URBAN GREEN

December 2025

Nerdfest 3

Smooth Operator

Effective O&M in Electric Buildings

Urban Green Council's mission is to decarbonize buildings for healthy and resilient communities. We develop cutting edge policy, we educate a broad range of professionals, and we research solutions that drive policy and best practices nationally and globally.

Cover photo: YP Senior Residence courtesy of Magnusson Architecture and Planning.

Operations & Maintenance practices must keep pace with building electrification

New York City is advancing toward building electrification. Local Law 154 requires all new buildings to use electric heat pumps for heating, cooling and water heating and Local Law 97 caps carbon emissions from NYC's largest buildings with a goal of reducing greenhouse gas emissions from large buildings by 40% by 2030 and reaching net-zero emissions by 2050. To achieve this goal, New York City Department of Housing Preservation and Development (HPD) is developing tools to help improve industry practices, which is critical to ensure long-term efficiency, cost control and tenant comfort in affordable multifamily buildings.

Operations and maintenance (O&M) practices must evolve to meet performance goals in cost-effective ways. This is especially urgent for affordable multifamily housing, where staffing constraints and financial pressures are most pronounced.

In response to this challenge, the New York State Energy Research and Development Authority (NYSERDA) and NYC Department of Housing Preservation and Development (HPD) requested that Urban Green Council convene a group of experts to identify O&M strategies that meet the emerging demands of electric buildings.

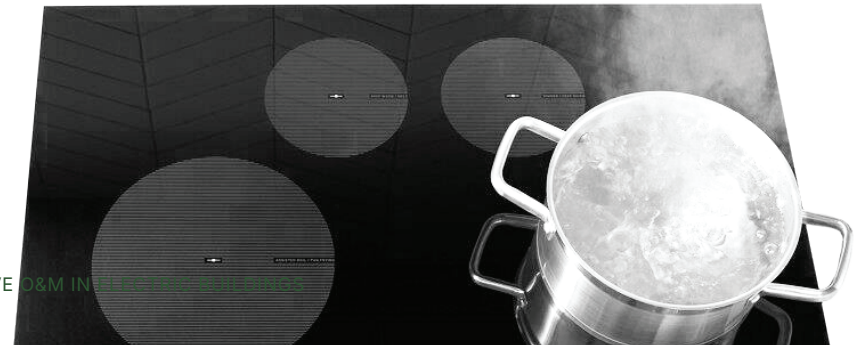
On April 9, 2025, over 50 stakeholders from across the affordable housing industry gathered at the 32BJ Thomas Shortman Training Center to share their expertise about O&M best practices in electric buildings. For this report, we are defining "electric buildings" as new or retrofitted buildings that have some or all of the following:

- Heat pumps for space heating and cooling. The heat pump equipment could be centralized, distributed per apartment, or per room
- Heat pump water heating systems
- Induction stoves for cooking

Although the convening aimed to focus on building operations, a clear consensus emerged during the conversation: achieving the expected energy performance from affordable multifamily housing can't fall solely on the shoulders of the operations team. Performance-oriented operations must be proactively integrated into design and construction from the start to ensure that systems are intuitive, reliable and usable by building staff with diverse experience levels.

The findings, summarized in this report, highlight persistent gaps in design and construction practices and offer actionable guidance for improving system performance—particularly in the affordable housing sector, but applicable to a broad range of building types. As building electrification becomes the new norm, establishing industry best practices is central to the success of decarbonized buildings.

> *"I don't want a Ferrari I can't drive. I'd rather have a Honda I can operate well."*
>
> -Nerdfest Attendee



Who is this report for?

This report is intended for people who own, develop, design, manage, operate, service, maintain, and set policies and standards for affordable multifamily buildings.

