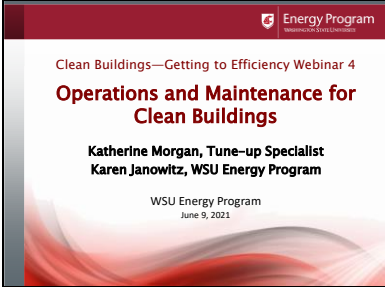


# Operations and Maintenance for Clean Buildings – Webinar Presentation Notes

Slide 1



Energy Program  
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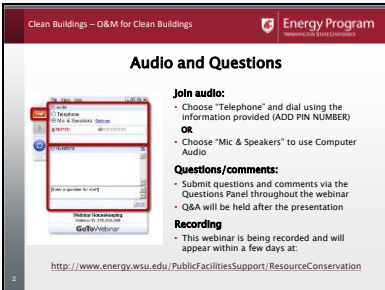
Clean Buildings—Getting to Efficiency Webinar 4

## Operations and Maintenance for Clean Buildings

Katherine Morgan, Tune-up Specialist  
Karen Janowitz, WSU Energy Program

WSU Energy Program  
June 9, 2021

Slide 2



Clean Buildings – O&M for Clean Buildings

Energy Program  
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### Audio and Questions

**Join audio:**

- Choose "Telephone" and dial using the information provided (ADD PIN NUMBER)
- OR**
- Choose "Mic & Speakers" to use Computer Audio

**Questions/comments:**

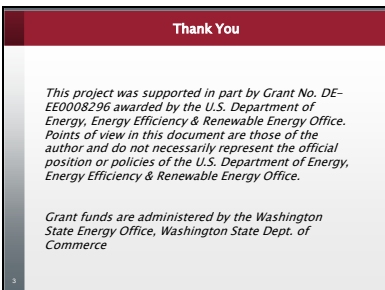
- Submit questions and comments via the Questions Panel throughout the webinar
- Q&A will be held after the presentation

**Recording**

- This webinar is being recorded and will appear within a few days at:

<http://www.energy.wsu.edu/PublicFacilitiesSupport/ResourceConservation>

Slide 3



Thank You

*This project was supported in part by Grant No. DE-EE0008296 awarded by the U.S. Department of Energy, Energy Efficiency & Renewable Energy Office. Points of view in this document are those of the author and do not necessarily represent the official position or policies of the U.S. Department of Energy, Energy Efficiency & Renewable Energy Office.*

*Grant funds are administered by the Washington State Energy Office, Washington State Dept. of Commerce*

Slide 4



Clean Buildings – O&M for Clean Buildings

Energy Program  
WASHINGTON STATE UNIVERSITY

Karen Janowitz  
Program Manager  
Washington State University  
Energy Program




Katherine Morgan  
Instructor  
Building Operator Certification Program  
Project Manager, Tune-up Specialist  
ArchEcology



Thank you to Neil Bavins for developing the webinar series!

# Operations and Maintenance for Clean Buildings – Webinar Presentation Notes

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Clean Buildings – O&M for Clean Buildings 

## Clean Buildings – Getting to Efficiency Webinar Series

- Efficiency Through the Clean Buildings Performance Standard (CBPS)  
– 3/30/21
- Tune-ups for Clean Buildings  
– 4/21/21, 11:30 am
- Energy Management Plans for Clean Buildings  
– 5/19/21, 11:30 am
- **Operations & Maintenance for Clean Buildings**  
– **6/9/21, 11:30 am**

<http://www.energy.wsu.edu/PublicFacilitiesSupport/ResourceConservation>


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Clean Buildings – O&M for Clean Buildings 

