

FEMP Re-tuning Challenge Webinar

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Introduction to the FEMP Re-tuning Challenge Webinar

- **The objective of the FEMP Re-tuning Challenge is to demonstrate**
 - How re-tuning is done
 - Help you build your capability to complete re-tuning on your own
 - Ultimate goal is to train the trainer
- **Today we will discuss**
 - Why FEMP is sponsoring the Re-tuning Challenge
 - What the Re-tuning Challenge is
 - What re-tuning is
 - Next steps for interested sites
- **O&M Working Group – Request Participation**

Why FEMP is Sponsoring the Re-tuning Challenge?

- Building re-tuning is an effective, low-cost method for reducing building energy use.
- Building re-tuning identifies opportunities primarily through Building Automation System (BAS).
- Re-tuning federal buildings, to date, has resulted in savings that typically range from 5 – 25% with a simple payback of 0.3 – 3.5 years.
- Re-tuning is a contributing approach to overall energy management program (i.e. ISO 50001).



James M. Carter and Judith N. Keep Courthouse
GAO-18-420

- DOE program offers a **no-cost** way to receive **DOE recognition** for establishing a business practice around the management of energy
- Not a certification program and **no third-party audits** or verification
- DOE provides **free tools and technical assistance** to implement and maintain 50001

Key Actions in a 50001 Ready EnMS

- Set an Energy Policy
- Have management commitment
- Empower an energy team
- Identify where energy is used
- Create plans to improve energy use
- Management approval of plans
- Track progress and reassess energy action plans

Key Benefits of a 50001 Ready EnMS

- Manage risk associated with energy performance and projects
- Reduce energy-related costs
- Develop pipeline of vetted and prioritized energy projects
- Dedicate more resources to energy improvement opportunities
- Demonstrate leadership and compliance with federal requirements

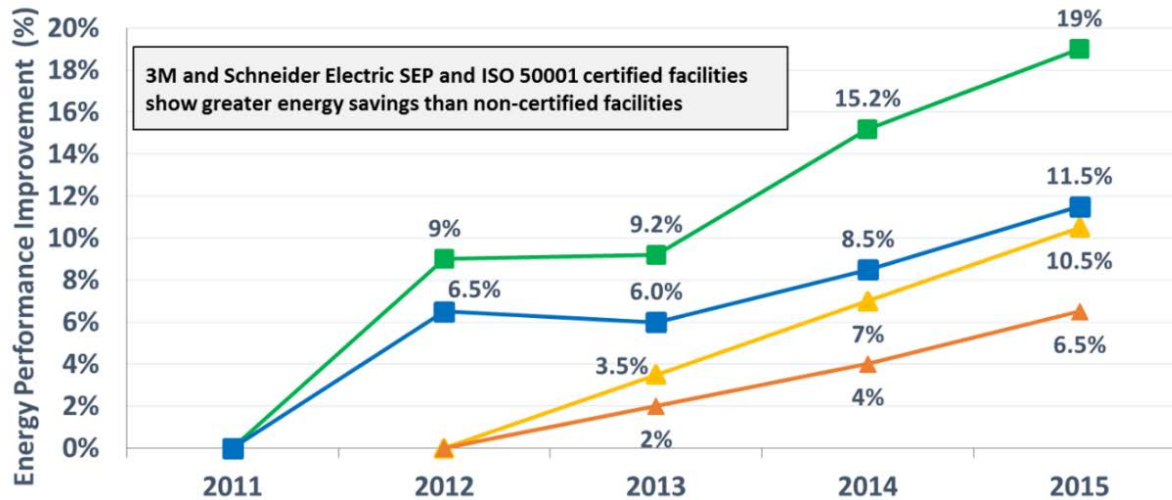
Energy Manager Note

50001 does not necessarily mean you need to do something NEW. It is often a reorganization of existing activities and commitments in a streamlined and replicable architecture

Field Validation of ISO 50001 Savings

Proven data around typical US energy savings over time.

- Business-as-Usual [EIA] ~1% per year
- Industry Leaders [Better Plants] ~ 2.5% per year
- **ISO 50001 facilities [DOE] ~4% per year**
- **Enterprise-Wide Approach [DOE] ~5% per year**



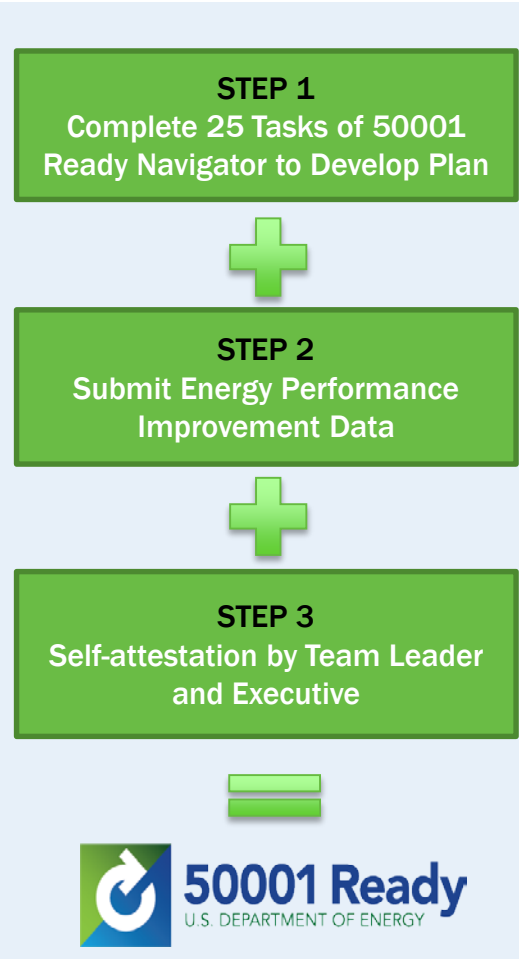
3M and Schneider Electric SEP and ISO 50001 certified facilities show greater energy savings than non-certified facilities

Data analysis conducted by 3M and Schneider Electric

- Schneider Electric: ISO 50001 and SEP Certified
- Schneider Electric: Not ISO 50001 or SEP Certified
- 3M: ISO 50001 and SEP Certified
- 3M: Not ISO 50001 or SEP Certified

Energy Manager Note

Within the companies' own facilities they found a doubling of energy performance. They also had robust EnMS in place already so it started (like federal sites) with existing energy mgmt



Testimonial: Tinker Air Base (USAF base)

“The strength of our [ISO 50001] Continuous Energy Improvement program is that we get the people who understand each operation to think about how to do things a little differently – to change their processes in some way to save energy.”

“Energy Improvement is precisely the kind of operational discipline we are good at. We’re just applying that skill in a new way.”

Joseph Cercle
OC-ALC Energy Manager



Contact Jay.Wrobel@ee.doe.gov or Brad.Gustafson@ee.doe.gov
Or visit energy.gov/50001Ready for more info or to get started

What is the Re-tuning Challenge?