1. Key priority areas PAGE 5

- Commissioning
- Preventive Maintenance
- Monitoring and Data Analysis
- Effective Occupant Engagement
- Staff Training

2. Advice for stakeholders PAGE 7

- Owners, Developers and Owner's Representatives
- Designers and Service Providers
- Manufacturers
- Contractors
- Operators and Property Managers

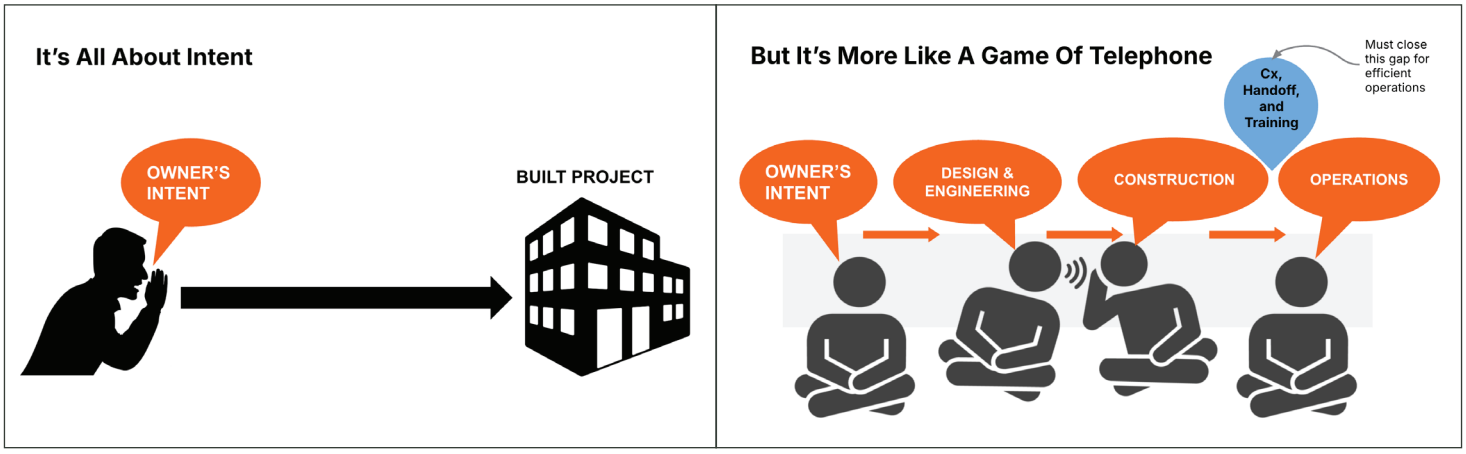
3. Seeking further research PAGE 13

4. Appendix PAGE 14

1. Key priority areas

Many of the most critical decisions that shape long-term building performance happen well before operations begin. Design and construction teams must lay the groundwork to ensure that electric heat pump systems are easy to operate and maintain by the building's O&M team.

This section highlights five priority challenges that must be addressed early and collaboratively across project teams to enable successful building operations. These areas reflect both persistent gaps in current practice and high-impact opportunities to improve outcomes in electrified buildings.



Source
GPRO Construction Management, Urban Green Council

Commissioning

Begin with the end in mind: A clear operational intent should be the throughline from design to commissioning to turnover, ensuring buildings perform as intended.

When designing and constructing a building, the Owner's intent doesn't get translated directly into the built project. Scores of people from different companies are involved and project communication needs to be clear, intentional and actionable.

Commissioning (Cx) is the process that ensures that building systems work as designed. For the best outcomes, the commissioning process starts during the design phase. It clearly defines all roles, responsibilities, testing instructions and expected results, and provides a feedback loop throughout construction. **Turnover** is the transition period that marks the end of the design and construction phase and the beginning of the operations and maintenance phase.

The building owner typically hires the commissioning firm, and the contractor is responsible for turnover, so these processes are, by design, interconnected across the many companies and trades involved with the project. Because of this complexity, these processes are often overlooked or rushed at the end of construction—undermining system performance from day one. Focusing on the key commissioning and turnover strategies described in section *2. Advice for stakeholders* can significantly improve the performance and reliability of electric heat pump systems.

Preventive maintenance

Routine tasks—like cleaning filters and checking heat exchangers—are often overlooked but critical for system longevity.

Comparing the Preventive Maintenance (PM) practices in buildings with electric heat pumps to those without, there are far more similarities than differences. Building supers will always need to respond to tenant complaints about heat and hot water, log basic information about the systems in a logbook, schedule regular system maintenance and use a systems-thinking approach to building performance.

