NYSERDA Case Study:

Gradient Window Heat Pumps

Final Report

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NYSERDA Case Study: Gradient Window Heat Pumps

Executive Summary

Project Details	**Technology:** Window heat pumps (WHPs) are energy efficient alternatives to window-mounted air conditioners that offer users both cooling *and* heating capabilities. **Hypothesis:** WHPs are a scalable and cost-effective solution to decarbonize NYCHA's multifamily buildings, especially in cases where structural barriers and/or high retrofit costs preclude traditional electrification. **NYCHA Beta Test:** NYSERDA, the New York City Housing Authority (NYCHA), and the New York Power Authority (NYPA) awarded Gradient funding to develop and commercialize a cold climate WHP. NYCHA beta tested Gradient WHP units in 12 apartments at Woodside Houses in Queens between December 2023 and September 2024.
Benefits & Successes	**Energy Benefits:** Switching to WHPs in the 12 pilot apartments reduced NYCHA's annual natural gas consumption by 812 MMBtu (68 MMBtu per apartment) and lowered net energy consumption by 483 MMBtu (40 MMBtu per apartment). **Fiscal Benefits:** NYCHA's annual energy costs increased by $937 ($78 per apartment), suggesting that energy efficiency improvements from switching to WHPs helped balance the impact of the 3x gas-electricity price differential. **Environmental Benefits:** NYCHA avoided 24 $MTCO_2e$ in emissions (2 $MTCO_2e$ per apartment) at a net cost of $39 per ton (in increased electricity expenditures). **Comfort Benefits:** 92% of tenants confirmed the new WHP units kept them warm in the winter and cool in the summer, and nearly 80% were satisfied with their units overall.
Insights & Next Steps	**Insights:** Installing WHPs in all 1,357 apartments at Woodside Houses could decrease annual energy consumption by 54,600 MMBtu at a cost to NYCHA of $106,000 per year in increased electricity bills. Annually, 2,700 $MTCO_2e$ could be avoided at a value of $436,000. NYCHA's cost to maintain steam heating infrastructure is significant and may attenuate or even outweigh the increase in energy costs from switching to WHPs. **Next Steps:** Gradient is proactively addressing observations identified by NYCHA staff related to condensation performance. While NYCHA and Gradient complete this evaluation, large-scale deployment of the Gradient window heat pump units at NYCHA has been slowed, but the existing 10,000-unit contract remains in effect. Gradient's window heat pump is fully commercialized and is being sold and installed for customers nationwide.

Project Background

In 2021, the New York City Housing Authority (NYCHA) initiated a search for a scalable and affordable solution for decarbonizing its building portfolio. NYCHA manages over 170,000 apartments in 2,550 buildings across NYC, more than half of which were constructed prior to 1950 and rely on energy inefficient steam radiators and window air conditioners for heating and cooling.[1] NYCHA had previously conducted pilots of electrification technologies including air source heat pump (ASHP) mini-splits and geothermal heat pumps, but installing these solutions required extensive building retrofits and proved to be cost prohibitive.

NYCHA identified window heat pumps (WHPs) as a potential solution that could be both scalable and cost-effective. WHPs are compact, energy efficient ASHPs that are mounted in a window like traditional air conditioners but offer both cooling *and* heating capabilities. WHPs are easy to install and require no structural modifications (e.g., cutting holes in walls to accommodate mini-splits, running condensate and refrigerant lines, or adding ductwork for ducted systems). NYCHA was aware that some manufacturers were developing room air conditioners with limited heating capabilities suitable for mild climates, but a true cold climate WHP technology was not yet commercially available.[2]

Figure 1. Gradient Window Heat Pump

Photo: Gradient (via Wired)

CLEAN HEAT FOR ALL CHALLENGE

The Clean Heat for All Challenge (CH4A) is a joint initiative of NYSERDA, NYCHA, and NYPA to support innovation among heating and cooling equipment manufacturers. The initiative aims to develop new electrification products that can better serve the needs of existing multifamily buildings and advance the transition to fossil-free heating sources.