## Terms & Abbreviations

- The Standard or CBPS = Washington State Clean Buildings Performance Standard
- ASHRAE = American Society of Heating, Refrigeration and Air-Conditioning Engineers
- ASHRAE Standard = ASHRAE 100-2018 Standard
- AHJ = Authority Having Jurisdiction = Commerce
- Commerce = Washington State Department of Commerce
- EMP = Energy Management Plan
- O&M = Operations and Maintenance
- EEMs = Energy Efficiency Measures (asset improvement measures)
- ECMs = Energy Conservation Measures (O&M measures)
- EUI = Energy Use Intensity as kBtu/gsf/yr
- EUI<sub>T</sub> = Energy Use Intensity Target
- WNEUI = Weather Normalized EUI
- GSF = Gross Square Feet, also gross floor area, measured to exterior walls, excluding parking
- kBtu = kilo (thousand) British thermal units, a common energy unit used for different sources such as kWh (kilowatt hours) and therms

Slide 7


Clean Buildings – O&M for Clean Buildings 

## Requirements of the Clean Buildings Performance Standard

- Energy Management Plan (EMP)
- Operations & Maintenance (O&M) Program
- Compliance through one of these performance metrics:
  - Meet Energy Use Intensity Target (EUIT)
  - Implement All Cost-effective Energy Efficiency Measures

**The O&M program must be implemented at least one year prior to compliance date!**

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Clean Buildings – O&M for Clean Buildings 

## WA Department of Commerce Clean Buildings Web Page

<https://www.commerce.wa.gov/growing-the-economy/energy/buildings/>

- Links to Legislation and Reference Standards
- Early Adopter Incentive Program
- Determining if your Building Must Comply
- Steps to Comply
- Personnel Roles
- Resource and Support Links
- Links to Trainings, ENERGY STAR Portfolio Manager Trainings
- Building Owner Portal (coming July)

**Contact your utility – they may have resources and incentives to help comply with the Standard**

# Operations and Maintenance for Clean Buildings – Webinar Presentation Notes

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Clean Buildings – O&M for Clean Buildings

Energy Program

### Additional Resource

- 96 page users guide, avail. 5/10/21
- Not an ASHRAE publication
- Supports ASHRAE 100
- Does not reflect all CBPS amendments
- Explains core concepts
- Provides helpful process flow charts
- Organizes the Standard by roles
  - Owner, Qualified Person, Energy Mgr., etc.

Available to download at NEEA website:  
• <https://neea.org/resources/ashrae-100-users-guide>

ASHRAE 100  
USERS' GUIDE

- This guide may be particularly helpful for those unfamiliar with many of the technical concepts referenced in the CBPS, as well as those not familiar with using ASHRAE guides.
- Appendix also includes useful checklists for applying Standard 100 and the O&M Program .
- There is a lot of information covered today, so our goal is to review the whole thing and some key items to keep in mind, but a resource like this will be helpful to dig into a review of some of the details.

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Clean Buildings – Energy Management Plans

Energy Program

### Updates

- A single combined standard is being created
- Available free of charge by July 1, 2021 on the Commerce Clean Buildings website
- The ASHRAE Standard combined with Clean Buildings Performance Standard amendments

*Yeah!*

Slide 11

Clean Buildings – O&M for Clean Buildings

Energy Program

### Poll Question 1

What is your relationship to O&M Programs?

1. Directly involved in O&M practices at my organization
2. Indirectly involved in O&M practices at my organization
3. Work for a firm that provides O&M services
4. Work for an organization that consults/advises on O&M work
5. None of the above

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Clean Buildings – O&M for Clean Buildings

Energy Program

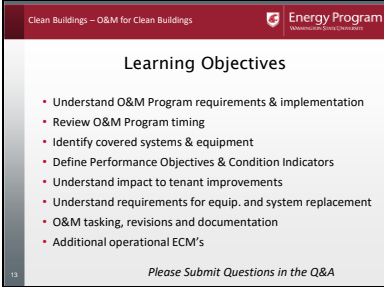
### Poll Question 2

If you have a current O&M Program, does it include reviewing energy use?