- **Re-tuning Challenge** is to provide agencies with training and apply learned methods to building in their portfolio.
- **Sites can still participate in training even if not selected.**
- **FEMP will provide the following support:**
 - Selected sites (3 – 5 sites):
 - Completed re-tuning of one building
 - Re-tuning training for site staff
 - Technical support for a site staff re-tuning effort
 - Results monitoring and presentation
- **Site participation**
 - Interested sites will be screened for re-tuning applicability (details later in the webinar)
 - Sites will be selected by June 27, 2019

Re-tuning

- **Re-tuning is a process of improving control of existing building energy systems, centered on the BAS of centrally controlled buildings through**

- The application of the sidebar principles on the right, embodied in a few dozen best-practice re-tuning measures
- Identification and correction of faulty control infrastructure
- Adopting strategies for better monitoring and control into the culture and mindset of the building operators (e.g. use of trend data and training on how to manipulate reset parameters for “tuning”)

- **Benefits of re-tuning are**

- **Energy savings** typically range from 5 – 25%*
- **Cost savings and cost effectiveness** average \$0.185/sf-year and show a simple payback of 0.3 – 3.5 years*
- **Thermal comfort**, through correction of faults, and making airside systems responsive to specific zone demands.

* Based on PNNL experience with GSA buildings



“Mitigate simultaneous heating and cooling”



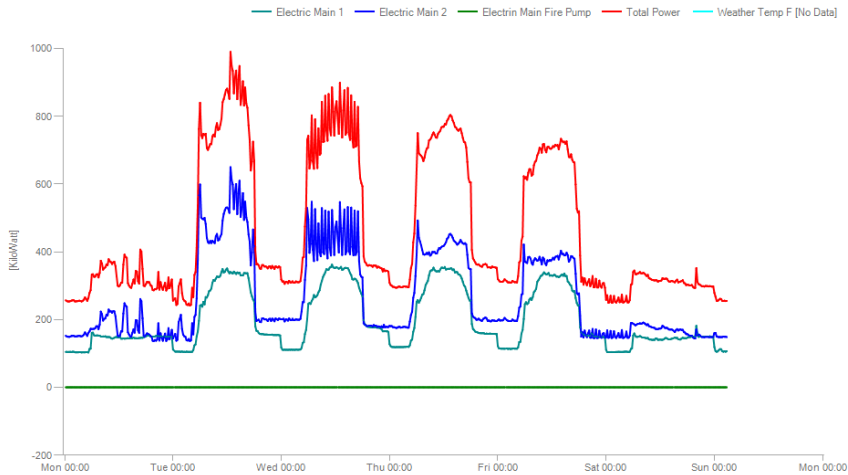
“Reduce infiltration and outdoor air”



Re-tuning Methodology for Identifying Opportunities

Investigation

Oct 13 2014 to Oct 20 2014



VS.

Best Practice Checklist

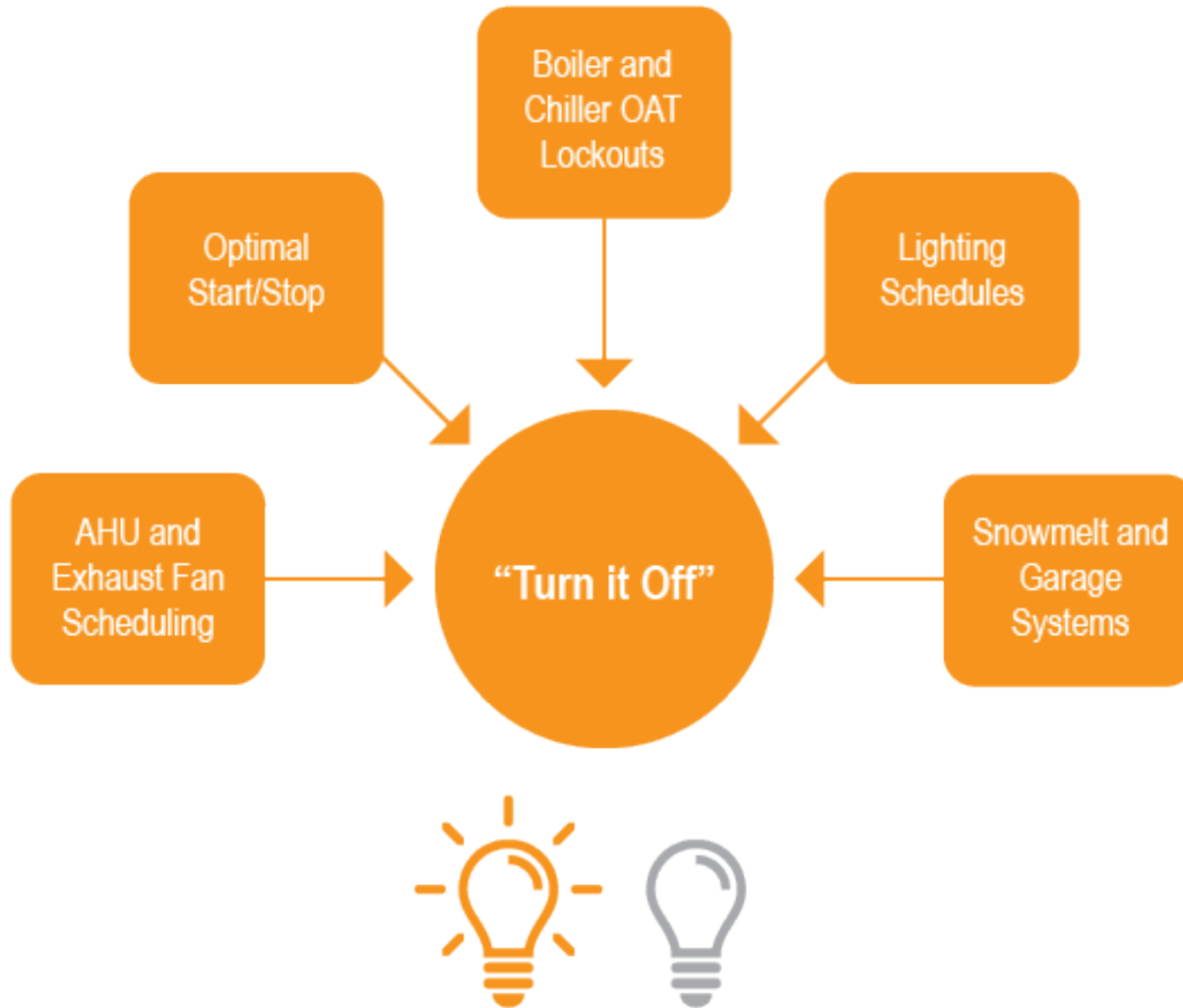
Control Type	Baseline Observations	Opportunity
AHU Duct Static Pressure		
AHU Supply Temperature		
VAV Minimum Airflow		
Optimal Start/Stop		
AHU Schedules		
AHU Economizers		
Minimum Outdoor Air		
Chiller Lockouts		
VFD Pump DP Control		