To address this commercialization gap, NYSERDA collaborated with NYCHA through the NextGen Building Innovation Challenge (PON 3519) and awarded contracts to manufacturers Gradient and Friedrich to develop a WHP that could meet NYCHA's needs. In addition, NYSERDA, NYCHA, and NYPA jointly issued an RFP under the Clean Heat for All Challenge (CH4A) for a pilot demonstration of 30,000 WHP units in NYCHA facilities. In August 2022, the NYPA Board of Trustees awarded manufacturers Gradient and Midea a combined $70 million in CH4A prize funding to commercialize and pilot the 30,000 units.[3]

In advance of the full pilot, NYCHA ordered a beta test of 72 pre-commercialized units in 12 tenant apartments (three units per apartment) at Woodside Houses in Queens. Situated on 22 acres, NYCHA's Woodside Houses development consists of 1,357 tenant apartments across 20 six-story brick buildings.[4] The development was constructed in 1949 and relies on steam generated at an onsite gas-fired boiler for heating, and window air conditioners for cooling. Buildings contain eight apartments per floor, each 700 square feet with two bedrooms, a living room, a kitchen, and a bathroom. Columns of six apartments (occupying the same position on each of the six floors) have identical layouts and share a common steam radiator and electrical riser. Buildings are

[1] See the U.S. Department of Energy's NYCHA Better Buildings Profile found here: https://betterbuildingssolutioncenter.energy.gov/partners/new-york-city-housing-authority-nycha and 2022 Challenges and Solutions Electrifying NYCHA presentation found here: https://betterbuildingssolutioncenter.energy.gov/sites/default/files/2022Summit-Electrification_in_Existing_Multifamily_Buildings-Slides.pdf.

[2] Interview with Jordan Bonomo, NYCHA Senior Project Manager (April 2024).

[3] Gradient and Midea were announced as winners of the $70 million CH4A investment in August 2022.

[4] https://www.nyc.gov/assets/nycha/downloads/pdf/Woodside.pdf.

master metered and NYCHA recovers average energy costs in the rent; there is no direct relationship between a tenant's energy consumption and monthly rent.

In preparation for the beta test, NYCHA selected two adjacent apartment lines in two buildings (one building for Gradient and one for Midea), isolated 12 apartments in each building from the central steam supply, and removed radiators to make space below each window for the WHP units. Tenants received technical support for using the new WHPs from the manufacturers, NYCHA, and M&V contractors Taitem Engineering and MaGrann Associates. The beta test ran from December 2023 to September 2024.

Figure 2. NYCHA's Woodside Houses

Photo: NYCHA

Case Study Purpose

NYSERDA selected Gradient as the focus of this case study because the Authority funded Gradient under both the NextGen Building Innovation Challenge (WHP prototype development) and the Clean Heat for All Challenge (WHP commercialization and deployment).[5] The case study estimates the impact of NYCHA's Gradient WHP beta test in terms of energy benefits (avoided gas use and net energy use), fiscal benefits (energy and maintenance cost savings), environmental benefits (GHG emission reductions), comfort benefits (improved thermal comfort), and product design improvements. **Table 1** contains additional details on estimated benefits, including anticipated beneficiaries and associated data sources. Results will inform NYSERDA's future efforts to advance WHP technology as a solution for multifamily building decarbonization in NYS.

Table 1. Estimated Benefits, Beneficiaries, and Associated Data Sources

Category	Benefit	Beneficiary	Data Sources
Energy	Avoided natural gas consumption Avoided electricity consumption	NYCHA, Society	NYCHA gas consumption data NYCHA electricity consumption data
Fiscal	Energy cost savings Reduced maintenance costs	NYCHA	NYCHA gas and electricity billing data NYCHA interview
Environmental	Avoided GHG emissions Value of avoided GHG emissions	Society	Avoided energy use estimates NYSERDA emission factors NYS DEC value of carbon guidance
Comfort	Improved thermal comfort Other benefits (e.g., noise, air quality)	Tenants	Tenant survey responses NYCHA and M&V contractor interviews
Product Design	WHP design improvements	Gradient	Gradient interview

[5] Midea is also piloting precommercialized WHP units in 12 tenant apartments at Woodside Houses under the CH4A contract. However, Midea was not a recipient of NYSERDA funding for WHP prototype development under the NextGen Building Innovation Challenge.

