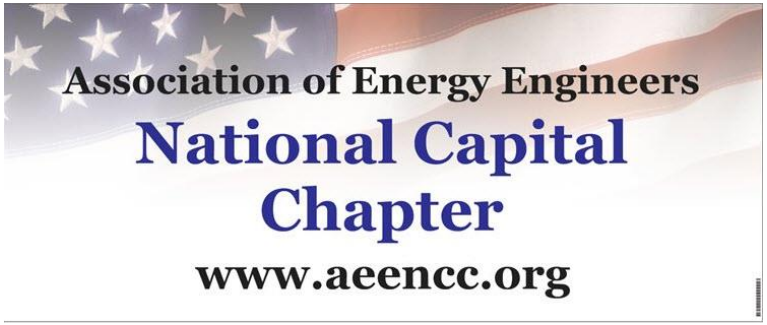
Building Re-Tuning

AEE-NCC
September 11, 2015
Washington, DC

Lisa Shulock



CONSORTIUM for BUILDING ENERGY INNOVATION

Session Objectives

- Understand the purpose of Building Re-tuning
- Discover the potential energy and cost savings
- Understand the leading opportunities for energy savings as a result of building re-tuning
- Assess your organization's readiness to conduct building re-tuning

Acknowledgements:

- The U.S. Department of Energy funded the development of Building Re-Tuning Training

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

- Much of the content of the Building Re-Tuning training was developed by the Pacific Northwest National Laboratory

Pacific Northwest NATIONAL LABORATORY

Building Re-Tuning: Purpose

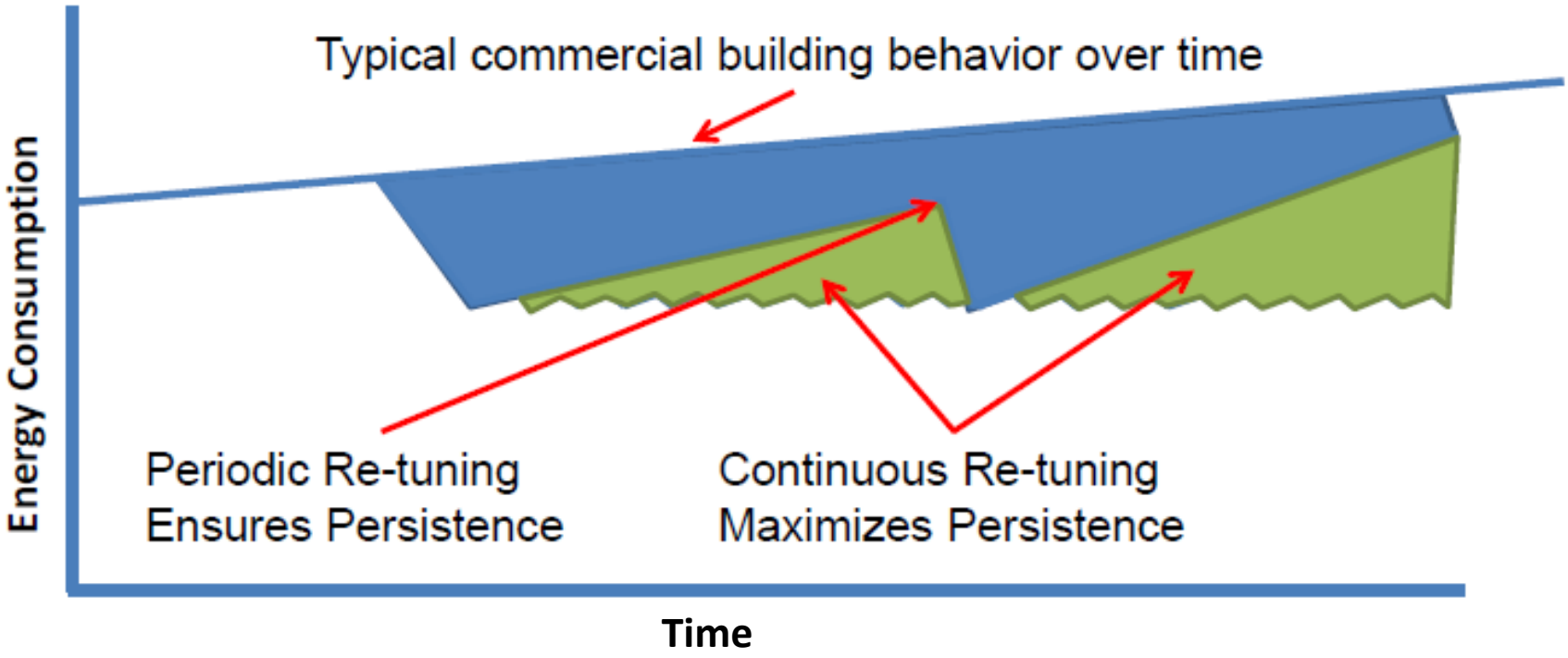
- Improve the building's energy efficiency and tenant comfort
- Identify and correct no/low cost operational problems that lead to energy waste
- Identify problems that require physical repair such as sensors or air dampers