...AND Problem Solving

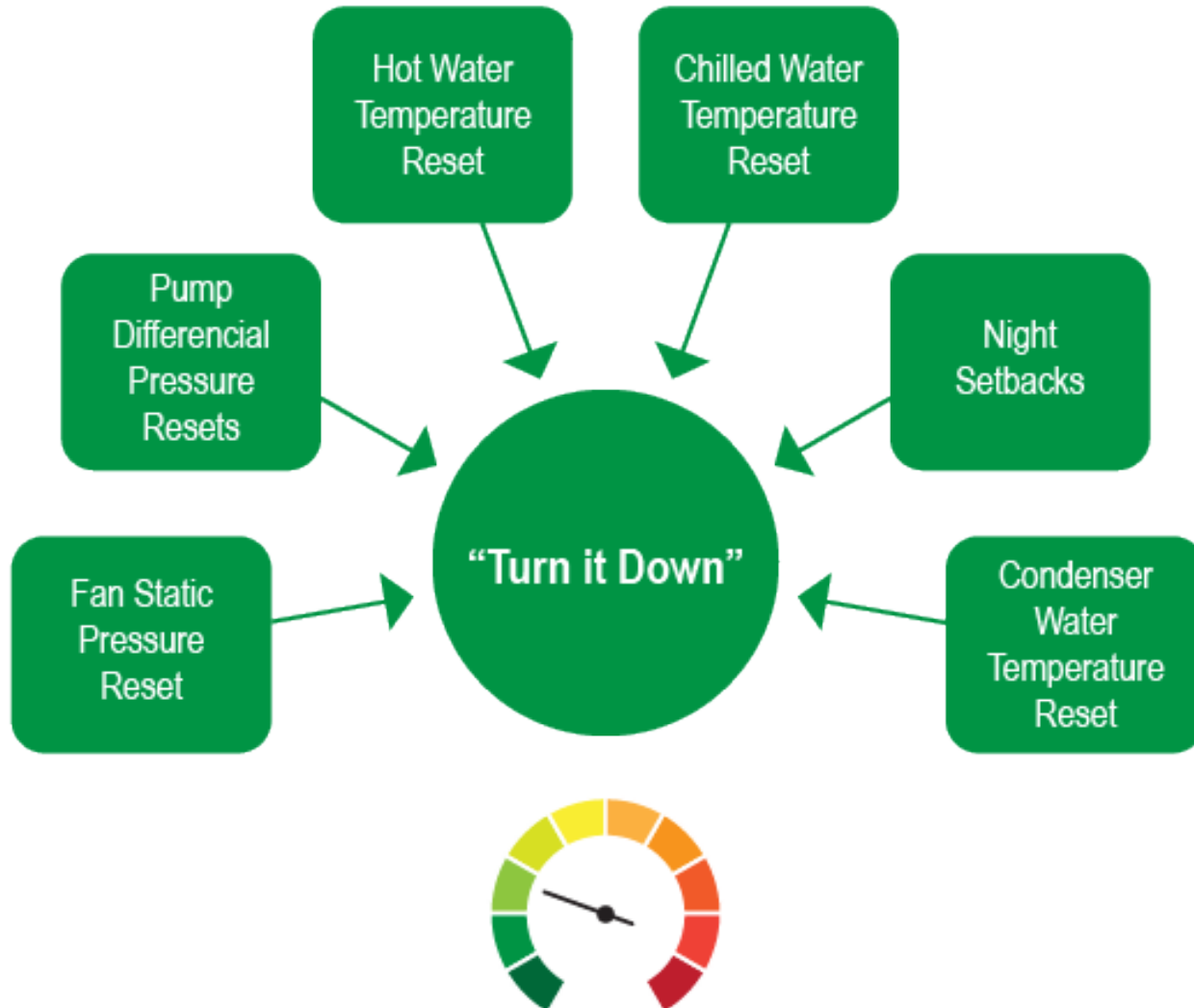


- Interval-Metered Data
- Trend Data
- BAS Graphics
- Sequence of Operations

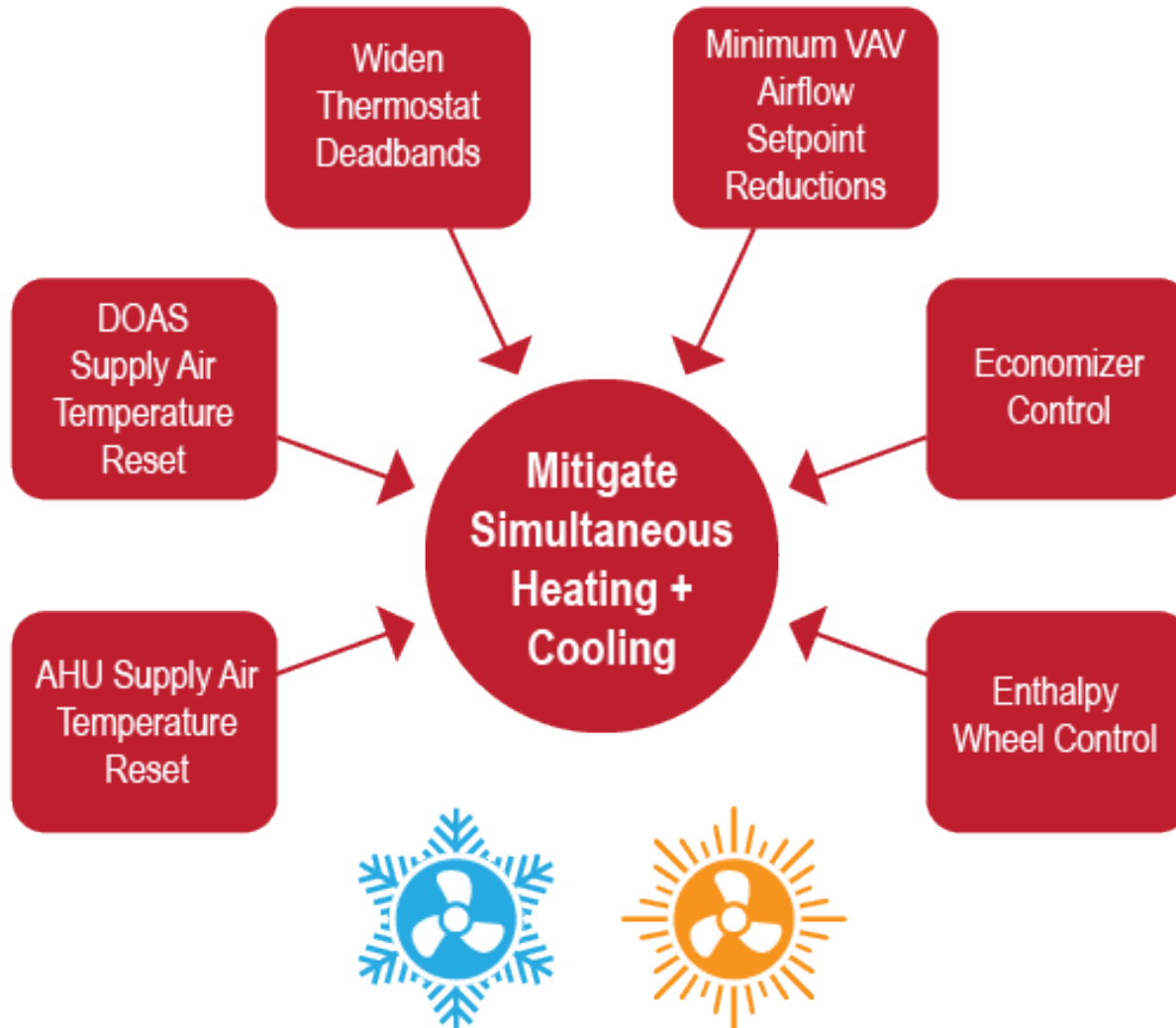
Re-tuning Checklist: Re-tuning Principles