1. Yes, annually or as needed
2. Yes, several times per year
3. No, but it would if we had better access to energy info
4. No, but we would like to add it
5. No, energy use is reviewed by others outside of O&M

# Operations and Maintenance for Clean Buildings – Webinar Presentation Notes

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Clean Buildings – O&M for Clean Buildings


Energy Program  
Washington State University

### Learning Objectives

- Understand O&M Program requirements & implementation
- Review O&M Program timing
- Identify covered systems & equipment
- Define Performance Objectives & Condition Indicators
- Understand impact to tenant improvements
- Understand requirements for equip. and system replacement
- O&M tasking, revisions and documentation
- Additional operational ECM's

Please Submit Questions in the Q&A

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Clean Buildings – O&M for Clean Buildings

Energy Program  
Washington State University

### O&M Program Requirements

- O&M Program requirements are defined in Section 6
- O&M Program implementation is defined in Normative Annex L
- Additional O&M guidance is provided in Informative Annex D
  - This annex is informative only and not a requirement of the CBPS
- O&M Program Plan elements are part of the Energy Management Plan as well



- The O&M Program requirements are outlined in two different sections of the CBPS, section 6 and Normative Annex L.
- Informative Annex D, while not required, should be helpful in developing the O&M tasking that is required by the CBPS.
- Some of the defining documents, the Program Plan, like equipment list, goals, and tasks are listed as part of the EMP as well.

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Clean Buildings – O&M for Clean Buildings

Energy Program  
Washington State University

### O&M Program Requirements

From Section 6.2:  
*"A formal operation and maintenance program shall be established and implemented in order that the building energy-using systems achieve their intended energy efficiency throughout their service life."*



Does your existing O&M program meet the Standards requirements?

- Most O&M programs focus on reliability and equipment life and tend to focus on maintenance tasks, such as filter changes, cleaning and lubrication. While these are components of the CBPS, the Standard's focus on energy efficiency means a much greater emphasis on developing, implementing and documenting operational tasks, which have a significant impact on energy efficiency.
- Most O&M programs as they currently exist should meet the maintenance program requirements with a few adjustments, but few are likely to meet the more comprehensive operational program requirements required by the CBPS.
- Emphasis on 'formal' – guiding documents and protocol as well as record keeping. Since O&M programs often have a combination of staff and contractors, maintenance and controls contractors are common, and energy management might be another office/department or vendor – documents like this are useful to help coordinate and communicate among all these stakeholders.
- When a Tenant Improvement (TI) project is done, that information needs to be reviewed and brought into the documentation as well.

# Operations and Maintenance for Clean Buildings – Webinar Presentation Notes

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Clean Buildings – O&M for Clean Buildings

Energy Program

## O&M Program Requirements

From Normative Annex L (1):  
*"The building owner shall be responsible for meeting the requirements of this standard. The owner may designate other parties that shall be authorized and contractually obligated to fulfill the owner's responsibility."*

Do your current contracts obligate vendors & tenants to meet the CBPS requirements?

- In many cases where the owner has a net lease, the tenant is responsible for most building maintenance and utilities. In these cases, will the lease language contractually obligate the tenant to fulfill the owner's responsibility under the Standard?
- The owner or tenant will often hire a contractor to perform building maintenance tasks. Will the vendor also take on the operational tasks?
- What about review of the building's energy efficiency? The owner may need to contract additional consultants to complete efficiency tasking such as utility analysis, tenant improvement specifications and compliance. We will discuss TI impacts in more detail later in the webinar.

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Clean Buildings – O&M for Clean Buildings

Energy Program

## O&M Program Implementation

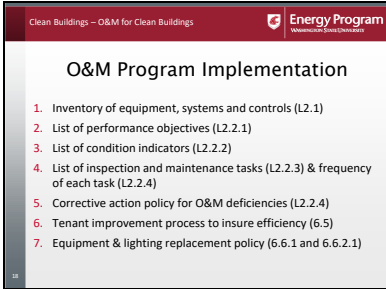
From Normative Annex L (2):  
*"At a minimum the O&M program shall contain an inventory of equipment, systems and controls to be inspected and maintained and a maintenance plan describing the goals, objectives and execution of the systems maintenance program."*

Does your existing O&M program include lighting?

