

How & When? Clean Heat and Climate-Friendly Homes for All

Join Building Energy Exchange (BE-Ex), New York City Housing Authority (NYCHA), New York Power Authority (NYPA), and New York State Energy Research and Development Authority (NYSERDA) for an engaging expert-led panel discussion and live Q&A on New York State's groundbreaking Clean Heat for All initiative and NYCHA's window heat pump program!

opening remarks

Siobhan Watson, Senior Director, Sustainability, NYCHA
Ravi Shankar, Director, Customer Project Delivery, NYPA

presentations by

Jordan Bonomo, Senior Project Manager, NYCHA
James Mannarino, Senior Project Manager, NYSERDA

moderator

James Mannarino, Senior Project Manager, NYSERDA

panelists

Jordan Bonomo, Senior Project Manager, NYCHA
Bryant Elder, Director, Business Development, Gradient
Brian Langness, Senior Project Manager, Midea America Corp
Tom Sahagian, Senior Technical Advisor, Energy Programs, NYCHA & Lecturer, Master of Science in Sustainability Management, Columbia University

**be
ex**

building
energy
exchange



NYSERDA



**NY Power
Authority**



31 Chambers Street
New York, NY

January 16, 2025
9:30 to 11:00am

1.5 AIA
LU | HSW

Clean Heat for All

Introduction & Program
Updates

January 16, 2025



Agenda

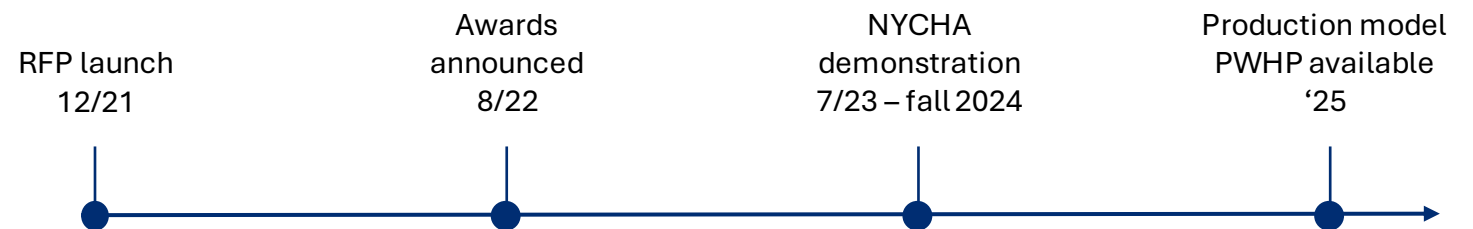
1. About Clean Heat for All (CH4A)
2. CH4A Challenge - specs and solutions
3. Costs & market potential
4. CH4A PTHP Program overview

The Clean Heat for All challenge spurred innovation by leveraging the NYCHA portfolio as an early adopter



Clean Heat for All Challenge

- Challenge to develop a unitary, packaged window heat pump to hasten the transition to heat pump electrification & fossil-free heating sources.¹
- NYCHA, NYPA, and NYSERDA partnered to fund development, demonstration and purchase/installation of 30,000 window heat pumps in NYCHA homes.
- Prior to implementing the full purchase, the window heat pumps are being evaluated against CH4A specifications through demonstration of 72 PWHPs in 24 homes at NYCHA's Woodside Houses.
 - Performance data has been collected for both the heating and cooling seasons.
 - Punchlist items uncovered have been reported to manufacturers and resulting corrections will be tested before full NYCHA purchase order is implemented.



¹ <https://www.nypa.gov/news/press-releases/2021/20211220-decarbonize>

The Clean Heat for All Challenge seeks a cost-effective, non-intrusive heating & cooling retrofit solution



Midea America Heat Pump

Key Innovations

- 120 volt / 15-amp standard outlet plug-in operation.
- Cold-climate performance below 0°F without backup electric resistance heating.
- Self-contained condensation management system, installs with no external drainage or plumbing.
- Saddle form factor does not obstruct window.
- Reduced risk/severity from refrigerant leaks.
- Installable by non-specialized labor/tenants
- Installation does not materially affect envelope performance



Gradient Comfort Heat Pump

The Clean Heat for All packaged window heat pump specifications

Midea Heat Pump Specifications

- 120 VAC / 12 A / 60 Hz
- BTU / Efficiency
 - 9,100 @ 95°F / 11.81 EER
 - 9,000 @ 47°F / 4.00 COP
 - 9,000 @ 17°F / 2.42 COP
 - 9,000 @ 5°F / 2.00 COP
- Operation down to -13°F
- Variable speed compressor
- R-32 refrigerant
- 51 Max dB(A)
- Weight: 130 lbs
- Dimensions: 25.5”W x 35”-41” D x 20.5” H

Gradient Heat Pump Specifications

- 120 VAC / 12 A / 60 Hz
- BTU / Efficiency
 - 9,000 @ 95°F / 10.0 EER
 - 9,000 @ 47°F / 4.0 COP
 - 9,000 @ 17°F / 2.60 COP
 - 7,200 @ 5°F / 2.35 COP
- Operation down to -7°F
- Variable speed compressor
- R-32 refrigerant
- 47 Max dB(A)
- Weight: 135 lbs
- Dimensions: 25.5”W x 33.65”-41.65” D x 24” H

Costs and market potential



Current heat pump electrification retrofits cost around \$38,000/dwelling unit (DU)*.

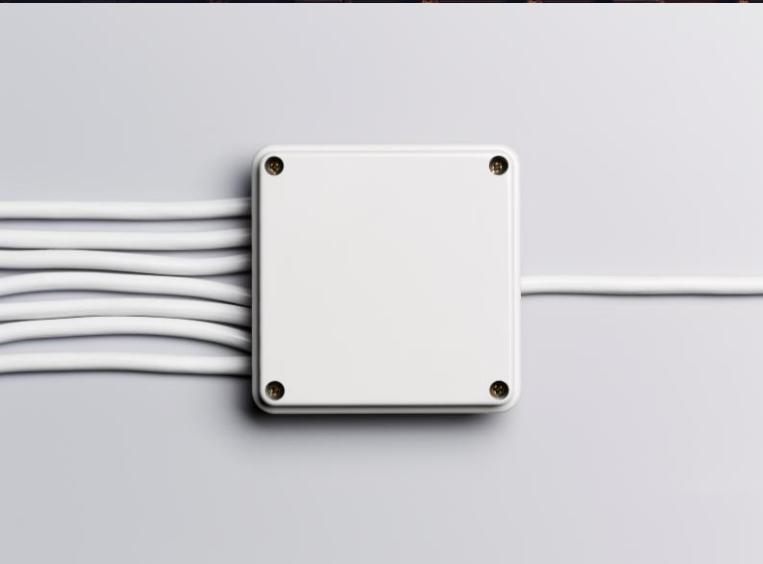
- VRF system install: \$33,000/DU
- Electrical upgrades: \$5,000/DU

**Source: Cadmus cost data analysis of 15 multifamily heat pump retrofit projects in NYC*

Retrofitting buildings with PWHPs could cost roughly 1/3rd of that. Or less.