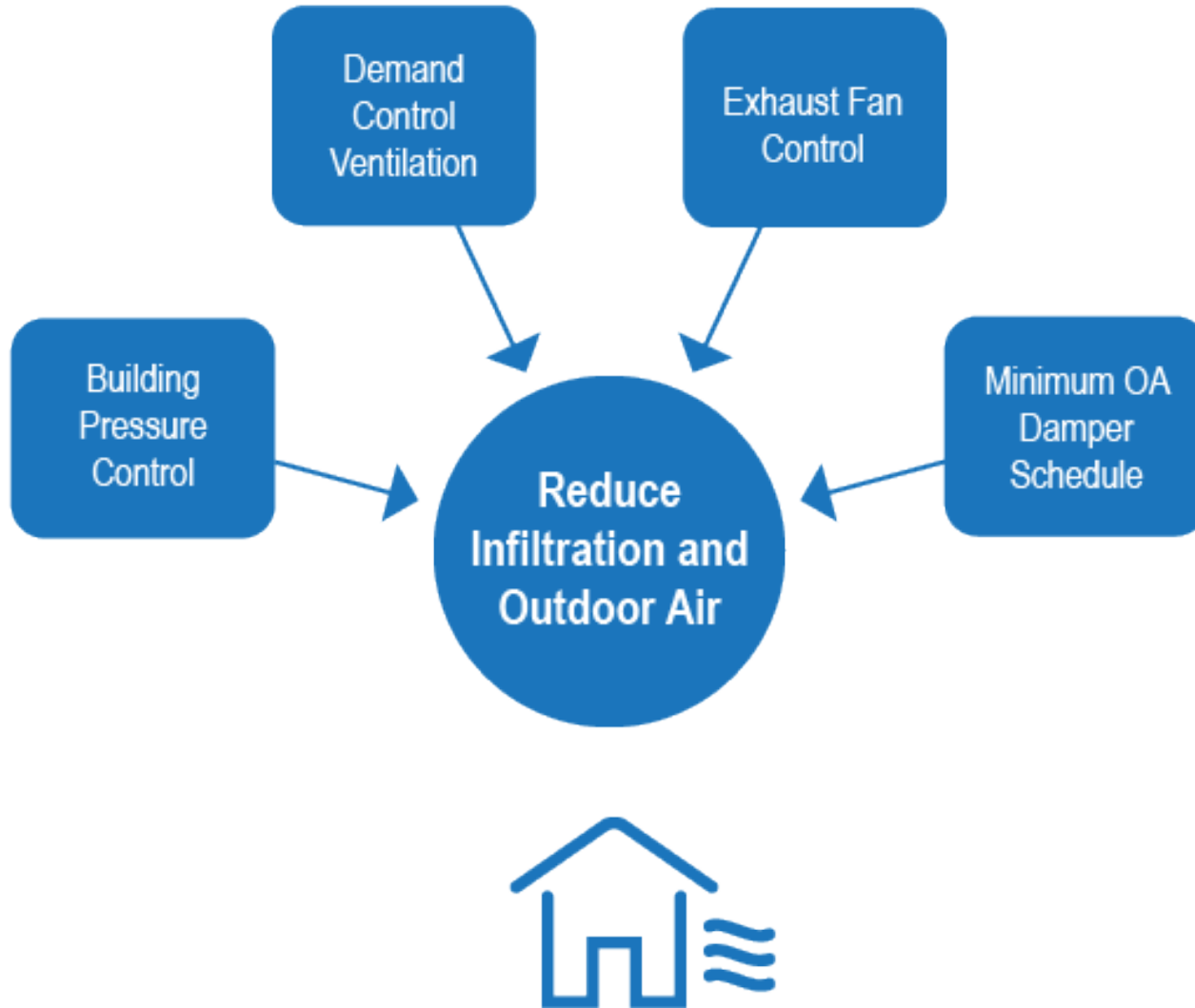
Re-tuning Checklist: Re-tuning Principles



Re-tuning Checklist: Re-tuning Principles



Re-tuning Checklist: Re-tuning Principles



Re-tuning Principles for Formulating Recommendations

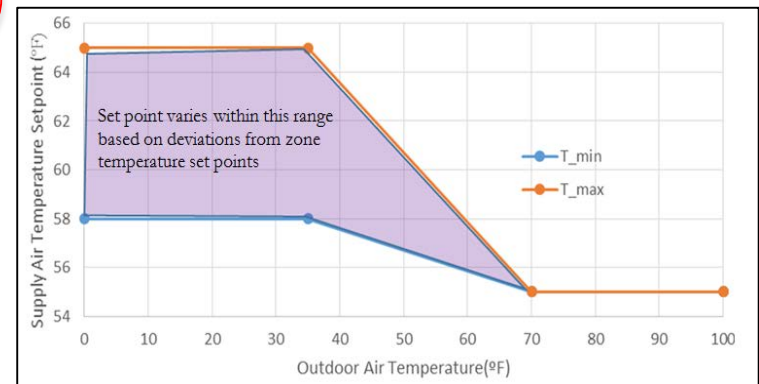
- **Stick to “tried-and-true” methodologies and best practices**
 - ASHRAE-Approved strategies
 - Standard minimum and maximum setpoints for resets
 - Choose common feedback variables
 - Trim-and-respond versus linear span resets
- **Take the path of least resistance**
 - Make use of control points that are already being calculated
 - Make use of existing resets, evaluate performance and tune, rather than re-inventing resets
 - Take an appropriate sample, if the number of points required for the programming becomes excessive.
- **Take into account observations about the baseline state**
- **Talk-through with building operators and identify limitations and consequences.**
- **Perform demonstration on one system first**