- Most manufacturers provide detailed maintenance guidance for their respective equipment. However, systems made up of multiple equipment components (as is common with HVAC), and control systems maintenance may require additional tasking that is specific to the system and building. This may not be described by an equipment manufacturer, and will place a significant emphasis on building operations.
- Older buildings or buildings that were 'design build' or have undergone upgrades and tenant improvements will have some work to do to get a clear set of guidelines and operational tasking.
- Start by making an inventory of your systems and equipment. Then establish goals and objectives for your O&M program, including legal requirements, reliability, performance, equipment life, and safety and health.
- Inspection and maintenance tasks are intended to address operational parameters – more later but important to keep in mind the idea that operational functions are addressed through inspections and maintenance – eg inspecting the controls and maintaining the control set points at the desired level.

# Operations and Maintenance for Clean Buildings – Webinar Presentation Notes

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**O&M Program Implementation**

1. Inventory of equipment, systems and controls (L2.1)
2. List of performance objectives (L2.2.1)
3. List of condition indicators (L2.2.2)
4. List of inspection and maintenance tasks (L2.2.3) & frequency of each task (L2.2.4)
5. Corrective action policy for O&M deficiencies (L2.2.4)
6. Tenant improvement process to insure efficiency (6.5)
7. Equipment & lighting replacement policy (6.6.1 and 6.6.2.1)

- We will take a closer look at which equipment needs to be included later in the webinar.
- Performance objectives can include energy efficiency objectives such as EUI or Energy Star score, AND comfort objectives such as space temperature range or lighting levels; AND maintenance/repair/service life – these would inform condition indicators.
- Condition indicators identify when equipment is not operating within design specification and corrective action is required. This is highly defined in the Standard.
- We will take a closer look at inspection and maintenance tasking later in the webinar.

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**O&M Program Timing**

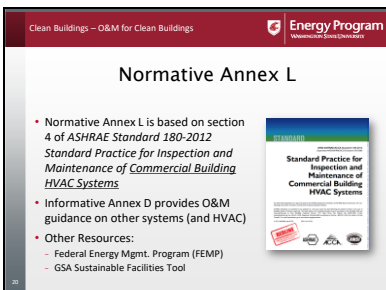
- O&M Program must have a year of implementation prior to compliance date
- O&M Program is a living document involving continuous updates
- Start as early as possible, most existing O&M programs will need to be revised

```

    graph LR
      A[Review and Update Existing O&M] --> B[Implement O&M Program]
      B -- 1 Year --> C[Compliance Date]
    
```

- As we discussed in webinar 2, *Tune ups for Clean Buildings*, the Tune up process is a great way to review and update the existing O&M practices, in preparation for meeting the more stringent O&M Program requirements specified by the CBPS.
- Many owners maintain high level O&M programs, however, few will comply with the requirements of the CBPS. Anticipate that you will have revisions, and additional documentation will be needed.
- **Remember continuous improvement is the purpose – so focus on that.**

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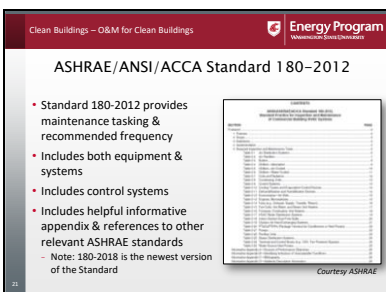


**Normative Annex L**

- Normative Annex L is based on section 4 of ASHRAE Standard 180-2012 *Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems*
- Informative Annex D provides O&M guidance on other systems (and HVAC)
- Other Resources:
  - Federal Energy Mgmt. Program (FEMP)
  - GSA Sustainable Facilities Tool

- Additional resources are available through FEMP, the Federal Energy Management Program, and the US GSA Sustainable Facilities Tool. Both of these programs are open to everyone, not just Federal employees.
- GSA tools are also available in Energy Star Portfolio Manager so you can look for those resources when you are benchmarking.