Target buildings are pre-war & other multifamily with steam/hydronic heating and window air conditioning.

- There are 3.7million housing units in New York City, 2.4million of which were built before 1950, many of which fit this sub-type.



Clean Heat for All:

Packaged Terminal Heat Pump Program

A \$10 million NYSERDA investment to support the development and demonstration of high-efficiency, cold-climate Packaged Terminal Heat pumps that:

- Compatible with existing wall openings.
- Use will not require street or building electric upgrades.
- Have high-efficiency, cold-climate operation.
- Possess flexible condensate management approaches for diverse building needs.
- Improve indoor air quality by delivering outdoor air with energy recovery capability.

The PTHP Program will accelerate PTHP development and adoption

1 Manufacturer Partnerships

Select a limited number of manufacturer proposals for heat pumps that meet the needs of NY buildings

2 Product Development

Support selected manufacturers to develop advanced PTHP products

3 Field Demonstrations

Work with manufacturers and building owners to fund field demonstrations and collect and publish performance results

4 Market Adoption

Run an early adopter program to drive large-scale market adoption

Manhattan

Queens

BE-EX: Clean Heat and Climate Friendly Homes for All

NYCHA's CH4A Pilot

January 16, 2025



NEW YORK CITY
**HOUSING
AUTHORITY**



Agenda

- What is a heat pump?
- Challenges to retrofitting multifamily housing
- CH4A heat pump pilot
- Pilot results
- Lessons learned

What is a heat pump?

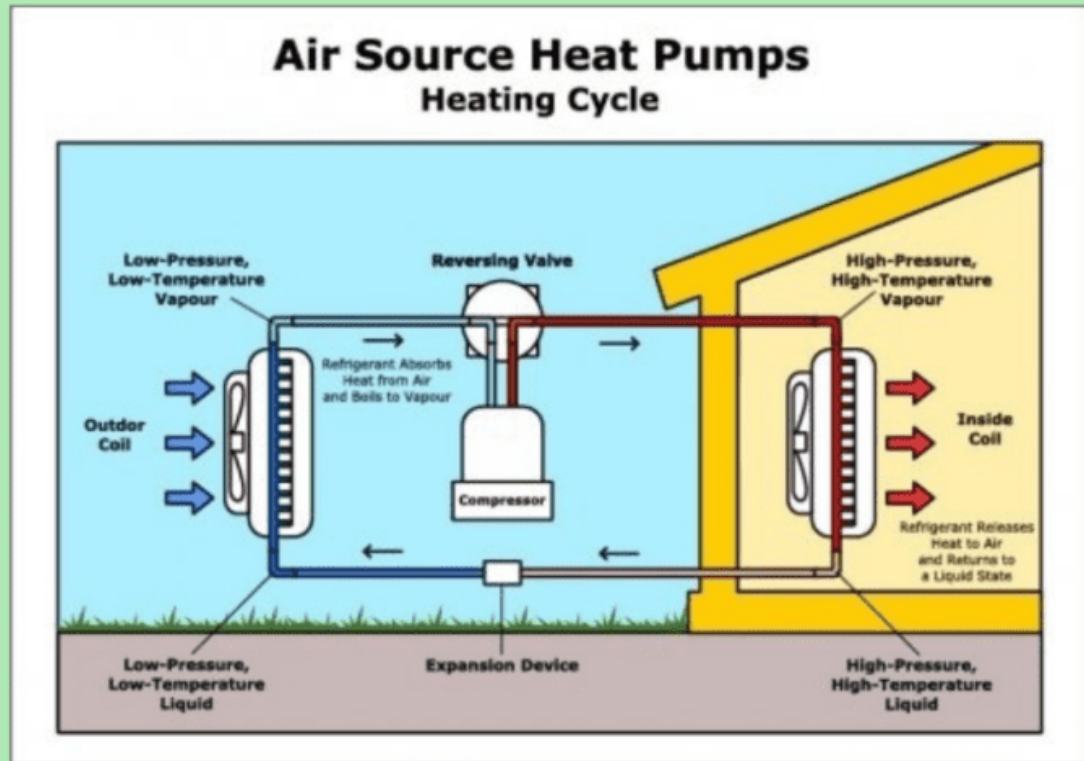


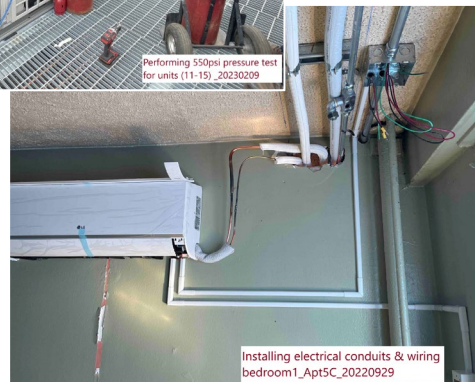
Image source: <https://www.energy.gov/energysaver/air-source-heat-pumps>



Central VRF System requires major electrical upgrades and construction – only possible for certain buildings

Mini-split, Multi-split, and Central VRF Attempts

- Central outdoor units (e.g. rooftop) each serving large number of indoor units (in apartments) through refrigerant piping
- 2-pipe system typically only allows heating or cooling at one time, but can be fitted with branch connector, while 3-pipe system allows both at same time but more complex piping
- Long refrigerant runs pose risk of refrigerant leaks (HIGH GWP!!)



Clean Heat for All Challenge

WHO: NYCHA-NYPA-NYSERDA

WHAT: Partnership to develop new all-in-one packaged cold climate heat pump installed through existing window.