Re-tuning; Sample Recommendation

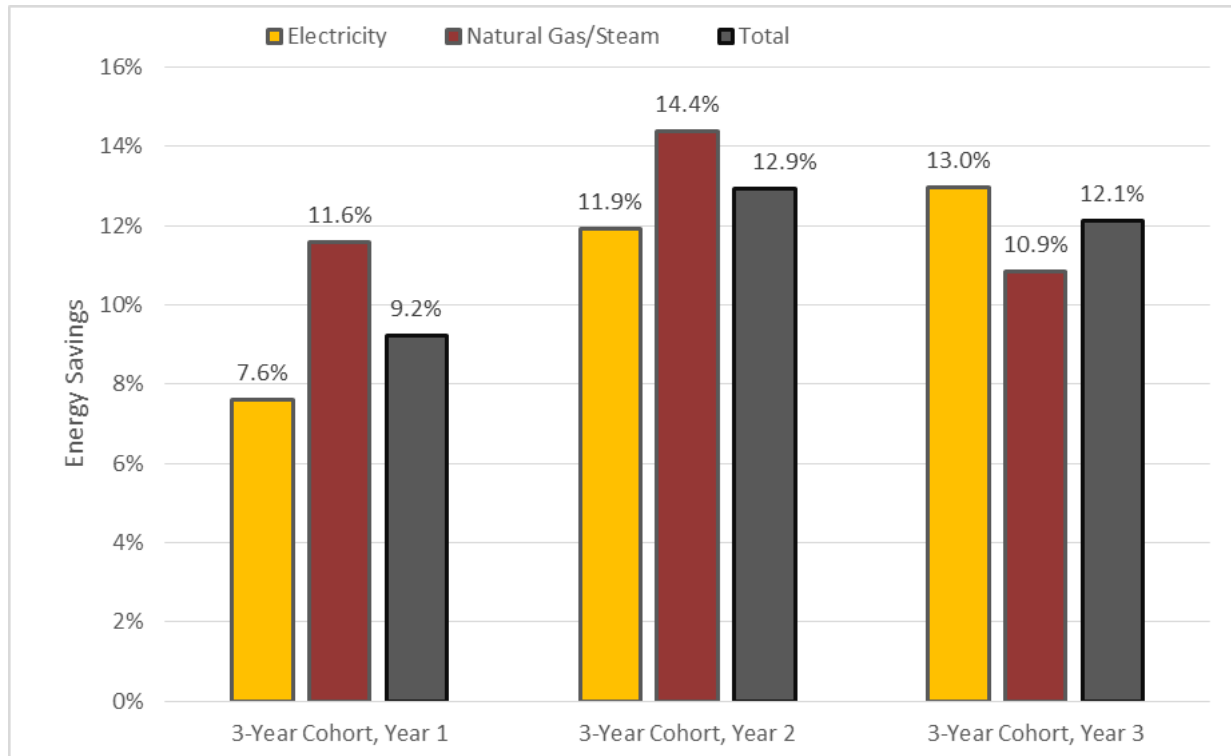
Measure 1: Supply-Air Temperature Reset
Observation:
<ul style="list-style-type: none">• The east and west AHUs on all 10 floors have constant year-round supply-air temperature (SAT) set points of 52°F.• These set points are extremely low, and cause the following:<ul style="list-style-type: none">○ In winter: excess use of waterside economizer followed by excess use of reheat at the terminal boxes,○ In shoulder seasons: excess use of chillers followed by excess use of reheat at the terminal boxes,○ In summer: exacerbation of use of reheat coils (the ultimate cause for their use is high terminal box airflow set points).
Recommendation:
<ul style="list-style-type: none">• January 2016: SAT reset, based on Stephen Taylor's (PE, ASHRAE) SAT reset strategy!• SAT reset based on average zone temperature (corridors and mechanical spaces excluded) with outdoor-air temperature (OAT) based limits imposed.<ul style="list-style-type: none">○ First step: Find average deviation from zone temperature set point○ Second step: Reset from 65°F at -0.5°F deviation to 55°F at 0.5°F deviation○ Third step: Impose maximum set point of 65°F at 35°F OAT, reset down to 55°F at 70°F OAT○ Fourth step: Impose minimum set point of 58°F at 35°F OAT, reset down to 55°F at 70°F OAT• The reset strategy is shown graphically in Figure 1.• February 2016: It was observed after implementation that the solar load on the perimeter zones was causing localized overheated zones that were not being adequately captured by the averages along the entire floor. The reset should be modified to be based on the maximum of perimeter (by façade) and interior zone thermostat deviations, rather than a single overall average deviation. The current reset programming can be found for each AHU in Workplace Pro under MNB_XX_AH_YY→DA_T_Reset, where XX and YY vary by AHU. A sample block diagram of

- Investigation and Problem Solving
- Take Into Account Observations about the Baseline State
- Stick to “Tried-and-True” Methodologies and Best Practices

Figure 1.