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**ASHRAE/ANSI/ACCA Standard 180-2012**

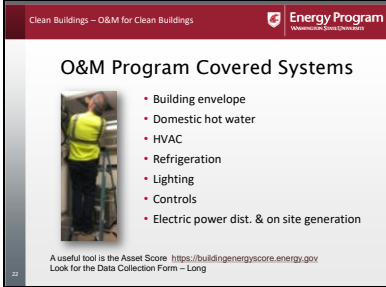
- Standard 180-2012 provides maintenance tasking & recommended frequency
- Includes both equipment & systems
- Includes control systems
- Includes helpful informative appendix & references to other relevant ASHRAE standards

- Note: 180-2018 is the newest version of the Standard

- HVAC only though, need to include other systems
- Annex D has some overlap with Section 5 but useful to review both, and Annex D includes other systems.
- Also note the appendices here – sources of performance objectives and indicators of unacceptable conditions.

# Operations and Maintenance for Clean Buildings – Webinar Presentation Notes

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Clean Buildings – O&M for Clean Buildings

Energy Program  
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### O&M Program Covered Systems

- Building envelope
- Domestic hot water
- HVAC
- Refrigeration
- Lighting
- Controls
- Electric power dist. & on site generation

A useful tool is the Asset Score <https://buildingenergyscore.energy.gov>  
Look for the Data Collection Form – Long

- All significant energy-using equipment need to be included in the O&M Program, including the building systems listed. You will need to meet all of the elements of the standards on each of these systems.
- Nothing in the Standard prevents you from including additional systems and equipment into your O&M program, as needed.
- We encourage you to consider water and waste-related systems while you are at it 😊 -
- Another resource is The Asset Score tool which provides a comprehensive list of elements and might be a good tool to use to gather information to input into the tool if you decide to do an asset audit that way.
- [https://buildingenergyscore.energy.gov/documents/energy\\_asset\\_score\\_data\\_collection\\_form\\_full\\_long.pdf](https://buildingenergyscore.energy.gov/documents/energy_asset_score_data_collection_form_full_long.pdf)

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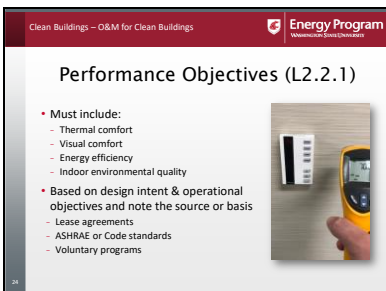
Energy Program  
Washington State University

### O&M Program

- Maintenance Plan:
  - Who performs & who authorizes
  - Documentation required
  - Monitoring of results
- Manufacturer's maintenance requirements for:
  - Equipment
  - Components
  - Systems
- BMS/BAS/EMS maintenance
  - Set points, schedules, & sequence of operation
- Safe and reasonable access for inspection, maintenance and repair

- Some of the components to include in the 'Program Plan' are listed here.
- Third bullet is where this really reflects typical Tune Up tasks.
- This is part of the program that overlaps somewhat with the EMP requirements – a summary of the Plan, location of the maintenance requirement record (or state of development might be included in annual updates as work is underway).

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Energy Program  
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### Performance Objectives (L2.2.1)

- Must include:
  - Thermal comfort
  - Visual comfort
  - Energy efficiency
  - Indoor environmental quality
- Based on design intent & operational objectives and note the source or basis
  - Lease agreements
  - ASHRAE or Code standards
  - Voluntary programs

- The source for your objectives could be an original design specification, from an ASHRAE standard, building code, or other requirements by the AHJ, such as the CBPS EUI target. It can be an internal reference or externally driven.