However, a systems-thinking approach to PM is even more crucial in buildings with electric heat pump systems. Electricity is generally more expensive than gas and oil, so ensuring that operators are prepared and well-informed on new systems is critical to maintain cost-effective efficiency and system longevity.

Specific PM practices for electric heat pump systems fall into two categories:

- **Routine tasks that can be completed by an in-house operator**—like cleaning heat pump filters, heat exchangers and condensate pans.
- **Tasks that should be outsourced to a service provider or manufacturer**, such as repairs to electrical components or refrigerants.

It's important to define who is responsible for which tasks. O&M protocols should clearly indicate which maintenance tasks are staff responsibilities and which should be outsourced to a service provider or manufacturer. This will vary from building to building.

Monitoring and data analysis

Practical, simplified verification points can identify system inefficiencies before they become major issues.

A comprehensive measurement and verification (M&V) process may be too costly for affordable housing projects. However, a scaled-down approach can still indicate system inefficiencies before they become major issues. Stakeholders recommend installing a manageable number of sensors coupled with basic analytics and an interface that can deliver useful, actionable information based on the sensor data without overwhelming the operations team.

A helpful model is NYCDEP's Leak Notification Program, which sends automated alerts when water use spikes. Similarly, buildings can set up automated emails for issues like an ERV system being switched off, domestic hot water dropping below a set temperature, or equipment short-cycling. Alert recipients should be limited to 3–5 key staff, including management, and contact information should be kept up to date.

> *"Instead of a full measurement and verification (M&V) process, I recommend just enough 'M' to get actionable information."*
>
> Nicole Ceci,
> Steven Winter Associates

Effective occupant engagement

Engage early and often: Ongoing, two-way communication with building occupants is key to ensuring systems are used as intended and performance goals are met.

Tenant engagement is both critical and challenging in affordable multifamily buildings. Effective occupant engagement enables easier access to the parts of systems inside apartments for both repairs and regular maintenance, encouraging tenants to act as monitors.

Staff training

The most efficiently designed building won't achieve the expected performance without trained staff.

To ensure building systems run as intended, staff need a foundation in systems thinking—understanding how building systems work together to optimize energy use—and practical strategies for operating high-performance buildings. This requires training on sustainability and electrification in general, as well as hands-on training with specific equipment, such as heat pumps, advanced controls and energy management systems.

Staff also need training on how to monitor performance data, identify issues and make timely adjustments. Fostering a culture of continuous training is essential for preserving institutional knowledge and keeping pace with evolving technologies. When equipped with this expertise, O&M teams can operate with confidence, troubleshoot effectively, and keep the building performing at its best.

2. Advice for stakeholders

Electric heat pump building systems are still new and much less well-known than fossil fuel-based equipment, so it may take some time for the industry to develop protocols and best practices. In this section, we'll cover specific advice for stakeholders involved with electrification projects, including: Owners, Developers & Owner's Reps, Designers & Service Providers, Manufacturers, Contractors, Building Operators and Property Managers.

Advice for Owners, Developers, and Owner's Representatives

Building owners and their representatives have the most control over the performance of a building. If energy performance and cost effectiveness are to be a priority, ownership needs to emphasize this to all stakeholders. The following recommendations can help hold the design and construction teams accountable for delivering a high-performance building.