HOW: RFP for bulk purchase

- Minimum Requirements Specifications
- Additional Design Target Specifications (scoring system)
- Initial purchase order of production units

WHERE: NYCHA campus developments

NYCHA estimated internal demand: 156,000 heat pump units to reach climate goals

External demand: Letters of interest from 13 stakeholders: PHAs, government agencies, ESCOs representing over 75,000 housing units. *Price guarantee allows others to purchase at the same price.*

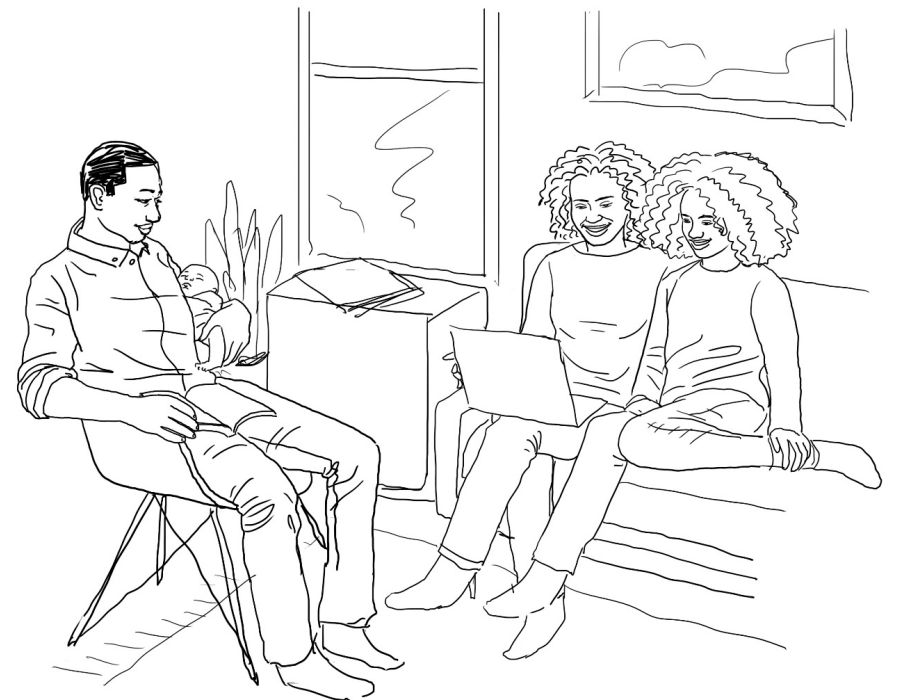


Image Source: Grain Collective

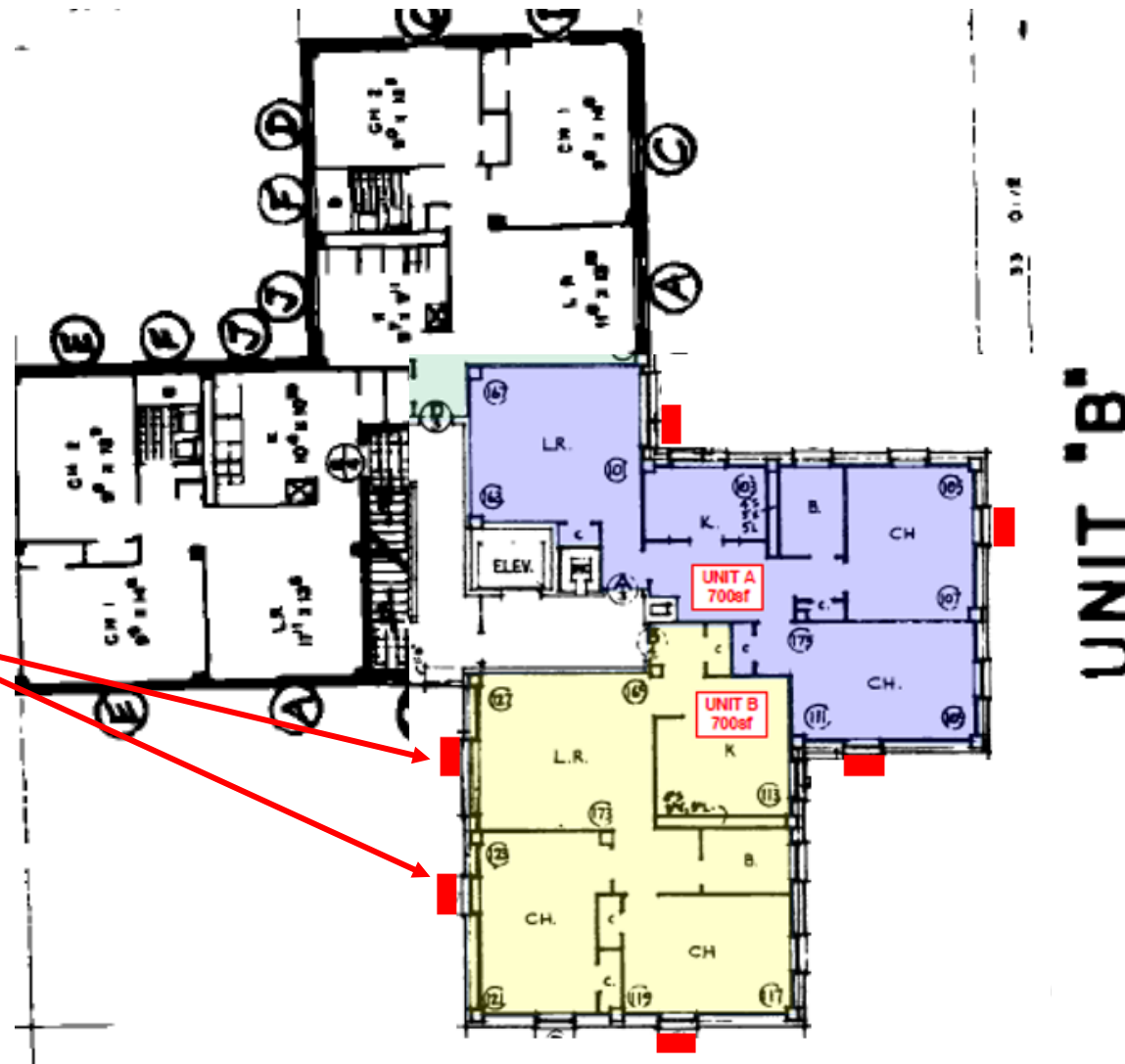
RFP Desired Product Specifications

- Form factor with approximate size and weight of a typical window or through-the-wall AC with all refrigerant piping hermetically connected within the unit and no exterior core drilling required for installation;
- Run on 115 VAC +/- 10% single phase, 60 Hz and plug into a standard 3-prong outlet, 15-amp circuit;
- Minimum efficiency of 1.85 COP at 17°F outdoor temperature and 70°F indoor temp in heating mode, at rated capacity;
- Shall operate down to 0°F and shall not use backup resistance heat for space heating;
- Variable speed compressor with capacity of 9,000 Btu/hr heating at 17°F outdoor temp;
- Condensate line and pump (if needed) are internal and discharge outdoors or nearby indoors with no need for plumber labor;
- Can be installed so it is airtight around its perimeter without any degradation to the overall R-value or infiltration of the building envelope;
- Provide BACNet compatibility for BMS integration with no external proprietary cloud software required; and
- Can be installed by unskilled labor within approximately two hours.