# Operations and Maintenance for Clean Buildings – Webinar Presentation Notes


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Clean Buildings – O&M for Clean Buildings 

### Performance Objectives Examples

- Thermal comfort
  - Temp: ex. 70°F-75°F
  - Humidity: ex. 40%-60% RH
- Visual comfort
  - Lighting levels office: ex. 40-60 fc (foot candles)
  - Lighting levels corridors: ex. 15-25 fc


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Clean Buildings – O&M for Clean Buildings 

### Performance Objectives Examples


- Energy efficiency
  - EUI: ex. 55 kWh/ft<sup>2</sup>/yr
  - Energy Star score: ex. 70
  - Chiller plant: ex. 1.2 kW/ton
- Indoor environmental quality
  - Carbon Dioxide (CO<sub>2</sub>) level: ex. 500-900 ppm
  - Air changes: ex. 6-8 AC/hr
  - Outside air intake: ex. 20 CFM/person

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Clean Buildings – O&M for Clean Buildings 


### Condition Indicators (L2.2.2)

- Conditions for acceptable & unacceptable equipment or systems operation
- Provided by equipment manuf. or established during start up & commissioning of the system
- Could lead to failure or energy waste if unacceptable conditions persist



- Condition indicators will also come from a variety of sources and will be specific to the equipment, systems and operation of each building.
- Also note that condition indicators are likely to change over time as equipment ages, and use or operation of the building changes. .
- The goal here is to identify and measure condition indicators needed to keep equipment and systems operating reliably and efficiently.
- The CBPS provides specific guidance on investigating and taking action when unacceptable conditional indicators or unacceptable performance is found (L2.2.4).

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Clean Buildings – O&M for Clean Buildings 

### Condition Indicators Examples

- HVAC
  - Amperage: ex. Fan motor amps vs rated full load amps (FLA)
  - Pressure (air or water): ex. Air handler discharge air pressure (DAP)
  - Flow (air or water): ex. chiller condenser flow vs manuf. rated range
- Domestic hot water
  - Supply water temperature: ex. water temp at faucet vs design temp
  - Supply water pressure: ex. water pressure vs allowable booster pump range
- Lighting
  - Office lamp color temperature: ex. 4200K
  - Lumen maintenance: ex. replacement of lamp at 70% lumen depreciation



# Operations and Maintenance for Clean Buildings – Webinar Presentation Notes

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- Reminder: The building owner is responsible for meeting the EUI target.
- Mentioned this last webinar as one of the Energy Manager roles, as well as code compliance.
- TI's can have a significant impact on building energy use. Energy impacts from a TI can include changes in occupancy, changes in equipment, changes to building systems, changes to the building envelope, changes to needed maintenance, and changes to the building operating hours and other operational impacts.
- Building a formal TI process that includes specifications, pre-construction reviews, and documented commissioning, testing and balancing, will go a long way in avoiding the financial and managerial impact of noncompliance, including penalties, required audits, and additional building modifications needed to meet the EUI.

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- O&M tasking involves a wide variety of activities, performed by a variety of individuals. In the context of the CBPS it's unlikely that a single individual will have the skills or time needed to meet all of the requirements. This will be a team effort.

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- Recommend you start with manufacturers minimum requirements, and customize from there.
- Revise tasking to include environmental impacts: Next to a dirty freeway, lots of cotton wood trees nearby, salt water, or extreme heat or cold, etc.
- Revise tasking to include variability of occupant operations: Amount of foot traffic, operations that produce dust or lint, extended operating hours, tenant filter spec's, etc.
- If scheduled component replacement is specified by the manufacturer, as is common with condensing gas boilers, include those in the tasking too.
- Experienced managers understand that completed tasking needs to be reviewed in the field and in documentation to ensure tasks are completed consistently and on time.