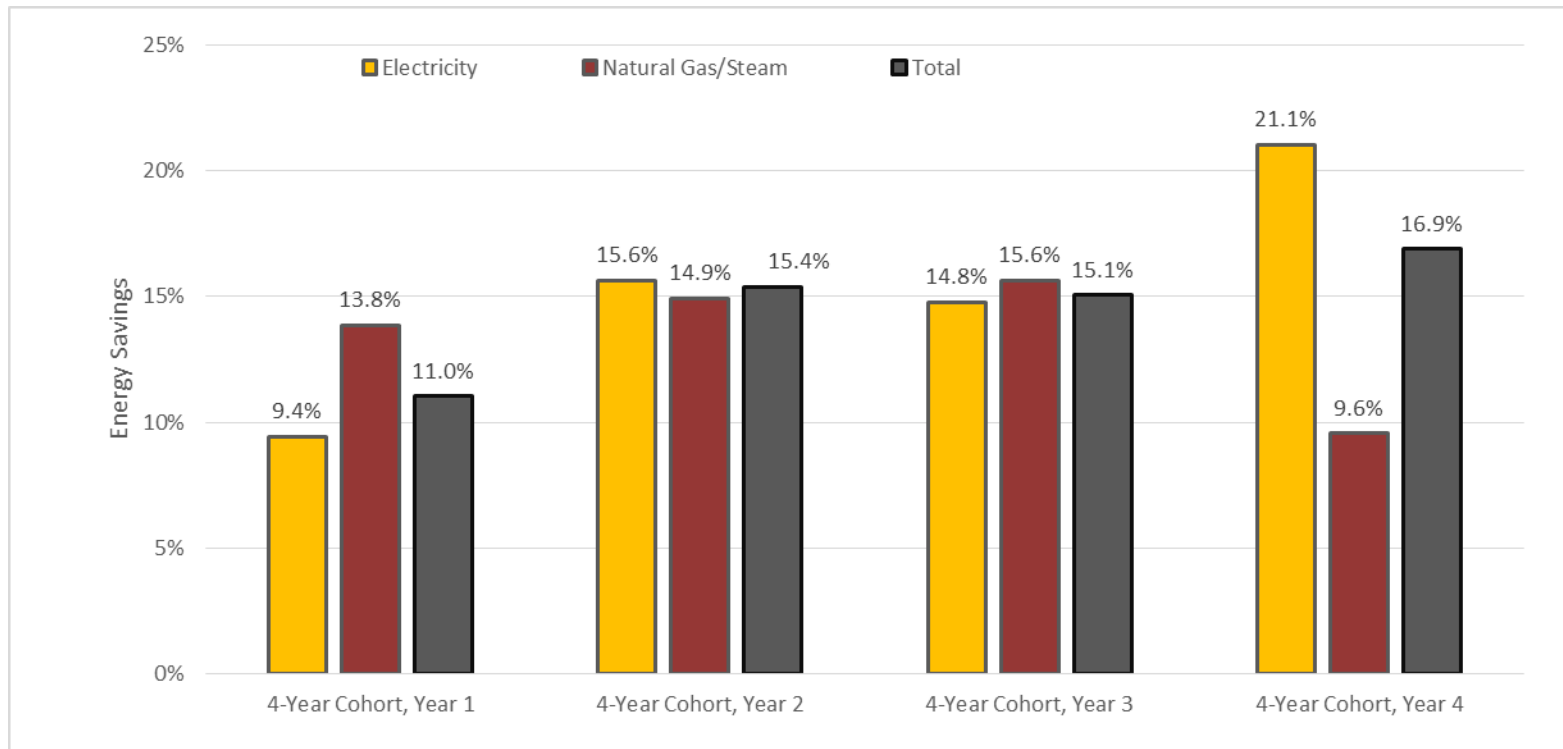


GSA Energy Savings and Its Persistence (3-Year Cohort)



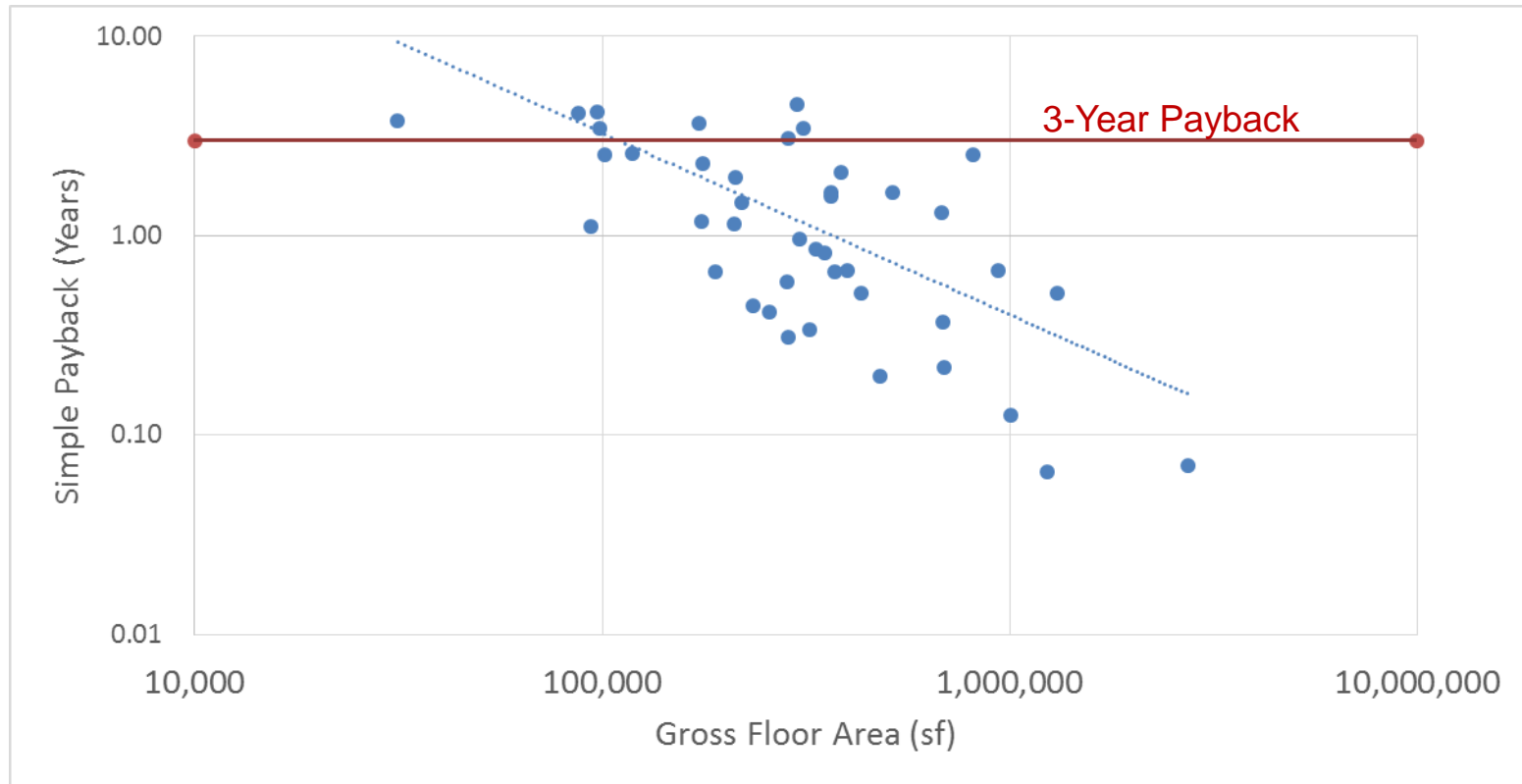
- **42-Building Cohort with at least 3-Years Post-Site Visit**
- **Two sites with major occupancy reductions removed**
- **Additional 3.7% Savings Year 1 to Year 2 (Completion of implementation may be 6-months to 18 months after site visit)**
- **-0.8% Savings Year 2 to Year 3**

GSA Energy Savings and Its Persistence (4-Year Cohort)