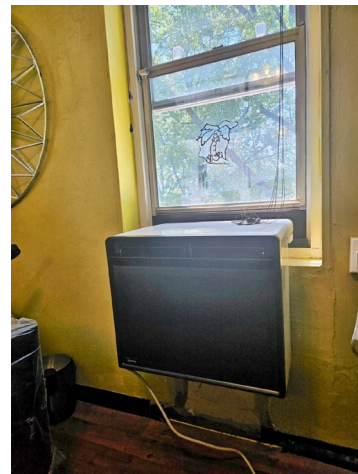
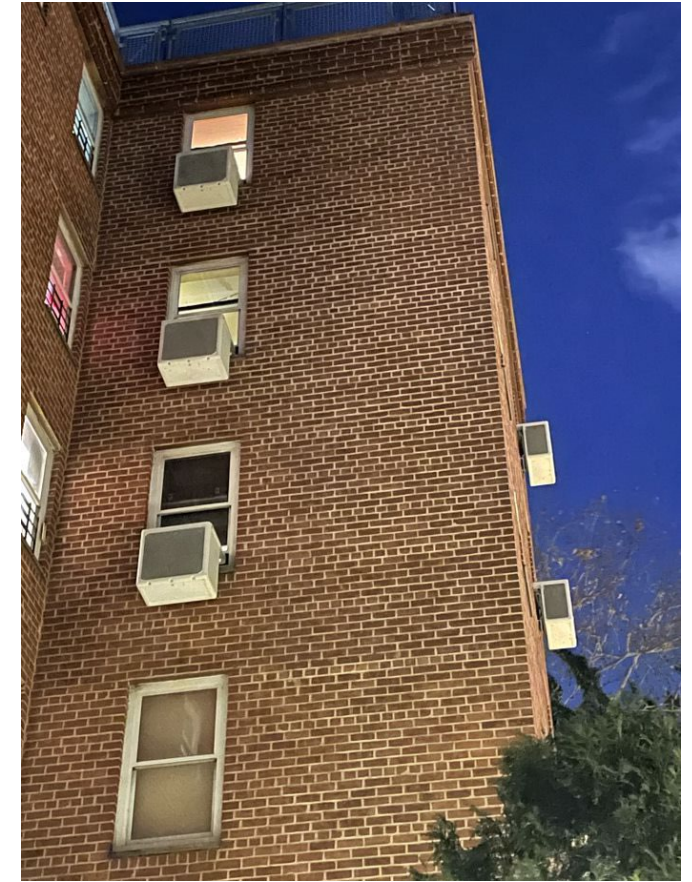
Two window heat pump products piloted at Woodside

Background

- ❑ Two adjacent lines of apartments selected at two 6-story buildings
- ❑ 6 apartments per line, 12 apartments in each building, 24 total apartments
- ❑ Buildings currently heated by 2-pipe steam
- ❑ Steam service was disconnected for the pilot apartments but left in place for the control apartments
- ❑ One heat pump installed in each bedroom and living room
- ❑ No direct heat given in kitchens and bathrooms
- ❑ Electric meters installed in each apartment and on each riser
- ❑ Space temperatures measured in each room



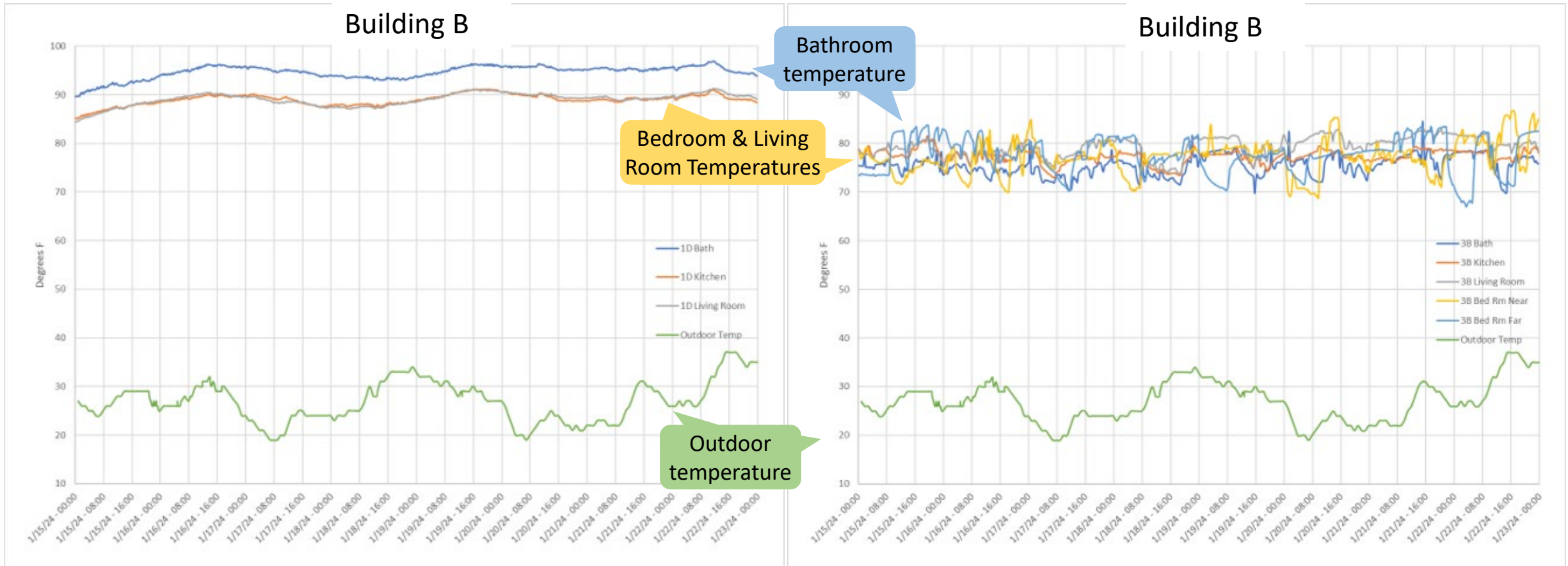
Pilot installation completed by NYCHA maintenance staff with 24 apartments completed in 8 days (excluding outlets)