Building Re-tuning:
Basic Energy Management Principles

- If you don't need it, turn it off
- If you don't need it at full power, turn it down
- Make holistic energy decisions when adjusting systems to the real building needs
- Save energy without negatively impacting the comfort of the occupants

Life Cycle of Building Performance

- Re-tuning should be repeated on a quarterly or monthly basis to maximize savings



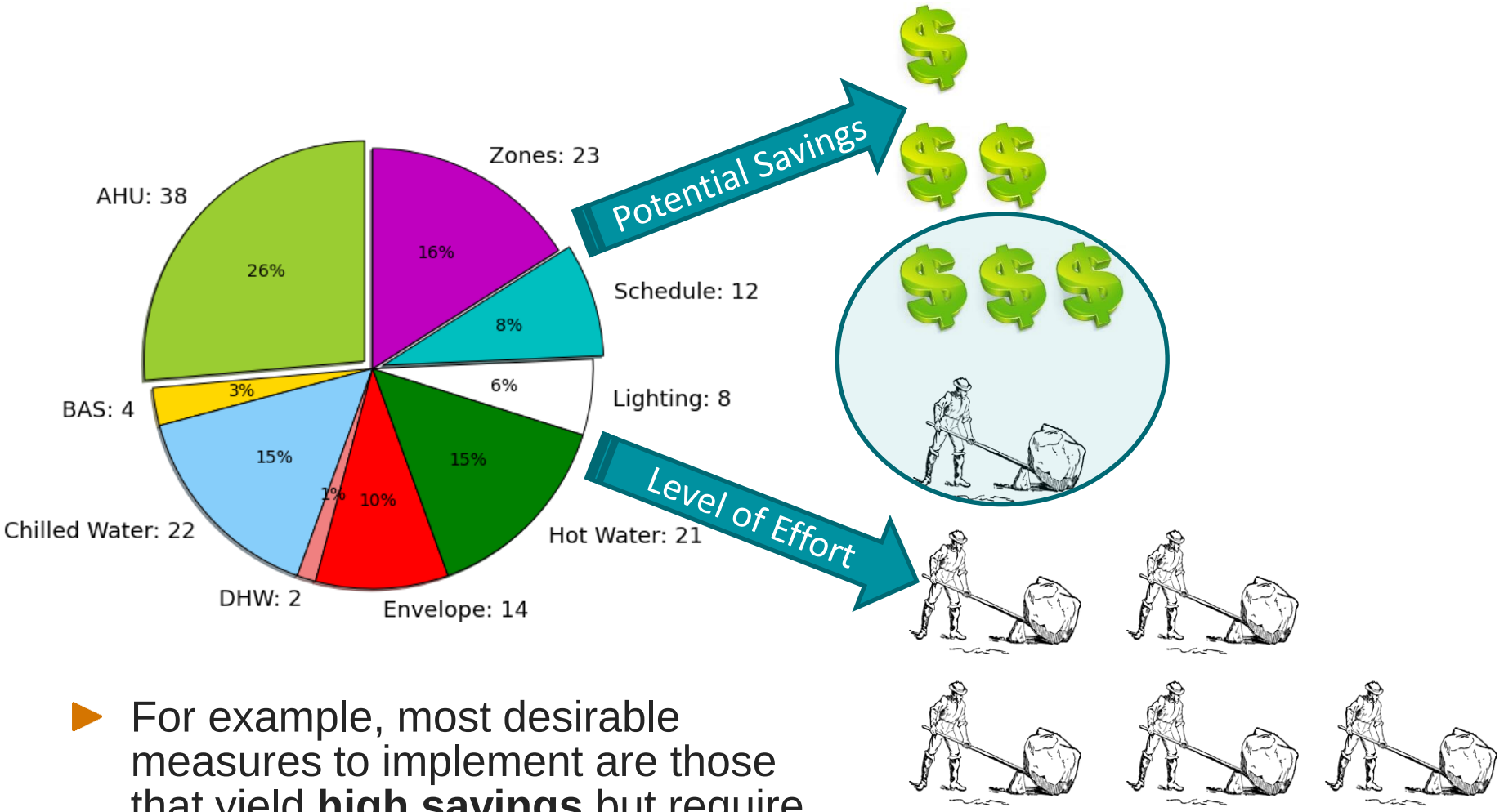
Building Re-tuning: Why?