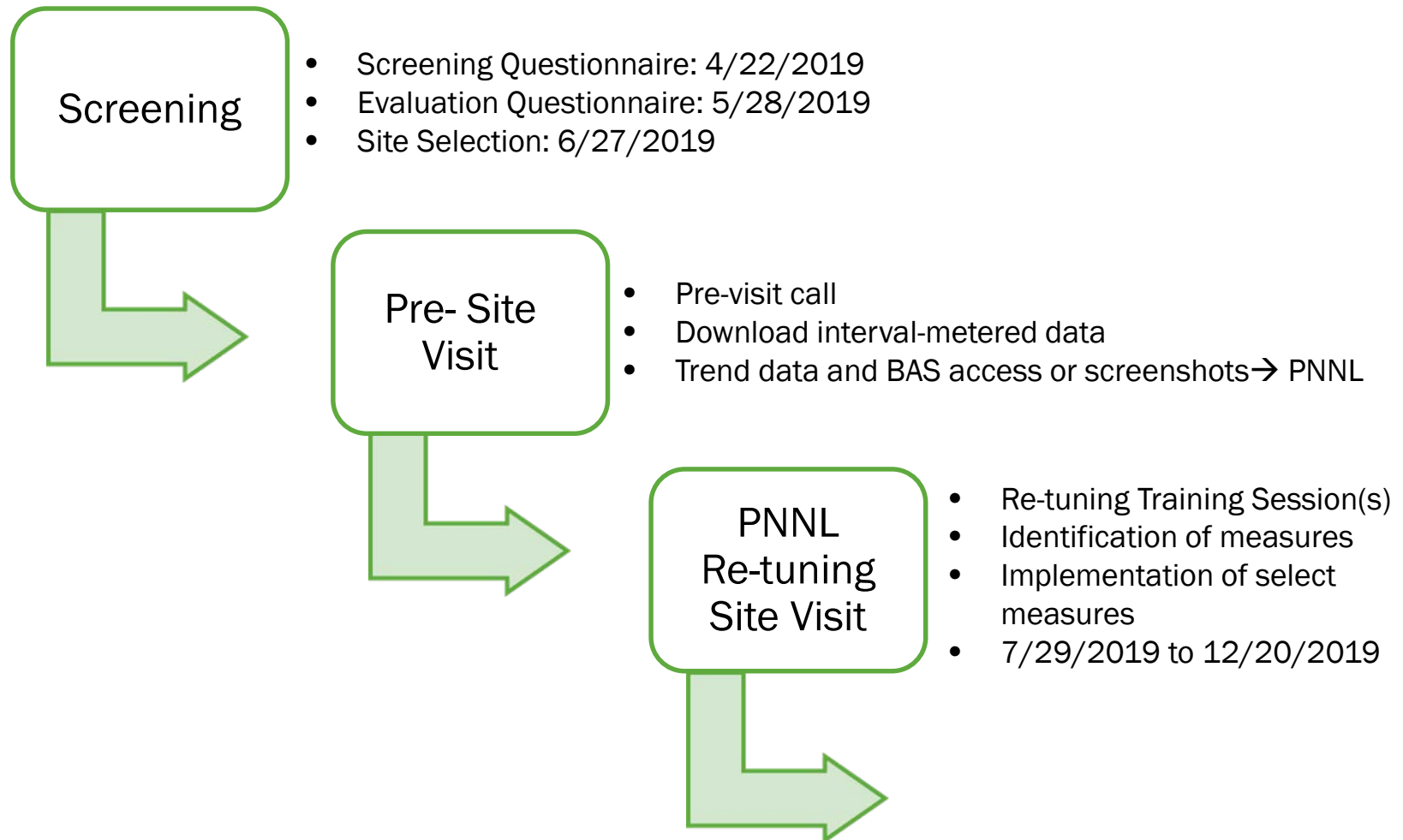
- 25-Building Cohort with at least 4-Years Post-Site Visit
- Increase in savings year 3 to year 4
- Big electricity savings increase suggests another systemic cause (e.g. widespread LED lighting upgrades or more teleworking)

GSA- Re-tuning Payback Period

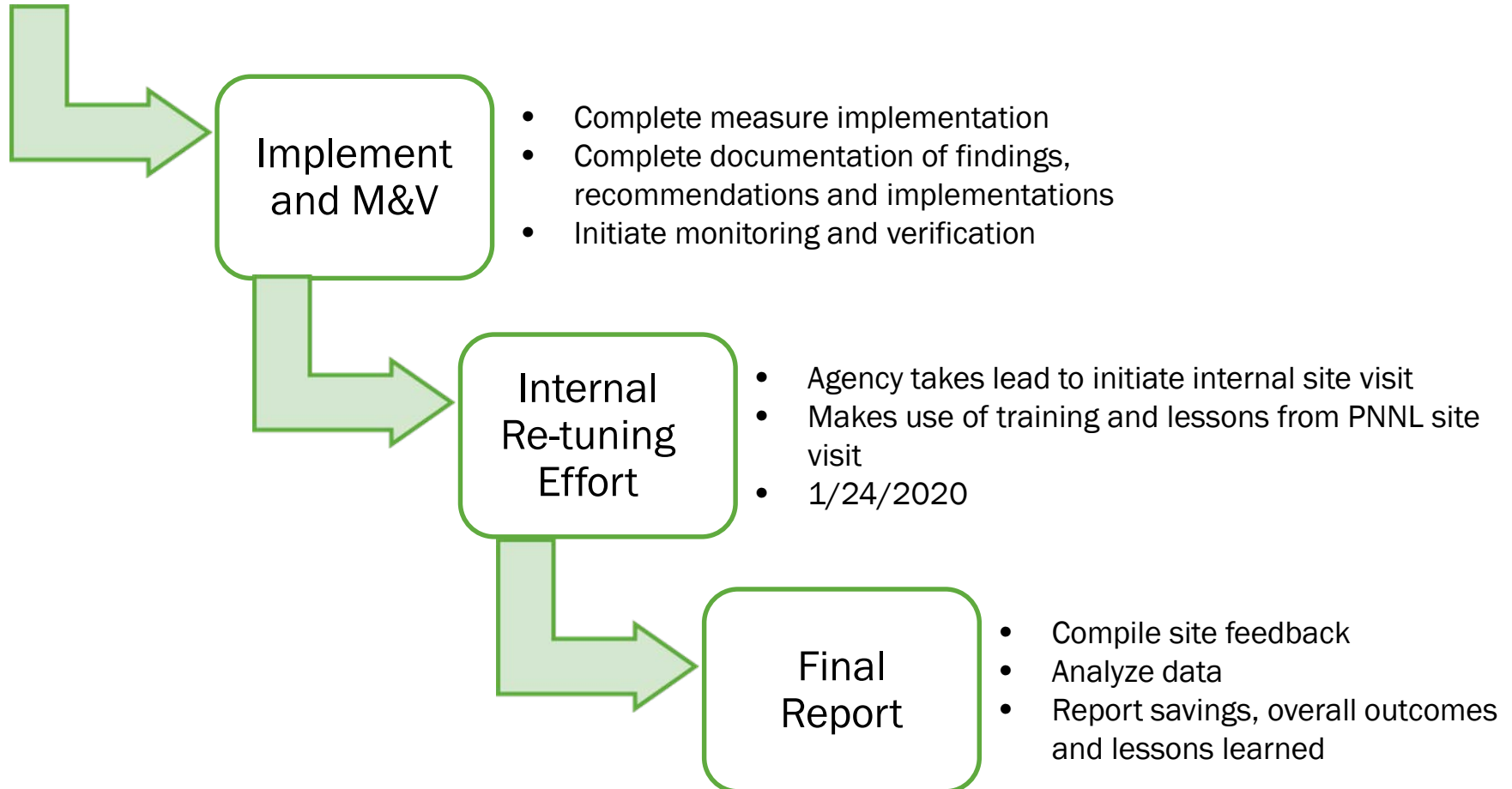


- Overall simple payback based on Year 2 savings: 0.51 years
- 75% of sites below 3-year payback
- Includes total contracted cost but does not include additional costs borne by GSA (control contractor retention, any capital projects that were funded)