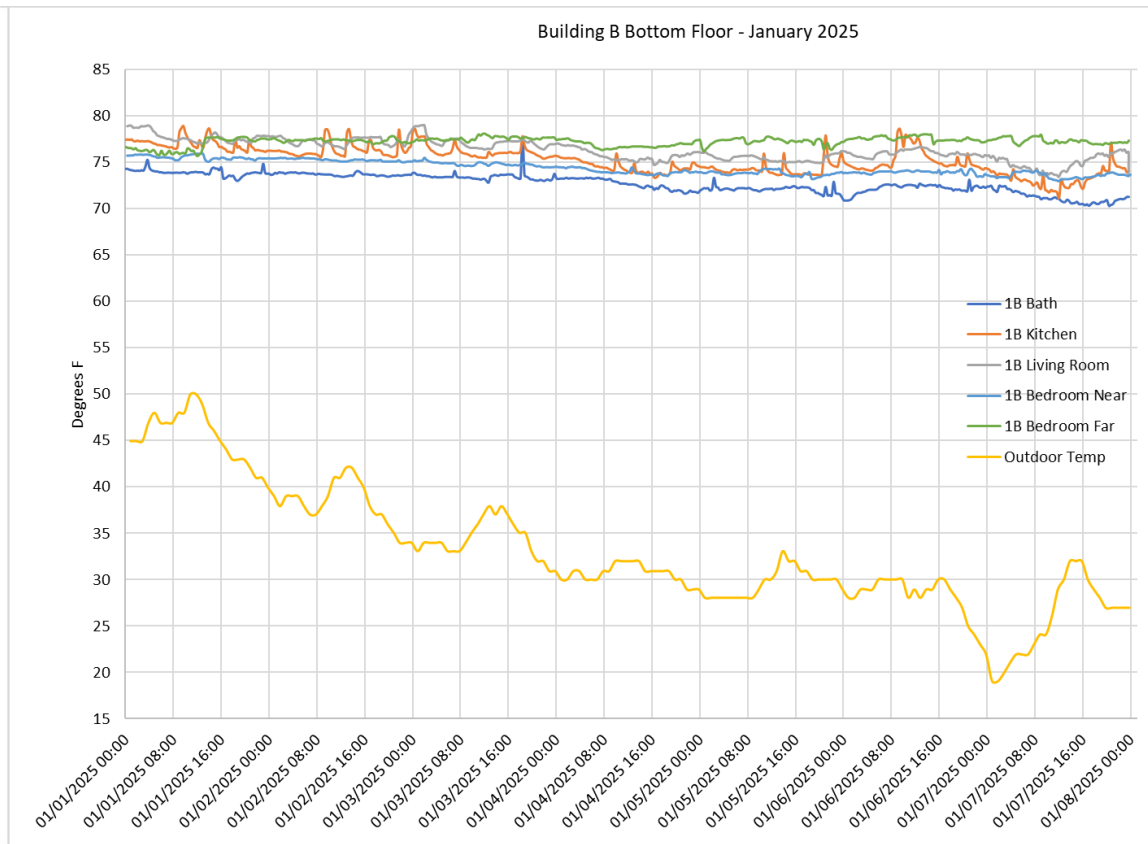
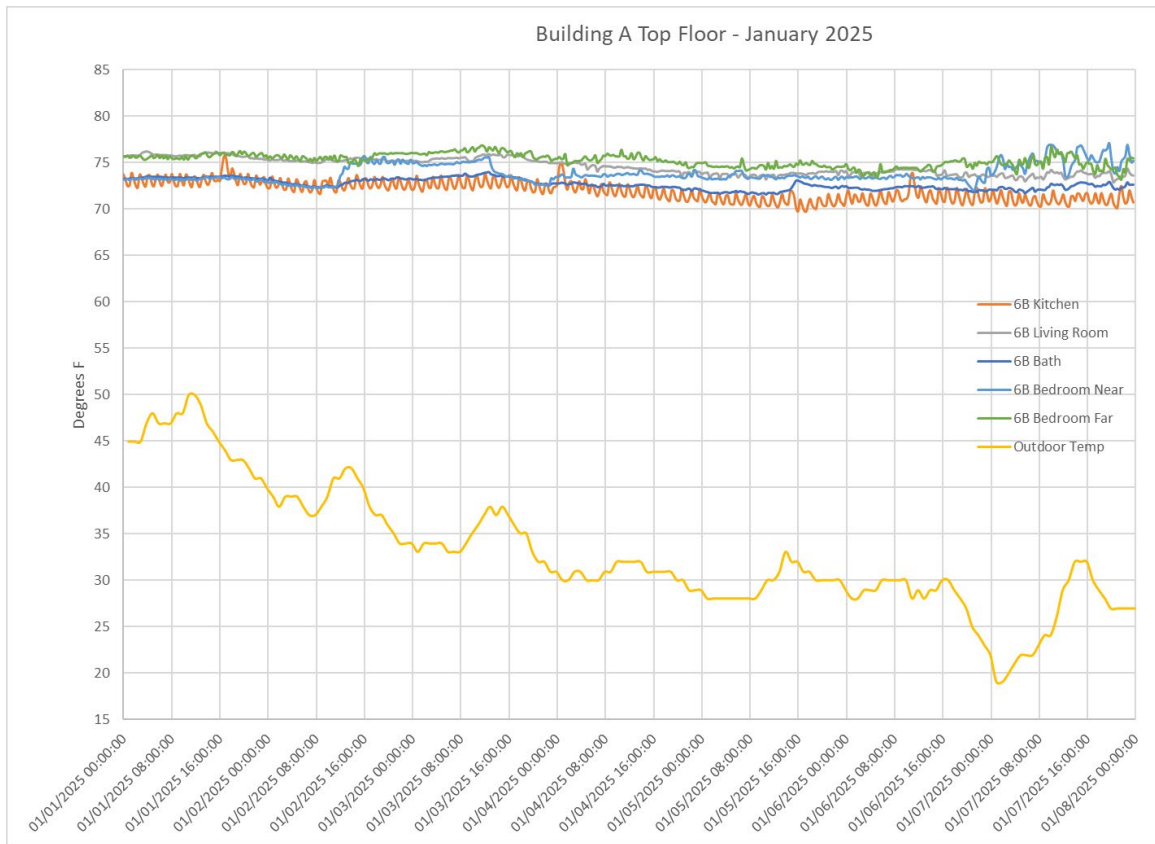
Preliminary Results: Consistent comfortable temperatures

Control Apartment (Steam System)