- The new frontier of building operations
- Re-tuning skills can be developed in almost any job skill set
- Low- to no-cost method for improving your building's energy performance and savings money
- Often results in improved tenant comfort and less tenant complaints

Benefits of BRT

- Energy Savings
- Cost Savings
- Improved Tenant Comfort
- Improved Energy Ratings
- Longer equipment life

Classification of Re-tuning Measures



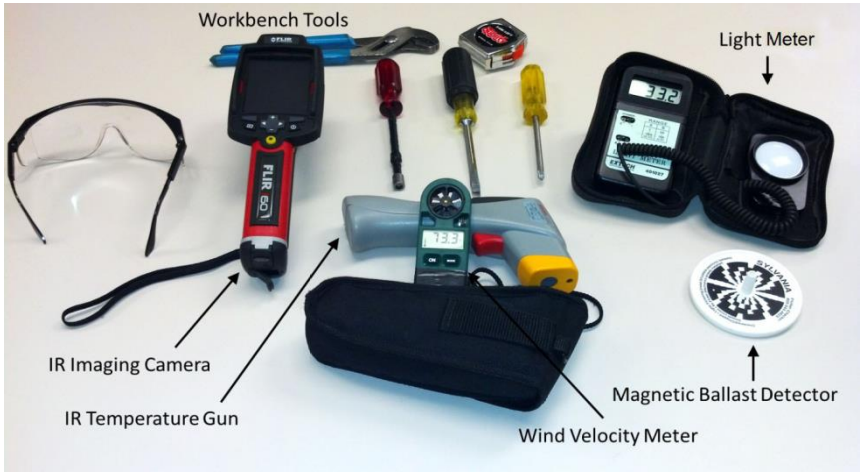
- For example, most desirable measures to implement are those that yield **high savings** but require **low effort**
  - Scheduling measures fall in this category

Building Re-tuning: Multiple Paths

- Non-BAS Prescriptive Field Checks – walk through of building and equipment following a checklist of visual and simple measurement checks
- Prescriptive Guidelines – check for and correct a limited set of simple operational control issues within the building automation system (BAS)
- Data-driven Analysis – deeper investigation of many and complex control issues from the BAS and energy meters

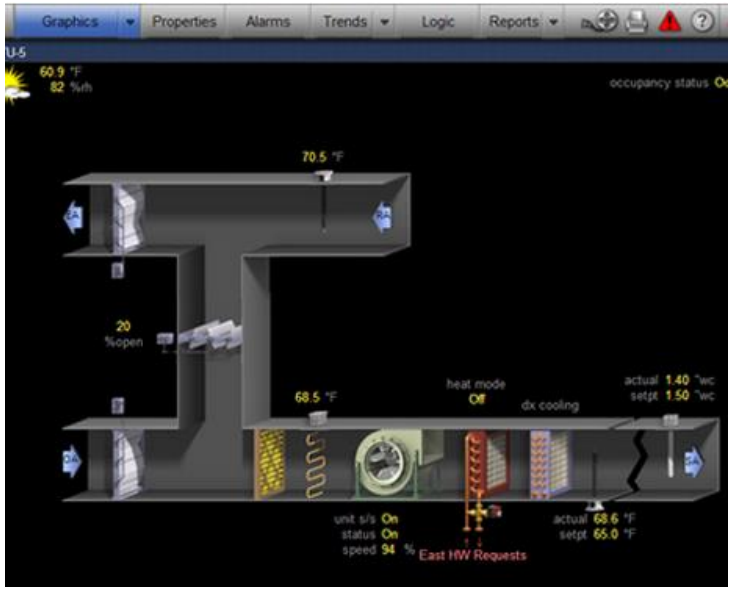
Building Re-tuning:
Non-BAS Prescriptive Field Checks

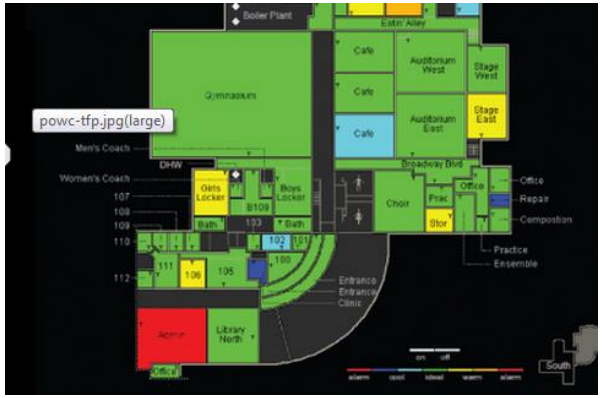
- Applicable to all buildings but most useful for smaller commercial buildings with rooftop HVAC equipment and no BAS
- Enables staff to diagnose malfunctioning or broken equipment and maintenance issues
- Requires sufficient knowledge of the equipment operation and the schedules of the building