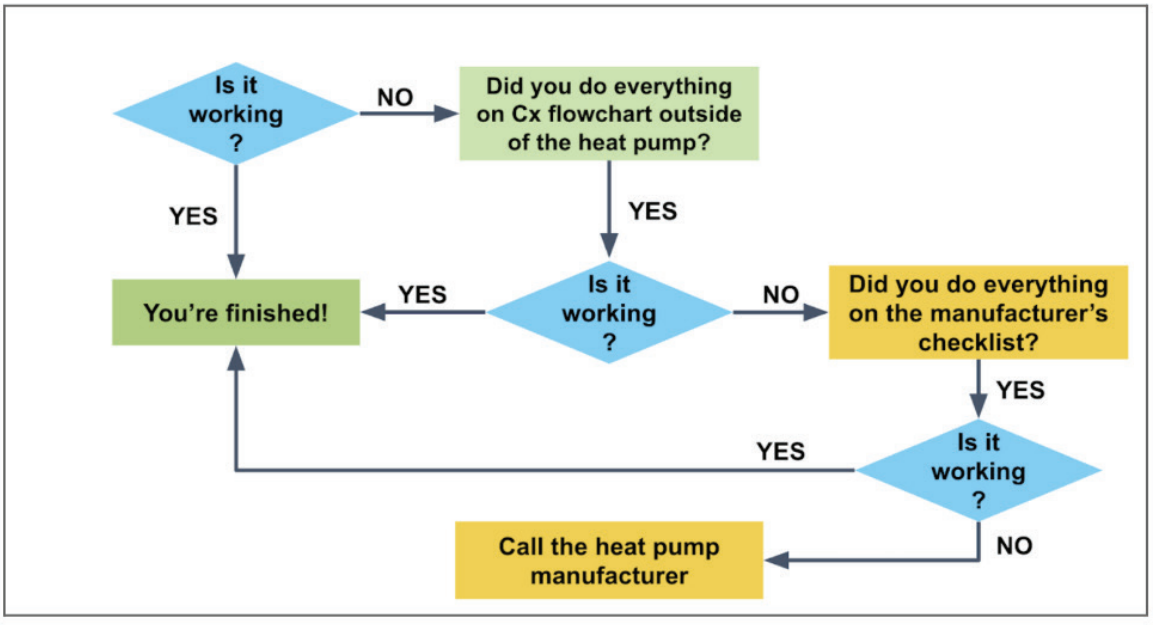
1. **Prioritize clarity of information and ease of operations**
   - Include Ease of Operations into the Basis of Design to establish this as a key priority before the design starts.
   - Require that the design and construction teams to document systems so that the underlying design and performance intent is clear, and operational information is straightforward and accessible, enabling staff to manage and maintain equipment efficiently and confidently. This documentation should incorporate operator workflows and anticipate their reactions.

2. **During construction, ensure that the commissioning process is progressing.**
   - Hiring the commissioning team is the Owner's responsibility. Deploy this team early in the project and ensure that their work is fully integrated with the construction team.
   - Ensure that an appropriate amount for Commissioning is integrated into the construction budget.
   - Require that all commissioning and sustainability-related documentation are current and verified before approving each payment requisition. Projects that prioritize sustainability in this way have better outcomes.

3. **Select key performance indicators (KPIs)**
   - Ask your Commissioning Agents (CxAs) to develop a full list of KPIs and then prioritize the top 3-5 metrics to measure.
   - Schedule a quarterly review of this data to verify that their performance goals are being met.

4. **Test system performance at full occupancy and seasonally:**
   - The performance of electric heat pump systems, particularly air-source heat pumps, is heavily impacted by outdoor temperatures. Even ground source systems can vary seasonally.
   - Review systems at full occupancy and again after the first full heating and cooling cycles. Many issues, including poor setpoint configuration, tenant override behavior, and runtime mismatches, do not manifest until seasonal demand changes. This process may require additional budgeting.

5. **Require that instructions for system operation are easily understood by staff and residents:**
   - Include in the Owner's Project Requirements that the operation of each system must be documented as part of the design and construction process and delivered to the operations team at turnover. Depending on the makeup of your team, your designer, contractor and/or service provider may be best situated to provide hands-on training and an O&M handbook.
   - Handbook: At a minimum, the operations team should have a systems manual with plain-language instructions that includes the intent of each system, along with set points, thermostat settings and programming instructions, and clear flow charts to help them determine when there's an operational problem and when the manufacturer needs to be called in. Ensure that the manual is durable, editable, and able to be updated for the next team, should a new operations team or Superintendent take over. In addition, the manual should include cut sheets to make it easier to find replacement parts.
   - Include information about how to operate systems, interpret fault codes and respond appropriately. Train staff about how all building systems interact to deliver comfort, efficiency, and performance, and when to troubleshoot in-house or call a service provider. This training should be recorded for use by future teams and new staff.



Source
Heat Pump Water Heating Systems Installation for Plumbers, Urban Green Council, UA Plumbers Local 1

Advice for Designers and Service Providers

Architects, Engineers and Service Providers are often a client's first interaction on a project. These professionals set the tone and create the literal blueprints for the project.