# Operations and Maintenance for Clean Buildings – Webinar Presentation Notes

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Clean Buildings – O&M for Clean Buildings 

### O&M Task Revisions (L2.2.4)

- Unacceptable indicators (more than two inspections) require investigation and analysis.
- Causes could include:
  - Poor field practices
  - Insufficient time
  - Repairs not made
  - Design issues
  - Obsolete equipment or components
  - Outside (of the system) causes (climate, water leaks, vandalism, etc.)
  - Assessment may indicate need to increase or decrease frequency of tasks (filter changes for example)
- Revisions to O&M Program must be documented


- We refer to the O&M Program as a living document, requiring continuous revisions as conditions in and around the building change, and as equipment and systems age.
- Revisions to the documentation may include changes to performance and condition indicators, changes to tasks, revised frequency task frequency, and changes to skill level needed for the task.

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Clean Buildings – O&M for Clean Buildings 


### Equipment & Component Replacement

- CBPS has specific requirements around equipment & component replacement
  - HVAC, domestic hot water, refrigeration, and appliances 6.6.1
  - Lighting 6.6.2.1
- Replacements must meet the most stringent requirements of:
  - Federal equipment standards
  - State equipment standards
  - Building Code



- This ties into the Energy Audit and Energy Management Plan.

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Clean Buildings – O&M for Clean Buildings 

### O&M Program Deliverables

- Form A (26.1) Item 8 requires upload of your O&M Program to AHJ
  - Incl. confirmation by Owner, Energy Manager & Qualified Person that O&M requirements have been met
- There is no O&M Program template or form to follow
  - Owners can use whatever format/system that works best for their operations
- Components of your plan could be in many different locations
  - Written documentation or spreadsheets
  - Vendor agreements
  - Work order software or other tasking software
  - Vendor maintenance tasking software (ask for printed copies of tasking)


- Reminder – is there a mechanism to get this information from tenant-contractors to owner...?

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Clean Buildings – O&M for Clean Buildings 


### O&M Program Deliverables

- Summary document
- Describes how CBPS requirements have been met
- Describes documentation
  - Executive summary or checklist
  - Format is not specified in the Standard
  - Detailed documentation is not required for the upload



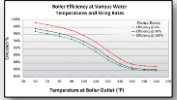
# Operations and Maintenance for Clean Buildings – Webinar Presentation Notes

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Clean Buildings – O&M for Clean Buildings 


### HVAC Operational Energy Conservation Measures

- Reset schedules for HVAC equipment
  - Key concept: match equipment capacity to load
- Examples:
  - VAV system supply air temperature reset
  - VAV system supply air pressure reset
  - Chilled water supply temperature reset
  - Boiler supply water temperature reset



- We wanted to ensure this webinar series provides actionable information. Here are some additional HVAC ECM measures that typically generate good energy savings here in the NW.


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Clean Buildings – O&M for Clean Buildings 

### HVAC Operational Energy Conservation Measures

- Review/revise control system sequence of operation
  - Changes to the building or building operations
  - Review for energy efficient operations
  - Remove overrides or temporary programming
- Look for and lock out, or correct rogue zones:
  - System operation may be negatively impacted by a zone not maintaining set point
  - Examples include:
    - South or west exterior offices
    - Computer rooms
    - Undersized terminal units


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Clean Buildings – O&M for Clean Buildings 

### HVAC Operational Energy Conservation Measures


- Inadvertent simultaneous heating and cooling
  - Overlapping control loops
  - Leaking valves on heating or cooling coils
  - Dirty air velocity sensors on VAV systems
- Air balance corrections
  - Over or under supplied zones
  - Over or under exhausted restrooms, kitchens, industrial applications
  - Incorrect make up air volumes and balance
  - Incorrect outside air intake minimum
  - VAV box minimum ventilation airflow

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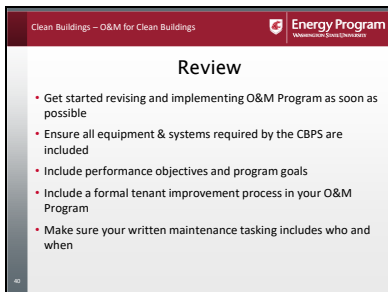
### HVAC Operational Energy Conservation Measures