Building Re-tuning: Prescriptive Guidelines

- Applicable to buildings that are controlled by a building automation system (BAS)
- Enables staff to determine if a limited set of the simpler re-tuning measures are present.
- Requires sufficient knowledge of the equipment operation and the schedules of the building, and basic knowledge of and read-only access to the BAS user interface





Parmenter "prescriptive" BRT

Parmenter Realty Partners
Re-Tuning Training Action Items

ParmenterGREEN
HIGH PERFORMANCE BUILDINGS

Instructions:

Step 1: save this file as "Re-Tuning Follow Up Action Log - YOUR PROPERTY NAME"
Step 2: Fill in Column H for each Re-Tuning ECM (Energy Conservation Measure) with an indication of whether this measure has been implemented at your property. If not, why not? If the ECM is not applicable, briefly explain why. If it requires an expense, briefly explain what the project scope should be.
Step 3: If the ECM has been implemented, please estimate the resulting actual energy savings in Column I.

Category A: Low-Cost/No-Cost Re-Tuning ECMs

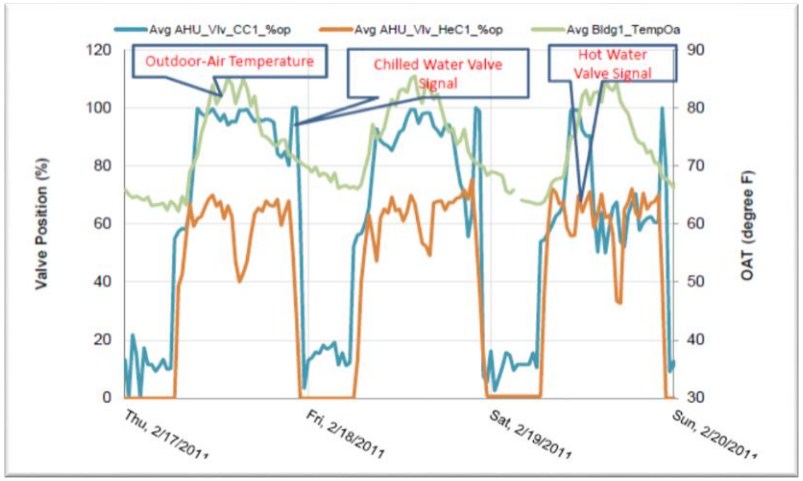
	#		ECM (Energy Conservation Measure)	Effort	Potential Savings	Property Actions/Comments	Actual Savings
A	1	HVAC Equipment	Consider tightening up the air handling unit (AHU) start schedules in winter (October – April), such that when outdoor air temperatures (OATs) are < 55oF, the primary AHUs are not allowed to run until just before the true occupancy period starts (7 AM). This strategy works well for AHUs that have perimeter, fan-powered boxes with integral heating coils and fans (such as at Las Colinas Towers). These fan-powered boxes are designed to deliver tempered air to most of the floor spaces, but this capability needs to be verified prior to implementation.	Low	High		
A	2	HVAC Equipment	Evaluate implementation of optimal start to allow for intelligent recovery. Ensure night setback high and low limits are in place and working to automatically activate the heating, ventilation and air conditioning (HVAC) system (AC-3 and chiller plant as needed) to keep the building space conditions from dropping too low or rising too high during unoccupied periods (suggest 62oF and 84oF,respectively, for low and high limits).	Medium	Medium		

Parmenter "prescriptive" BRT

A	**16**	Building Envelope	Repair or replace door seals at edges (top, bottom and middle –if double door) and seal or repair exterior holes and penetrations around piping or removed piping.	Low	Low
A	**17**	Lighting	Evaluate parking garage lighting. The lights (metal halide) appear to provide adequate lighting (excess lighting?) for the space. Evaluate de-lamping and/or automated controls that can turn lights off when not occupied.	Medium	High
A	**18**	Lighting	Evaluate interior lights for interior hard walled spaces that are on occupancy sensors (but not working properly) and repair, replace or adjust as required.	Medium	Medium
A	**19**	Compressed Air	Evaluate system for leaks and for improperly set pressure regulators. Repair leaks and correct regulator settings.	Low	Medium
A	**20**	Domestic HW	Consider tightening up schedules so domestic hot water systems are shut down after 4 PM and for all weekend/holiday periods.	Low	Medium