1. **Discuss cost implications early:**
    - Designers should have honest conversations with clients about costs related to commissioning and O&M. They need to clarify expectations about future utility bills, especially for retrofits. Older buildings with gas boilers will have totally different cost propositions than buildings with electric heat pumps. Designers need to explain that electric bills will likely go up, demand charges (for peak power draw) can significantly increase costs, and that it is imperative for the operations team to track both energy consumption and demand.
    - Explain the strategies that will have the best return on investment, such as engaging in a proper commissioning process and investing in envelope upgrades, which can be costly, but can substantially offset operational cost increases from electrification.

2. **Design for O&M simplicity:**
    - The design process should explicitly prioritize operator usability as a core requirement.
    - Select equipment with straightforward, cost-effective maintenance needs and ensure the project scope supports ease of operations.
    - Provide clear, plain-language statements of system intent to help staff understand how systems are meant to function, supporting effective training and troubleshooting.
    - Design systems with operational efficiency in mind.
    - Bring the O&M staff into discussions early - if staff is available, specifically for retrofit projects.
    - Price out maintenance early so it can be included in the operational budget.

3. **Include performance monitoring and fault detection and diagnostics:**
    - A building automation system is typically only designed to control a building. It should also be designed and specified to allow for long-term monitoring of the systems, and to include fault detection and diagnostics.
    - For designers seeking to standardize the design, documentation, and specification of Building Automation Systems (BASs) in HVAC applications, refer to ASHRAE Guideline 13, Specifying Building Automation Systems, specifically:

        Appendix E: Performance Monitoring and Fault Detection and Diagnosis (FDD).

        Appendix K: Fault diagnostic and performance monitoring.

- Ensure that specifications include equipment with integrated monitoring and requirements for systems to be connected. Remote verification allows the manufacturer to "see" the equipment and provide timely alerts (e.g., for temperature drops or system shutdowns) that can enable proactive maintenance.

4. **Consider space requirements:**
   - The space needed for electric systems is different from fossil-fueled equipment. Air source heat pumps located indoors need a sufficient volume of air to operate properly.
   - Make sure to include access for servicing equipment, including equipment in apartments.
   - Provide elevators to the roof if rooftop equipment is being installed.
   - Provide access to refrigerant lines.

5. **Specify and allow time and budget for operational verification, Cx and training:**
   - Include in the project's contract documents:
     i. Specification for adequate time to commission the systems and for post-occupancy commissioning.
     ii. Provision for hands-on staff training.
     iii. Creation and delivery of system manuals that are written in accessible, non-technical language.

6. **Follow-up post occupancy:**
   - Follow up with clients after the building is occupied to compare actual performance with design estimates. This feedback loop not only helps identify discrepancies and areas for improvement but also informs better design on future projects.
   - Key metrics might include peak load, hot water demand, and system runtimes, as well as occupant comfort and energy use patterns.
   - Designers should incorporate these post-occupancy services into their basic services.

7. **Prioritize consistency amidst staff turnover:**
   - The design of buildings using electric heat pumps is still relatively new. Staff turnover during the design process can make clients feel like they are starting from scratch and can lead to gaps in information. Firms need consistency, redundancy, protocols and succession plans to ensure internal knowledge transfer.
   - Develop protocols for internal knowledge transfer.

Advice for Manufacturers

New heat pump equipment for heating, cooling and hot water systems are coming onto the market at a faster pace than ever before. The following recommendations for manufacturers will help building operators achieve the listed performance:

1. **Provide clear checklist templates:** Maintenance, troubleshooting and repair tasks should be supported by clear checklist templates that can be modified to meet the project's needs and incorporated into project documents. These documents help ensure consistency, reduce errors, and make it easier for staff to keep systems running smoothly over time.
2. **Include built-in monitoring systems as a base feature:** Monitoring tools should be integrated into building systems and designed to be usable, accessible from remote locations, and easily understood by operational staff. This ensures that data can be effectively acted upon to support maintenance, troubleshooting and long-term performance.
3. **Establish a process for repairs and replacements:** For manufacturers of packaged units, consider partnering with end users so that if a problem can not be solved using the checklist, an off-site repair and replacement service would be provided as part of a long-term maintenance contract.