- Eliminate HVAC in vestibules and unoccupied areas
- Use outside air to flush and pre-cool the building
- Revise space layout, zoning and air distribution to:
  - Reduce the impact of doors and windows on occupants
  - Reduce the impact of drafts
  - Minimize impact of after-hours operation or partial occupancy



# Operations and Maintenance for Clean Buildings – Webinar Presentation Notes

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Clean Buildings – O&M for Clean Buildings

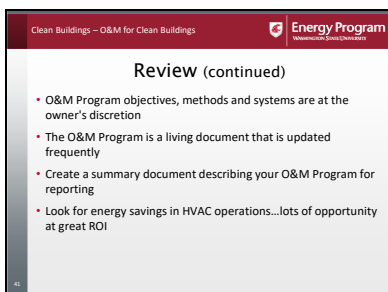
Energy Program  
Webinar Series Overview

### Review

- Get started revising and implementing O&M Program as soon as possible
- Ensure all equipment & systems required by the CBPS are included
- Include performance objectives and program goals
- Include a formal tenant improvement process in your O&M Program
- Make sure your written maintenance tasking includes who and when

- Consider a Building Tune up to kick off your efforts. See our 2nd webinar for more details.
- Get a complete list of equipment and systems, and establish objectives and goals up front.
- Recognize that the O&M Program is a living document, build review and updating into your O&M tasking.

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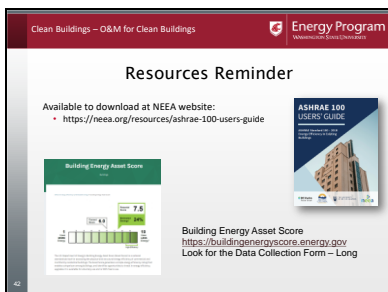
Energy Program  
Webinar Series Overview

### Review (continued)

- O&M Program objectives, methods and systems are at the owner's discretion
- The O&M Program is a living document that is updated frequently
- Create a summary document describing your O&M Program for reporting
- Look for energy savings in HVAC operations...lots of opportunity at great ROI

- Consider a Building Tune up to kick off your efforts. See our 2nd webinar for more details.
- Get a complete list of equipment and systems, and establish objectives and goals up front.
- Recognize that the O&M Program is a living document, build review and updating into your O&M tasking.

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### Resources Reminder

Available to download at NEEA website:

- <https://neea.org/resources/ashrae-100-users-guide>

ASHRAE 100  
USERS' GUIDE

Building Energy Asset Score  
<https://buildingenergyscore.energy.gov/>  
Look for the Data Collection Form – Long

- This guide may be particularly helpful for those unfamiliar with many of the technical concepts referenced in the CBPS, as well as those not familiar with using ASHRAE guides.
- Appendix also includes useful checklists for applying Standard 100 and the O&M Program.
- This resource will be helpful to dig into a review of some of the details of the webinar.
- Building Energy Asset Score – Integrated with Audit reporting in CBPS, free modeling tool to start evaluating improvements, can use to get started and if formal audit still needed will help reduce cost.

# Operations and Maintenance for Clean Buildings – Webinar Presentation Notes

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### Resources Reminder

- ASHRAE Standard 180-2012 Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
- Other Resources:
  - Federal Energy Mgmt. Program (FEMP)  
<https://www.energy.gov/eere/femp/federal-energy-management-program>
  - GSA Sustainable Facilities Tool – Resources in Portfolio Manager

Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems

Portfolio Manager

- Additional resources are available through FEMP, the Federal Energy Management Program, and the US GSA Sustainable Facilities Tool. Both of these programs are open to everyone, not just Federal employees.
- GSA tools are also available in Energy Star Portfolio Manager so you can look for those resources when you are benchmarking.

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30 minute Q&A starting now

Please submit your questions to the question box

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Thank you to Neil Bavins for helping develop the webinar series

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