)
- http://smallbuildings.org (Small Commercial Buildings)
- http://buildingenergyeducation.org (Outreach activities)