Advice for Contractors

Contractors and trades are the key personnel responsible for the proper installation and testing of the heat pump equipment. Transferring their expert knowledge about the systems to the building operators can boost system performance and avoid issues later.

1. **Work with the Commissioning Agent** to ensure that the completion of equipment and systems aligns with testing schedules
2. **Label units and equipment:** Ensure all units and electrical services are clearly and accurately labeled to facilitate easy identification and safe maintenance.
3. **Take advantage of equipment that comes with connectivity:** You can't track what you can't see. If the equipment comes with factory-installed IoT (Internet of Things) monitoring capabilities, connect it as early as possible, so it can be a resource for commissioning in year one.
4. **Flag any issues related to access for equipment servicing:** If any adjustments are needed to make servicing equipment more accessible, it's easier to make those adjustments earlier than later.

Advice for Building Operators and Property Managers

Building operators and property managers are ultimately responsible for the long-term health and performance of the building. If the above recommendations and best practices have been followed, the facilities team should be well-positioned to maintain energy performance for the life of the systems.

1. **Get involved:**
   - Ask questions of the construction team and service provider to understand troubleshooting issues and include all responses with your documentation.
   - Confirm when warranties expire for the systems and components.
2. **Ensure access to key information:**
   - Make sure you have access to all relevant data needed to verify building performance, including from submeters, sensors and utility bills.
   - Make sure all members of the operations team have access to the Handbook, and any equipment manuals and available training materials. These can be in analog binders or in a searchable digital repository. QR codes in the binders and on the equipment can link to tutorials/manuals.
   - Onboarding for new staff should include a walk-through of all available information.
   - Schedule an annual review and update of all key information.
   - Schedule quarterly reviews of KPI data to verify that the building's performance goals are being met.

3. **Require and budget for training for operations staff:**
   - Provide periodic time during working hours as necessary for staff training and include training during the onboarding of new staff.
   - Ensure that staff have sufficient training on data analysis, as targeted training may be needed to better interpret data and enable staff to escalate issues effectively. Energy use and energy costs are related, but not the same. Training staff to interpret energy consumption, demand, and cost helps staff get a better understanding of their building and enables them to reduce energy costs.

4. **Establish an apartment access plan:** Create a clear plan for gaining entry to apartments for repairs and share this plan with all relevant staff and occupants. This may need to be embedded into the lease agreement.

5. **Ensure that Property Management is aware of all Tenant complaints.** When tenant complaints arise related to heating, cooling, hot water, or other electric equipment, maintenance staff should make sure that property management is aware so that system-wide issues can be addressed holistically.

6. **Take steps to ensure that occupant engagement is effective:**
   - Present practical, cost-oriented information: Tenants are more engaged when project teams present information in an accessible, practical, health-, and cost-oriented approach. Try to avoid only presenting technical perspectives that describe how equipment and systems work, with a particular focus on any equipment that is controlled directly by tenants.
   - Highlight opportunities for feedback: Explain to tenants when they should let the maintenance team know about a problem and how important these items are to their own and their children's comfort, health and well being. If filters are clogged, systems are operating loudly, or are taking a longer time to heat or cool, these are valuable opportunities for tenants to speak up.
   - Demystify utility costs and demand charges: Many tenants assume their electric bill is just about "how much they use," not when they use it. For residents in buildings with demand-based rates, demand charges can lead to confusing and unexpectedly high costs. Project teams should provide simple visual explainers on how utilities calculate demand and offer tips for reducing peak usage, especially around shared systems like heat pumps or hot water. If the building participates in a demand response program, provide a clear explanation for what to expect during demand response periods.
   - Provide transparency around energy costs: Clear explanations build transparency and help tenants understand when they are being charged fairly and when they are not. If your building participates in submetering, explain how it works in simple terms and demonstrate its benefits to tenants. Transparent submetering practices, especially when paired with visuals or dashboards, help build trust and improve reporting when issues arise.
   - Share engaging and accessible materials: Effective tenant engagement involves consistent outreach, visual materials, and signage that is available in multiple languages.
   - Prepare tenants for power loss scenarios: In the event of a rare electrical outage, it is critical that tenants are prepared. Occupant engagement should include basic emergency preparedness tips, such as who to call, what backup resources are available locally (e.g., partner shelters), and how to protect children, the elderly, or medically vulnerable residents. This is particularly urgent in communities already vulnerable to

extreme weather or heat events. Operations teams should prepare sample emergency communication plans and backup strategies. Buildings with high-performance enclosures, such as Passive House, may want to include instructions to support sheltering in place.