Apartment with Window Heat Pump Units



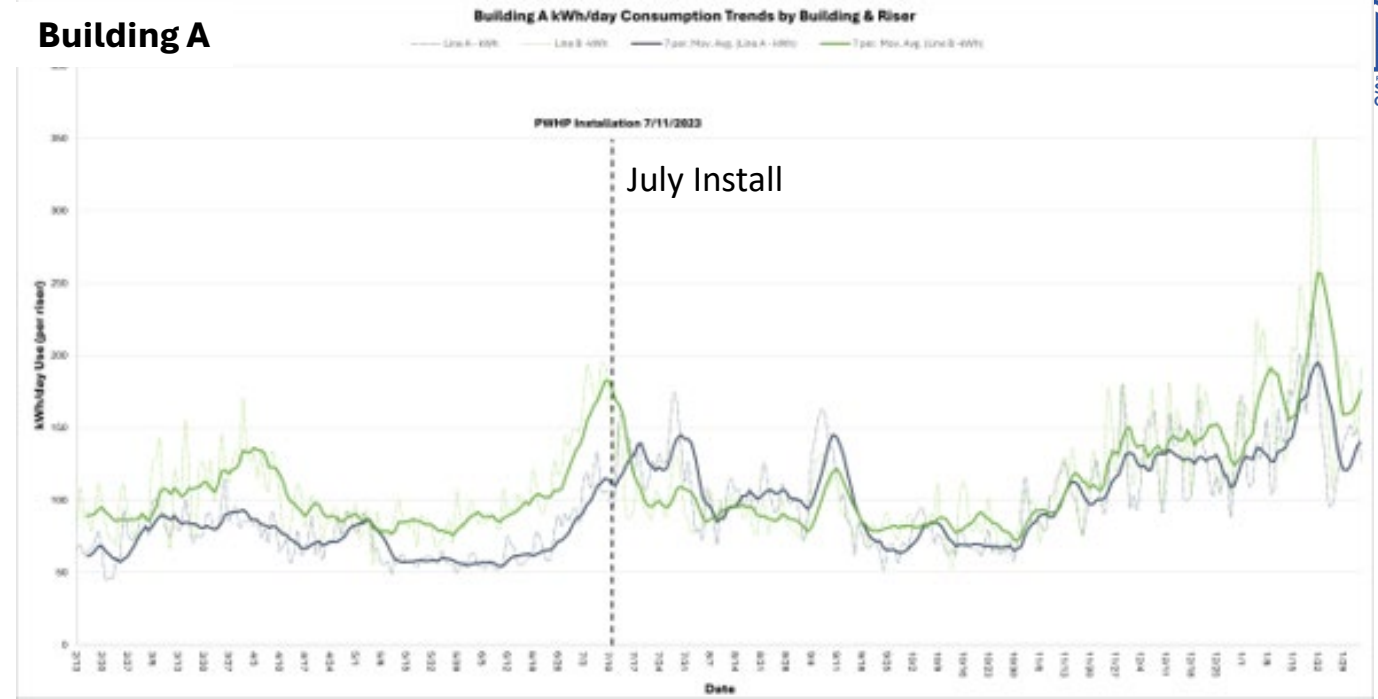
Consistent temperatures despite outdoor weather



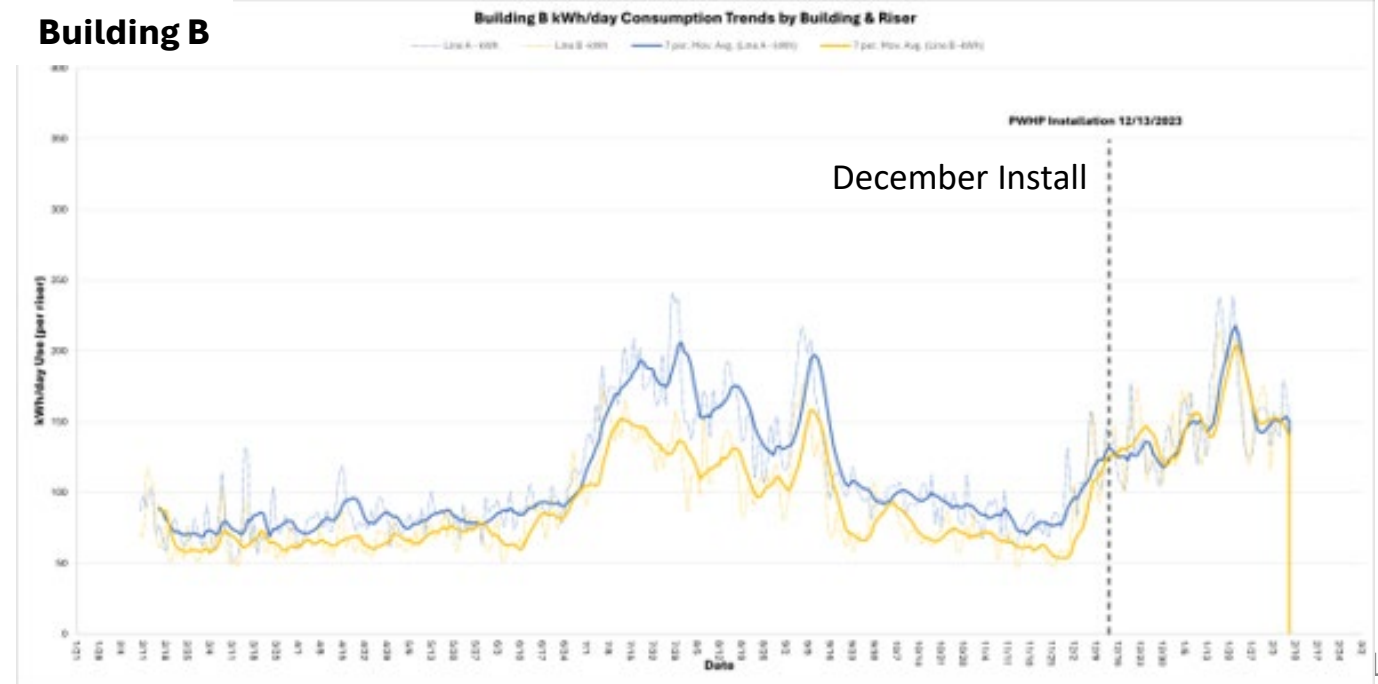
Increase in peak electrical demand but not enormous one despite doubling number of heat pumps relative to removed window ACs

- Slight drop in summer kwh/day after building A install
- Peak winter was about the same as peak summer in building B despite doubling the number of heat pumps vs window ACs
 - Note, 2023-24 heating season was relatively mild