Methodology

This case study leverages quantitative and qualitative data to estimate the benefits of installing Gradient WHPs at Woodside Houses. NYCHA gas and electricity billing data inform a model of pre- and post-installation energy consumption and associated costs. Net energy consumption estimates are then used as inputs to quantify the amount and value of avoided GHG emissions. Tenant survey responses and in-depth interviews with representatives from NYCHA, Gradient, and the M&V contractors provide qualitative insights into tenant comfort, technology readiness, and other project benefits.

Quantitative Analysis

The case study estimates avoided energy use by modeling gas and electricity consumption pre- and post-WHP installation. Before the beta test, the apartments at Woodside Houses consume gas for steam heating in the winter and electricity for cooling in the summer. During the beta test (mid-December 2023 through early September 2024), the apartments consumed zero gas and used electricity for both space heating and cooling. For analytical simplicity, the case study defines the beta test period as January-September 2024 and then annualizes estimates by extrapolating through the end of 2024.[6,7] The analysis defines the heating season as October to March and cooling season as April to September. All energy consumption estimates are weather normalized using heating and cooling degree days and converted to MMBtu as a common unit for comparisons.[8] Costs and energy prices are adjusted for inflation and reported in 2025 USD. Avoided GHG emissions are reported in metric tons CO_2 equivalent ($MTCO_2e$) and are calculated using NYSERDA's projected emission factors and the NYS Department of Environmental Conservation (DEC) value of carbon guidance.[9,10]

Qualitative Analysis

Data collected from in-depth interviews and a tenant survey provide qualitative insights on the benefits of the Gradient beta test. Representatives from NYCHA, Gradient, and M&V contractors Taitem Engineering and MaGrann Associates participated in in-depth interviews in early 2024 that focused on project successes and challenges to date. Interviewees also shared additional project background, context, and data required to complete the quantitative analysis. Interviewee feedback informed model design and is incorporated into the discussion of fiscal benefits, technology readiness, and insights and opportunities for future initiatives.

MaGrann Associates administered tenant surveys in three waves: The first and second waves were conducted in December 2023 and May 2024 and included questions about tenants' experience operating the WHP units during heating season. The third wave (November 2024) focused on tenants' experience during the cooling season. MaGrann received 24 total survey responses (eight per wave). Every pilot apartment

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[6] Gradient's pre-commercialized WHP prototypes were installed in tenant apartments from mid-December 2023 through early September 2024. Gradient requested the prototypes be removed after eight and a half months of deployment so that the company could replace them with an updated model that incorporated tenant feedback on the user interface and adjustments to address issues with condensate backup and corrosion.

[7] Energy consumption estimates for October, November, and December 2024 are extrapolated based on January 2024 consumption and adjusted for the number of actual heating degree days in each month.

[8] New York City (LaGuardia Airport) weather monitor, National Oceanic and Atmospheric Administration (NOAA), https://www.nyserda.ny.gov/About/Publications/Energy-Analysis-Reports-and-Studies/Weather-Data/Monthly-Cooling-and-Heating-Degree-Day-Data#NewYorkCity.

[9] New York State emissions factors are updated periodically. For this analysis, the Evaluation Contractor referenced the following: See NYSERDA Reports "Projected Emission Factors for NYS Grid Electricity" and "Fossil and Biogenic Fuel GHG Emission Factors" (2022).

[10] New York State emissions factors are updated periodically. For this analysis, the Evaluation Contractor referenced the following: NYS Department of Environmental Conservation (2023). "Establishing a Value of Carbon: Guidelines for Use by State Agencies." https://extapps.dec.ny.gov/docs/administration_pdf/vocguide23final.pdf.

completed at least one wave of the survey, but only three apartments responded during all three waves (see **Appendix A** for complete survey text and response data). The case study presents survey insights by combining tenant responses across waves and denoting, when applicable, how responses differ between heating and cooling season.