- Provide cost mitigation resources: Tenants should be given a short list of financial and technical resources available to them, such as utility bill assistance programs (e.g., Home Energy Assistance Program (HEAP), ConEd's EnergyShare), or community solar enrollment opportunities.

3. Seeking Further Research

As HPD develops the next revision of Design Guidelines, they will be seeking input on the following categories. Please let Urban Green know if you have proposed language to share on these topics or would be willing to provide input.

1. **Grid interactivity and demand response protocols**
   - Demand response strategies for owners and residents
   - Transparency and visibility around utility rates that include demand charges, such as a better understanding of power demand from Con Edison. ie. "This is how it's calculated for Service Rate 12".
   - Energy procurement criteria.

2. **Enhanced Commissioning requirements for heat pumps**
   - Design & construction
   - Post occupancy
   - Ongoing and beyond (RCx)

3. **Appropriate M&V strategies for affordable multifamily projects**
   - Heating
   - Hot Water
   - Key KPIs that should be considered

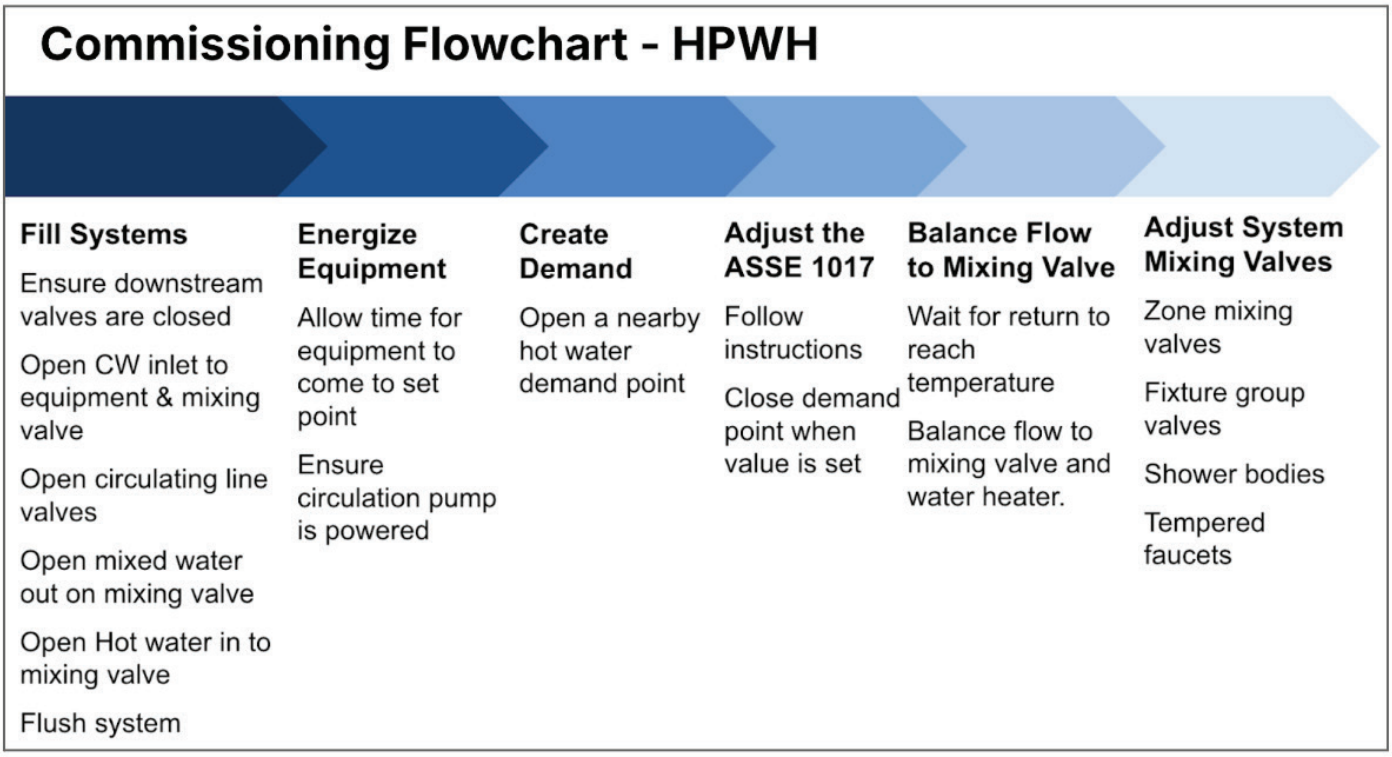
4. Appendix

Recommended Resources:

- ASHRAE Commissioning Guides and Standards
- ASHRAE Guideline 13, Specifying Building Automation Systems, specifically:

  Appendix E: Performance Monitoring and Fault Detection and Diagnosis (FDD).

  Appendix K: Fault diagnostic and performance monitoring.
- IPMVP Core Concepts, particularly around Operational Verification (Section 7.6)
- NEEP: Cold climate air source heat pump list
- Heat Pump O&M - YouTube: A 4-minute video on split heat pump maintenance.
- Commissioning Flow Chart for Heat Pump Water Heaters, from *Heat Pump Water Heating Systems Installation for Plumbers* course, Urban Green Council, UA Plumbers Local 1



Thank you!