Building Re-tuning: Data-Driven Analysis

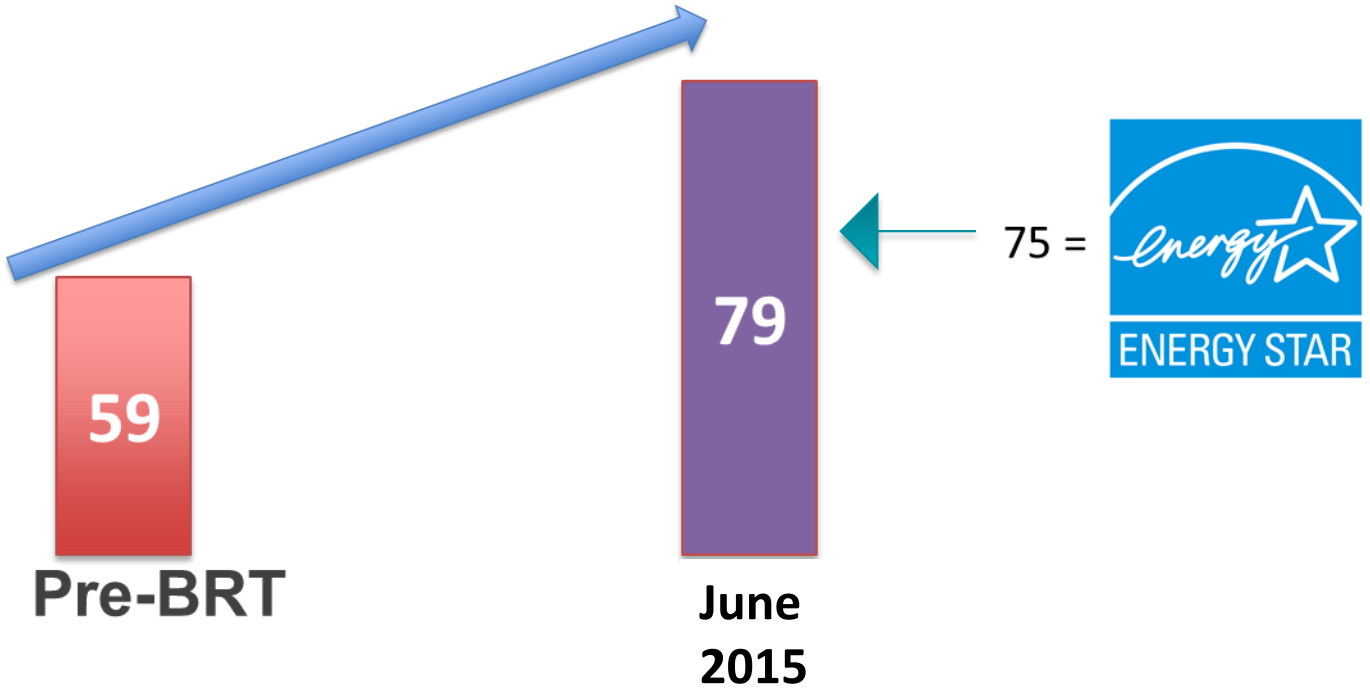
- Applicable to buildings that are controlled by a building automation system (BAS)
- Enables staff to determine the presence of a wide range of simple and complex re-tuning measures
- Requires sufficient knowledge of the equipment operation and the schedules of the building, setting up and exporting trend data (history of equipment's set points and performance) from the BAS, as well as working in Excel