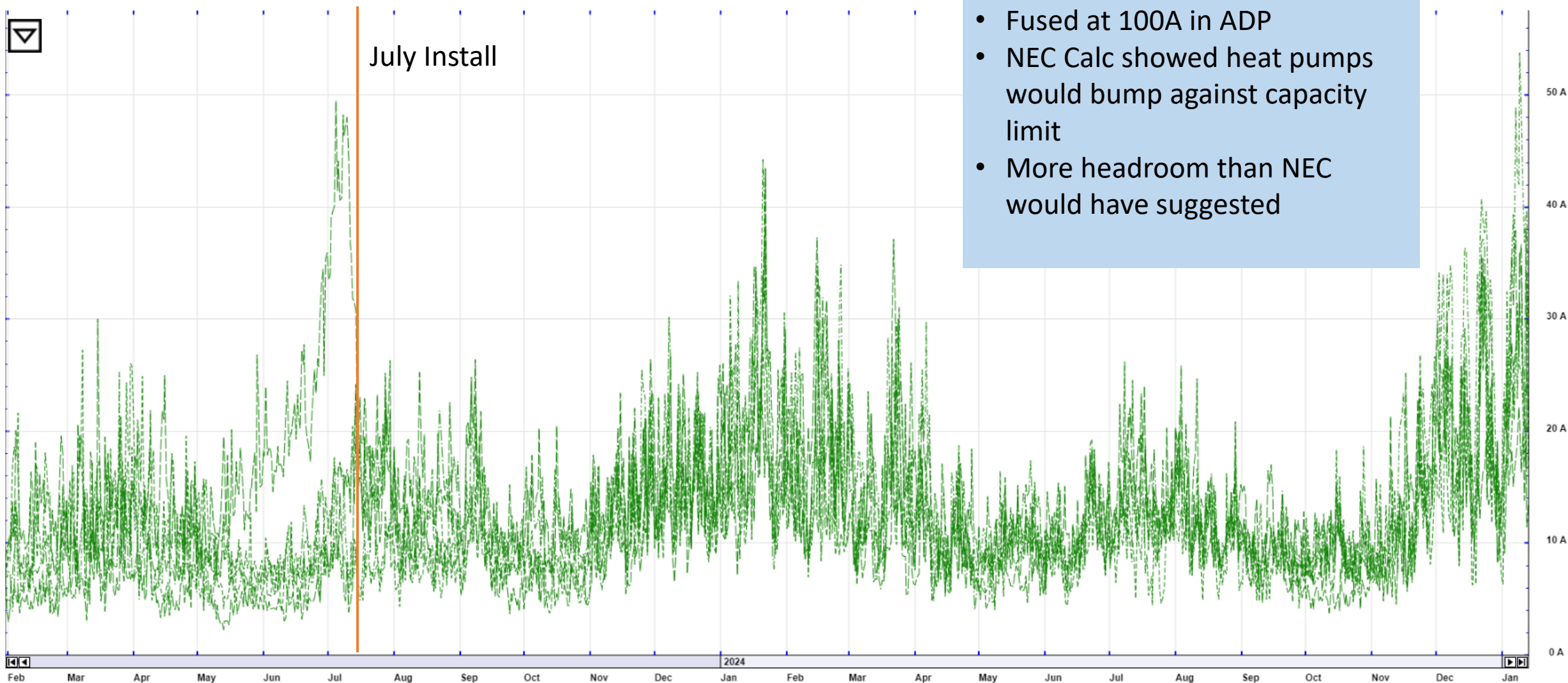
Building A



Building B



Metering showed that existing risers were only being loaded to ~30% of max capacity

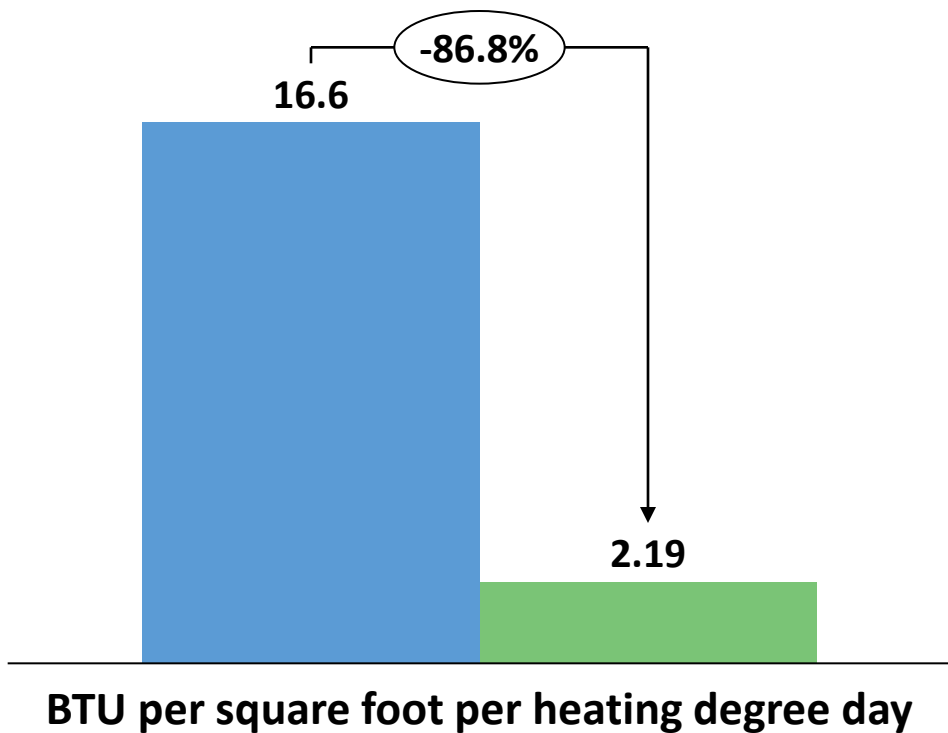


- #1 Risers, rated for 130A
- Fused at 100A in ADP
- NEC Calc showed heat pumps would bump against capacity limit
- More headroom than NEC would have suggested