Thank you to SEIU 32BJ Thomas Shortman Training Fund for hosting the convening and to the following contributors and supporters:

Sara Bayer, Magnusson Architecture and Planning

James Barry, 32BJ Training Fund

Jason Block, Cadence OneFive

Annie Boasberg, CPC

Jordan Bonomo, NYCHA

Michaela Boren, 32BJ Training Fund

John Braman, Bright Power

Jenna Breines, West Side Federation for Senior and Supportive Housing

Brian Cabezas, NYSERDA

Nicole Ceci, Steven Winter Associates

Loic Chappoz, NYSERDA

Jason Clarke, CBRE

Rebecca Elzinga, Urban Green Council

Mark Ginsberg, Curtis Ginsberg Architects

Asher Harris, HELPDevCo

Jon Harrod, Taitem Engineering

David Hawkins, IUOE Local 94

Eliot Hetterly, Settlement Housing Fund

Ellen Honigstock, Urban Green Council

Elizabeth Kelly, NYSERDA & EDKA Solutions

Jean Kim, NYC DOB

Caroline Kopp, ConEd

Andrea Kretchmer, Xenolith Partners

Jen Leone, NYC HPD

Giulia Luci, NYC HPD

John Mandyck, Urban Green Council

Kevin McDonald, Steven Winters Associates

Heather McKinstry, Dattner Architects

Christina McPike, WinnCo

Sheldon Mendonca, RMI

Izzy Nesci, CPC

Jane Olsen, CPC

Samantha Pearce, HCR

Adam Phillips, Strada NYC

Duncan Prahl, CUNY BPL

Rashi Puri, BRC

Jason Ramos, Riseboro

Emma Raymont, MaGrann Associates

Paule Reale, CUNY BPL

Michael Reed, NYSERDA

John Rhodes, LIPA

Martin Robertson

Tom Sahagian

Daphany Rose Sanchez, KC3

Shefali Sanghvi, Dattner Architects

Cecil Scheib, NYU

Daiva Scovil, Urban Green Council

Josh Shaffer, Riseboro

Ian Shapiro, Syracuse University

Minaiel Shoaib, L&M Development Partners

Charles Skolnick, Institute for Community Living

Justin Stein, Bronx Pro

Christoph Stump, Trinity Financial

John Sullivan, UA Local 1 Plumbers

Rosibel Tavares

Siobhan Watson, NYCHA

Kelly Westby, Steven Winter Associates

Thomas Yeh, NYSERDA

Kelly Zeigler, ConEd

Marc Zuluaga, Cadence OneFive

Smooth Operator

Effective O&M in Electric Buildings

urbangreencouncil.org

Nerdfest 3