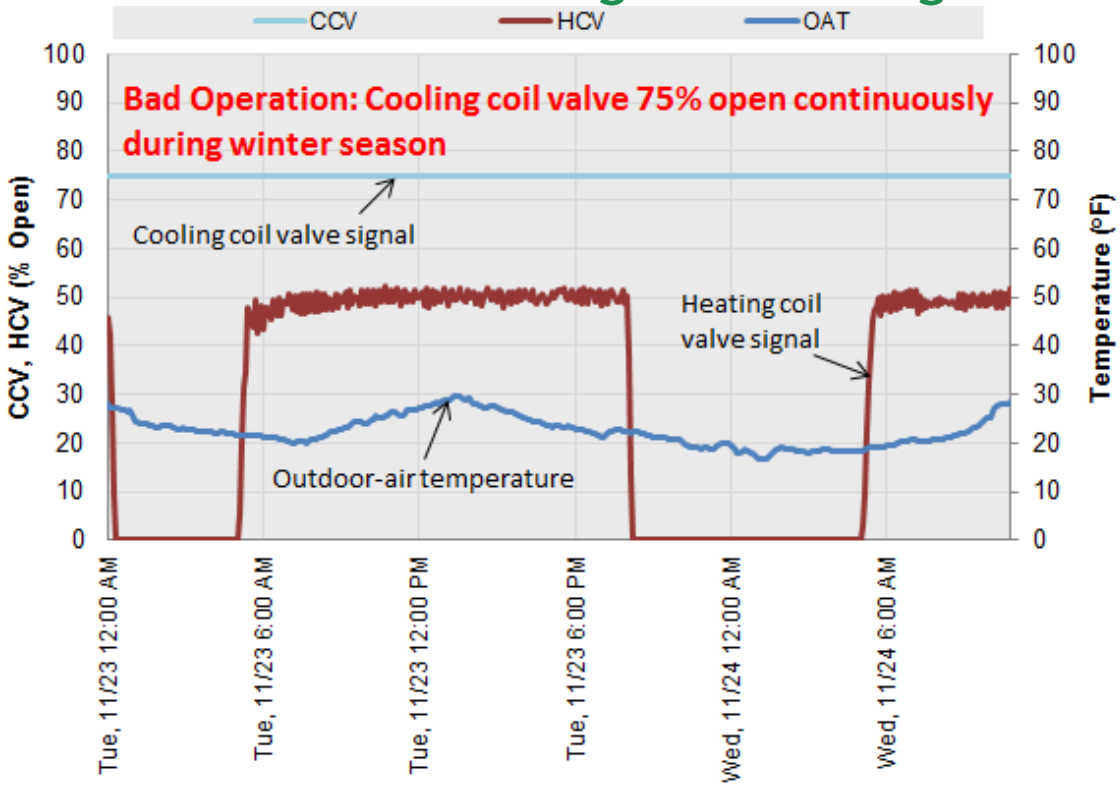
Real Results from BRT: Case Study

Building: Las Colinas
Size: 350,000 SF
Use: Commercial Office
Location: Dallas, TX
Owner/Manager: Parmenter Realty Partners