Findings

The Gradient beta test resulted in net reductions in energy consumption and GHG emissions. Although electricity is more expensive than gas, energy efficiency improvements moderate the price impact of fuel switching and annual energy costs increase by $78 per apartment. For each apartment at Woodside Houses that switches to WHPs, NYCHA can expect a 40 MMBtu decrease in annual energy consumption, which corresponds with an annual emissions reduction of about 2 $MTCO_2e$. As such, NYCHA pays $39 per $MTCO_2e$ removed, which is a relatively low cost compared to many decarbonization options. Also, the value of avoided GHG emissions is $322 per apartment per year. **Figure 3** summarizes the estimated energy, fiscal, and environmental benefits of Gradient WHP installation: average annual benefits per apartment, total annual benefits across all 12 apartments in the beta test, and *potential* total annual benefits if NYCHA were to install WHPs in all 1,357 apartments at Woodside Houses.

Figure 3. Estimated Annual Benefits of Gradient WHP Beta Test at Woodside Houses

	Avoided Energy Use	Energy Cost Savings	Avoided GHG Emissions	Value of Avoided Emissions
Single Apartment (Average)	**40** MMBtu	$**(78)**	**2** $MTCO_2e$	$**322**
Gradient Beta Test (12 Apartments)	**483** MMBtu	$**(937)**	**24** $MTCO_2e$	$**3,859**
Woodside Houses (1,357 Apartments)	**54,643** MMBtu	$**(106,014)**	**2,729** $MTCO_2e$	$**436,411**

Energy and Fiscal Benefits

Removing steam radiators for the beta test eliminates natural gas consumption entirely, but increases electricity consumption during the winter months as tenants rely on the WHPs for space heating. In the summer, electricity use for cooling is lower than before because the Gradient units are more energy efficient than window air conditioners. Overall, the elimination of natural gas outweighs the increased electricity use during the year of the beta test, resulting in an estimated net decrease in energy consumption of 483 MMBtu total or about 40 MMBtu per apartment (**Table 2**).

In 2024, NYCHA purchased gas from National Grid for about $0.52/therm ($5.23/MMBtu) and electricity from NYPA for $0.05/kWh ($15.68/MMBtu).[11] Although the WHPs reduced total energy consumption by 483 MMBtu, the 300 percent price differential between gas and electricity resulted in an overall increase in energy costs. Electrifying heating and cooling in the 12 beta test apartments cost NYCHA an additional $937 total for the year (about $78 per apartment). The energy efficiency of the Gradient units helped

[11] NYCHA purchases electricity at a government rate that is significantly less than the residential rate ($0.12/kWh for a standard residential Con Edison customer in August 2025; https://www.coned.com/en/accounts-billing/your-bill/rate-calculators/market-supply-charge). Readers are cautioned against extrapolating fiscal benefits outside of the NYCHA rate context.

moderate the cost impact of fuel switching. In addition, NYCHA interviewees suggested that avoided costs from radiator maintenance could further moderate (or even outweigh) increased energy costs.[12]

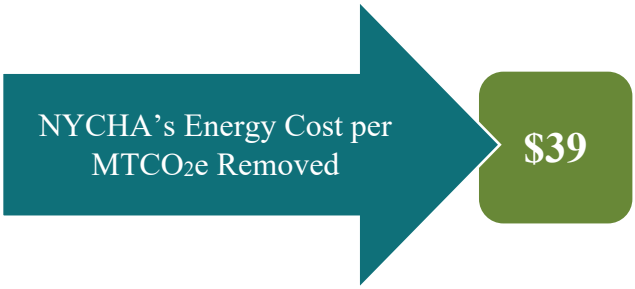
Table 2. Net Change in Energy Consumption (MMBtu) & Energy Costs (2025 USD) by Month*