Re-tuning Challenge Steps and Timeline



Re-tuning Challenge Steps and Timeline (Cont'd)



3 to 4 day site visit

- **Day 1**

- Presentation training session for agency representatives who will be involved in a future internal re-tuning effort
- Building walk-through with O&M staff, building management, and agency reps

- **Day 2**

- BAS review and interactive training session. Identification of measures and formulation of recommendations.
- Requires O&M staff to be present and discuss measures and any conflicts/limitations
- Potential demonstration/testing of some measures

- **Day 3/4**

- Implementation of agreed-upon re-tuning measures
- In some cases, this may require retention of a controls contractor (paid for by the agency) who is familiar with the building and BAS programming,

After visit

- The controls contractor (paid for by the agency) may need to return to complete measures.

Characteristics of Good Re-tuning Candidate Buildings

- **Large Buildings (at least 100,000 sf; 300,000+ sf ideal)**
 - The re-tuning process scales well
 - Cost savings improves with higher baseline energy cost
- **High Baseline energy consumption relative to similar buildings in similar climates**
- **Digital controllers, actuators, thermostats**
- **Modern BAS (updated within the last 5-8 years)**
- **Control of systems like Chiller, Boiler, Lighting via BAS**
- **Variable speed pumps and fans**
- **Single-Duct AHUs**
- **Presence of dedicated outdoor air-handling systems (DOAS)**
- **Not a “mission critical” building**
- **Little to no previous attempt at re-tuning or control-centered energy savings projects**

FEMP Re-tuning Challenge – Next Steps

Next Steps:

- Sites determine interest to participate.
- Submit completed **Screening Questionnaire** no later than **April 22, 2019** for consideration.
- Sites meeting the criteria as established in Screening Questionnaire will be asked to complete an **Evaluation Questionnaire** no later than **May 28, 2019** on site attributes affecting re-tuning.

Site Selection Screening

Screening Questionnaire addresses:

- 1) Building HVAC systems that are controlled by a centralized Building Automation System.
- 2) Buildings must be metered with advanced meters and have access to this data.
- 3) **Sites participating in the Challenge must commit to:**
 - a. Work with the PNNL team to implement agreed upon measures during the Challenge period.
 - b. Send site and/or agency staff to the onsite re-tuning training conducted by PNNL.
 - c. Use trained staff to attempt re-tuning based on the principles and methods demonstrated during the training session.
- 4) Site ability to host other agency staff participation in the onsite re-tuning training

Re-tuning Challenge Timeline

Milestone	Date/Deadline
FEMP conference call with interested candidate sites <ul style="list-style-type: none">- Detailed re-tuning presentation- Review site qualifications information	Today – 4/4/2019
Site screening questionnaire submissions to FEMP	Screening Questionnaire: Due no later than 4/22/2019
Site evaluation questionnaire submissions to FEMP (for notified sites)	Evaluation Questionnaire (for qualifying sites): No later than 5/28/2019
Site selection by FEMP	6/27/2019
Initial site communications	6/27/2019 – 9/27/2019
Sites host re-tuning	7/29/2019 – 12/20/2019
Site staff complete building re-tuning	1/24/2020

Re-tuning Challenge

Next Steps for Interested Agencies/Site

Action items:

- Interested sites self-assess using Screening Questionnaire criteria
- Submit completed Screening Questionnaire by 4/22/2019
- Optional: Additional information on the Re-tuning process
<https://buildingretuning.pnnl.gov/>

Direct questions to the Re-tuning Challenge at
FEMPRetuningChallenge@pnnl.gov

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202-586-8827



QUESTIONS/DISCUSSION?

FEMP Re-tuning Challenge Supplemental Slides

FEMP Re-tuning Challenge Supplemental Slides

Screening Questionnaire

- Include building information – agency, building name, location, utility energy sources, and square footage.
- Are most HVAC systems in the building controlled by a centralized Building Automation System (BAS)?
- Building Automation System (BAS) vendor and version (or date of last upgrade).
- Please note if boilers, chillers, and/or lighting are controlled via the BAS.
- List the utilities for which there is a reliable building-level interval meter or meters that report consumption at least at the hourly level, if not sub-hourly and for which at least **12** months of data prior to the site visit is available.

Screening Questionnaire - continued

- Will the site or agency commit to attempt re-tuning based upon the principles and methods demonstrated in that session and in the PNNL site visit at a different building owned or leased by the agency (**Internal Re-tuning Effort**) prior to January 24, 2020?
- Please name, title, and contact information for a point of contact within the agency/at the site that will serve as a “champion” for this Re-tuning Challenge. This person will be responsible for controlling the internal agency and building-level logistics for all three tasks, keeping the project on-schedule, and overseeing the team that will lead the internal re-tuning effort.

Screening Questionnaire continued

- Will the site or agency commit to the **PNNL Re-tuning Site Visit** taking place before **December 20, 2019**?
- Will the site or agency commit that they will complete implementation of all identified measures that are agreed upon by site staff by **January 24, 2020**, under the assumption that the site visit occurs prior to **December 20, 2019** (this may require the assistance of a local controls contractor)?
- Will the site or agency commit to sending representatives to the **Re-tuning Training** conducted during the **PNNL Re-tuning Site Visit**?

Re-tuning Site Selection

- **The Re-tuning Challenge site selection is comprised of the following 4 steps:**
 - **Step 1.** Agency submits at least one Screening Questionnaire. (Due 4/22/2019)
 - **Step 2.** Screening Questionnaires are reviewed and agency point of contact is advised if the building is eligible for the next step. If a building is eligible to continue, an Evaluation Questionnaire will be provided. (5/6/2019)
 - **Step 3.** Agency point of contact submits Evaluation Questionnaire. (Due 5/28/2019)
 - **Step 4.** Evaluation Questionnaires are reviewed and agency point of contact is advised if the building is selected to participate in the Re-tuning Challenge. (6/27/2019)

Estimated Site Time Requirements

- **PNNL re-tuning and training**
 - Building-level management – 6 hours
 - Building-level O&M staff/contractor (1 person) – 16 hours
 - BAS technician (site staff and/or contractor) – 0 to 12 hours (to be determined during site visit prep)
 - 2 Agency representatives – 8 hours+ each
- **Agency- re-tuned building**
 - 2+ trained staff from PNNL Re-tuning training: 3-4 days
 - Building-level management – 6 hours
 - Building-level O&M staff/contractor – 16 hours
 - BAS technician – 0 to 12 hours (to be determined during site visit prep)