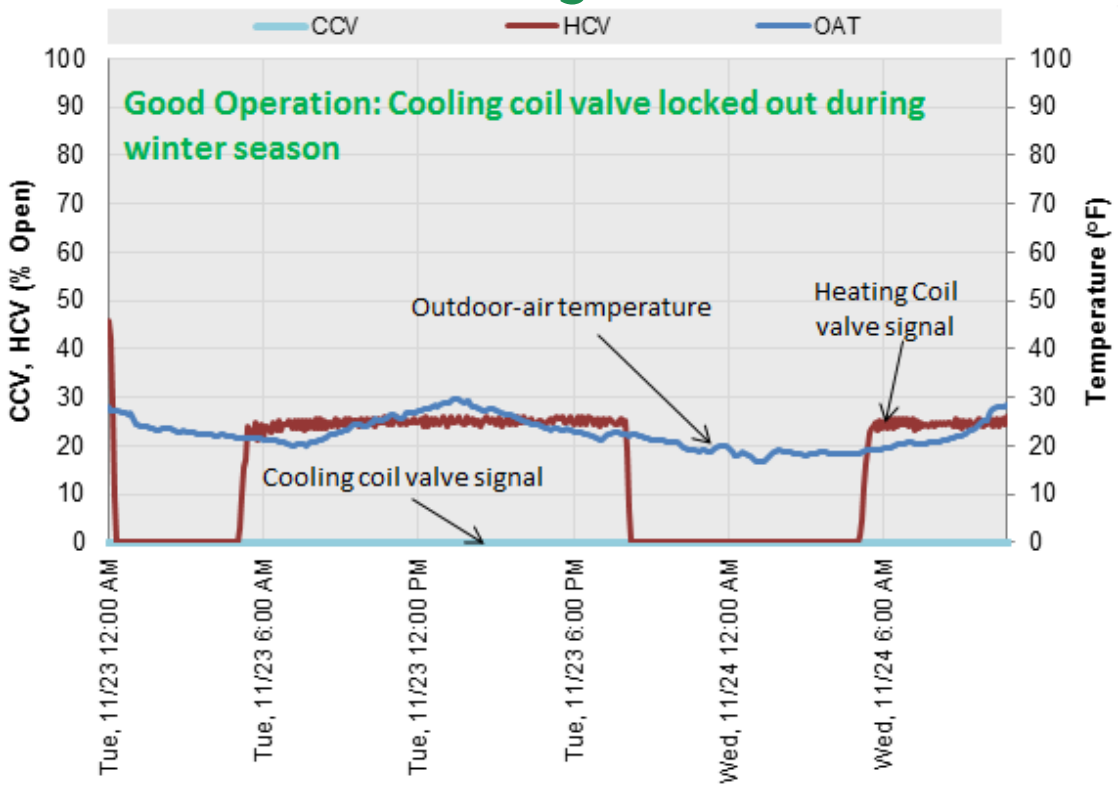
Energy Start Portfolio Manager Score



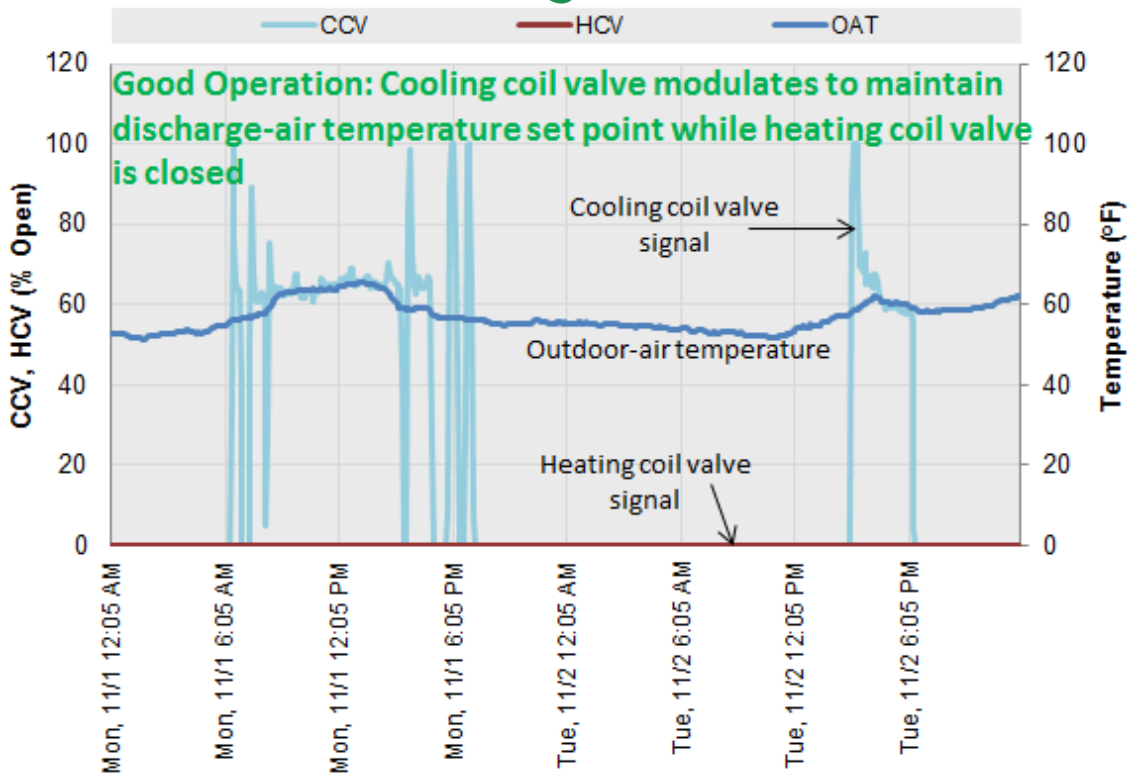
Simultaneous Heating and Cooling



Cooling Valve Lockout



Heating Valve Lockout

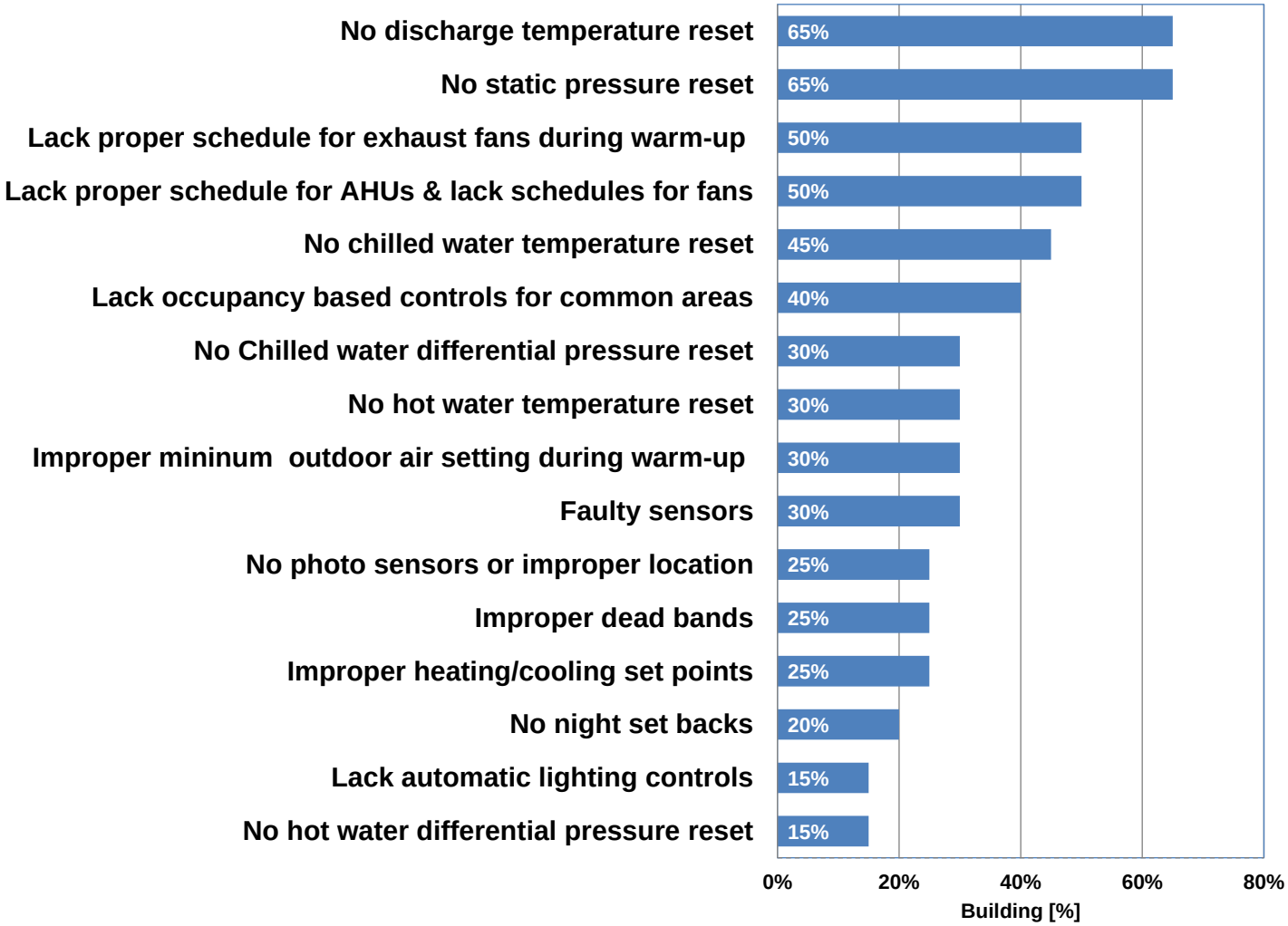


Real Results from BRT: PNNL Meta-Analysis

- 100 buildings underwent re-tuning using the BAS Data-driven Analysis technique
- The majority of the buildings were from large portfolio owners and the GSA
- Annual energy savings ranged between 2% to 26%, with a median savings of 15%
- Annual normalized cost savings ranged between $0.05/sf to $0.60/sf, with a median savings of $0.12/sf

Pacific Northwest
NATIONAL LABORATORY

Real Results from BRT: Most Common Re-tuning Measures



Pause for questions

- Next set of slides are about training options and opportunities

BRT – options for buildings without BAS

Course	Pre-req	Purpose	Training Time Commitment	Delivery Format
Non-BAS BRT "Prescriptive" – Re-tuning opportunities found through building walkdown	Basic building knowledge; comfort with material in "BRT Primer"	BRT for small/medium buildings without BAS	1 day	Instructor-led, in-person – mix of classroom instruction and building walkdown
PNNL BRT for Buildings without BAS	See above	BRT for small/medium buildings without BAS	2-4 hours	Online, on-demand with walkdown simulation

BRT – options for buildings with BAS

Course	Pre-req	Purpose	Training Time Commitment	Delivery Format
Data-driven approach to Building Re-Tuning	Basic building knowledge; comfort with material in "BRT Primer" Access to and familiarity with BAS; Excel experience	Comprehensive review of using BAS data to drive retuning	3-4 days spread over time	Instructor-led, in-person or webinar with online course supplement *(details on next slide)*