Preliminary Results: 87% decrease in energy use and 50% decrease in energy cost

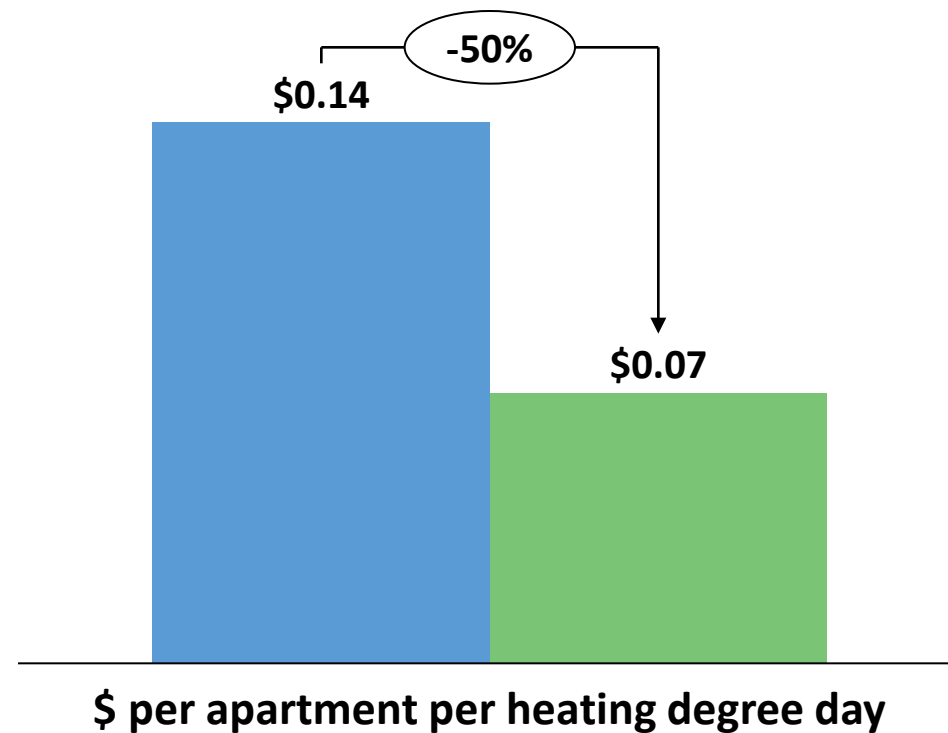
87% decrease in energy required

- Steam System (Space Heating Only)
- Window Heat Pump Unit



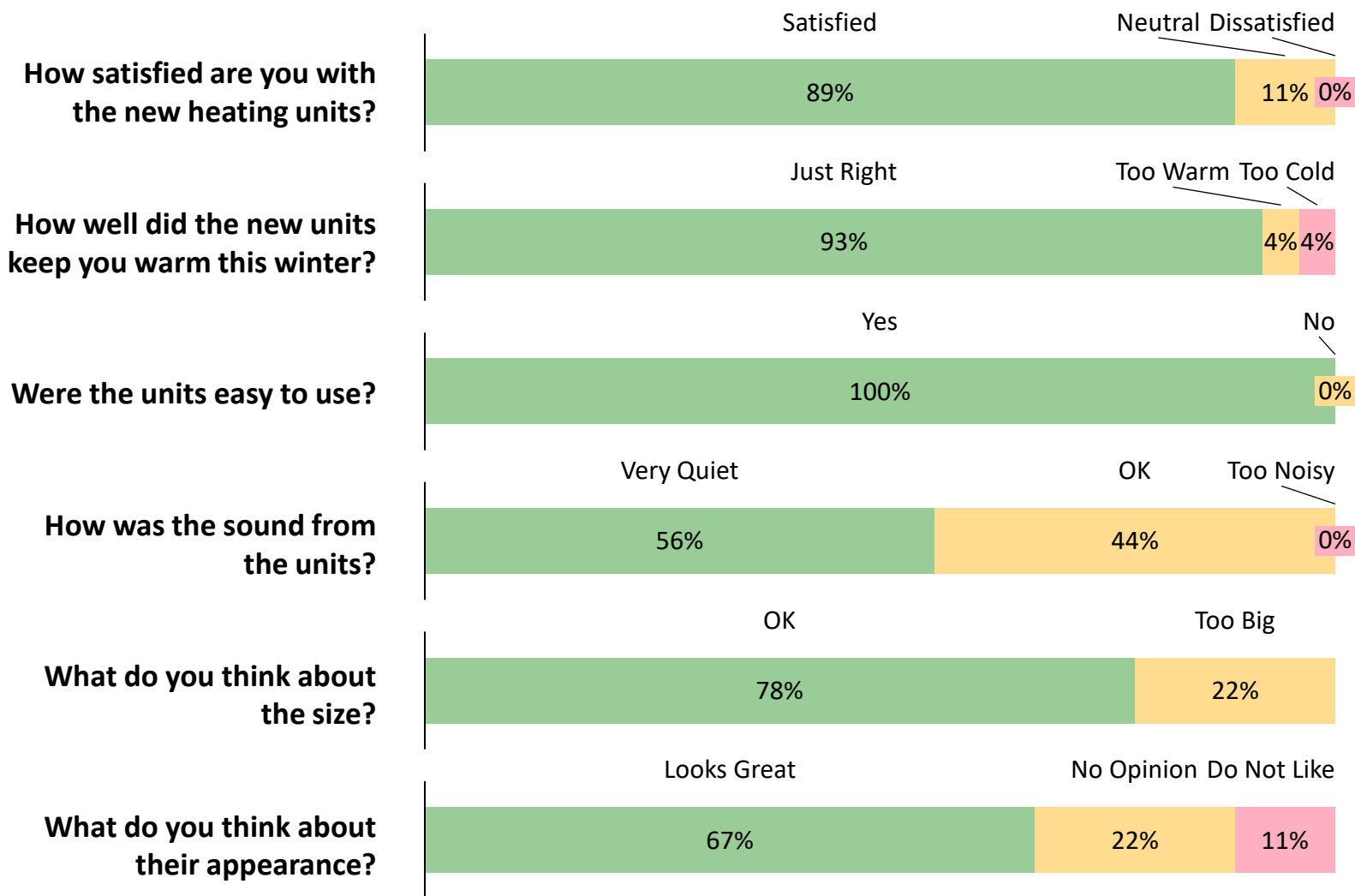
50% decrease in cost of energy

- Steam System (Space Heating Only)
- Window Heat Pump Unit



Based on average results from both manufacturers

Preliminary Results: Initial resident feedback also very positive



Lessons learned

- **Successes**

- Produced and demonstrated viability of 120V cold climate room heat pumps within three years of RFP launch
- Exceeded expectations for both efficiency and price point
- Demonstrated a new model for public–private partnerships through customer-centric process of R&D
- Involved residents in the M&V and feedback process

- **Challenges**

- Buy-in from key stakeholders takes time to develop
 - Internal realignments
 - External partners need to understand these types of products and how they align with their programs
- Many questions regarding longevity and O&M can only be answered through more run time and larger sample sizes
- Obstacles such as existing building codes and hazmat regulations need to be examined.





discuss.

moderator

James Mannarino, Senior Project Manager, NYSERDA

panelists

Jordan Bonomo, Senior Project Manager, NYCHA

Bryant Elder, Director, Business Development, Gradient

Brian Langness, Senior Project Manager, Midea America Corp

Tom Sahagian, Senior Technical Advisor, Energy Programs, NYCHA &
Lecturer, Master of Science in Sustainability Management, Columbia
University

thank you!