PNNL BRT for Buildings with BAS	Basic building knowledge; comfort with material in "BRT Primer"	Review of BRT for large buildings including using BAS data	4-8 hours	Online, on-demand

BRT Modules for Data-Driven BRT program

Module	Pre-req	Purpose	Training Time	Delivery Format
1-BRT Prescriptive Guidelines	Basic building knowledge; comfort with material in "BRT Primer"; BAS access	Guidance for limited BRT through BAS interface	1 hour	Webinar
2- PNNL BRT for Buildings with BAS	See above	Prep for Data-driven course	4-8 hours	Online, on-demand
3- BRT Data-driven Analysis Course	Module 2	Mastering BRT	10 hours	In-person for pilot; webinar ongoing
4- BRT Trend Data Setup Course	Module 2	Mastering BRT	3 hours	In-person for pilot; webinar ongoing
5- BRT Implementation Support	Module 3 & 4	Walk the O&M team through their first BRT	4 hours; optional additional consulting	Webinar

BRT Options for National Capital Region

- Prescriptive/non-BAS
  - PNNL online
  - In-person: APPA and BOMA have trained trainers to deliver training
- Data-Driven (with BAS)
  - PNNL online
  - Webinar series being piloted over next 6 months
  - PSD training
- Many resources available online
  - PNNL http://buildingretuning.pnnl.gov/
  - CBEI http://cbei.psu.edu/retuning-training-and-cases/

We need your input

- Do you think you want to bring re-tuning to your company?
- Who would be trained?
- Do we need a 1-2 hour training similar to this session for property managers before they send facility engineers to a training?

Questions/discussion

Lisa Shulock

Lshulock@engr.psu.edu

215-218-7582

CBEI/Penn State

CONSORTIUM for BUILDING ENERGY INNOVATION

Association of Energy Engineers
National Capital Chapter
www.aeencc.org