			Gas Consumption (Net MMBtu)		Electric Consumption (Net MMBtu)		Total Consumption (Net MMBtu)	
			Beta Test (12 Apts)	Single Apartment	Beta Test (12 Apts)	Single Apartment	Beta Test (12 Apts)	Single Apartment
Gradient Beta Test	Heating	January	(187)	(16)	128	11	(59)	(5)
		February	(170)	(14)	69	6	(101)	(8)
		March	(182)	(15)	67	6	(114)	(10)
	Cooling	April	-	-	57	5	57	5
		May	-	-	(33)	(3)	(33)	(3)
		June	-	-	(31)	(3)	(31)	(3)
		July	-	-	(20)	(2)	(20)	(2)
		August	-	-	(26)	(2)	(26)	(2)
		September	-	-	4	0	4	0
Estimate	Heating	October	(27)	(2)	18	2	(8)	(1)
		November	(76)	(6)	31	3	(45)	(4)
		December	(171)	(14)	63	5	(107)	(9)
Energy Consumption (annual net change)			(812)	(68)	329	27	**(483)**	**(40)**
Energy Costs (annual net change)			$ (4,380)	$ (365)	$ 5,317	$ 443	**$ 937**	**$ 78**

*Represents the change in energy consumption and associated costs compared to before the Woodside Houses beta test (estimates adjusted for heating and cooling degree days)

Environmental Benefits

The net reduction in energy consumption during the Gradient beta test helped NYCHA avoid emitting 24 $MTCO_2e$ overall, or about 2 $MTCO_2e$ per apartment (**Table 3**). Given that annual energy costs increased by $78 per apartment, NYCHA spent $39 extra on electricity per $MTCO_2e$ removed.[13,14] Decarbonization opportunities that generate cost savings (as opposed to cost increases) are typically energy efficiency measures (e.g., upgrading to a more efficient gas



[12] NYCHA's analysis of the maintenance cost implications of the Gradient beta test is forthcoming and not included in this case study.

[13] $78 increased energy costs per apartment / 2 $MTCO_2e$ saved per apartment = $39 per $MTCO_2e$ saved.

[14] Does not include equipment first costs (i.e., the installed cost of the WHP units, once commercialized). Accounting for first costs is outside the scope of this single-year analysis of a pre-commercialized prototype. However, the July 2025 ACEEE report Decarbonizing Space Heating in Existing Centrally Heated Multifamily Buildings estimates the average lifecycle and energy costs to install three WHPs in a two-bedroom apartment (the same specifications as the NYCHA beta test) is $14,474 over 24 years (about $603 per year), the lowest of all decarbonization measures analyzed by ACEEE. The report can be found here: https://www.aceee.org/research-report/b2506.

boiler) rather than fuel switching measures like electric heat pumps. For context, studies estimate that the marginal abatement cost of fuel switching measures, inclusive of first costs, ranges from $40-250 per $MTCO_2e$.[15,16] NYS DEC guidelines dictate a value of avoided emissions of $160/$MTCO_2e$ (2025 USD, 2% discount rate).[17] Thus, the beta test's total avoided emissions (24 $MTCO_2e$) are valued at $3,859 (or $322 per apartment annually). Note that reducing natural gas use also provides air quality and health benefits that are not quantified as part of this case study, given the small sample size and the data requirements for such analyses.

Table 3. Net Change in GHG Emissions ($MTCO_2e$) by Fuel by Month

			Gas Emissions (Net $MTCO_2e$)		Electric Emissions (Net $MTCO_2e$)		Total Emissions (Net $MTCO_2e$)	
			Beta Test (12 Apts)	Single Apartment	Beta Test (12 Apts)	Single Apartment	Beta Test (12 Apts)	Single Apartment
Gradient Beta Test	Heating	January	(12.2)	(1.0)	12.6	1.1	0.4	0.0
		February	(11.1)	(0.9)	5.8	0.5	(5.3)	(0.4)
		March	(11.9)	(1.0)	5.6	0.5	(6.3)	(0.5)
	Cooling	April	-	-	4.1	0.3	4.1	0.3
		May	-	-	(2.4)	(0.2)	(2.4)	(0.2)
		June	-	-	(2.6)	(0.2)	(2.6)	(0.2)
		July	-	-	(2.0)	(0.2)	(2.0)	(0.2)
		August	-	-	(2.5)	(0.2)	(2.5)	(0.2)
		September	-	-	0.3	0.0	0.3	0.0
Estimate	Heating	October	(1.8)	(0.1)	1.5	0.1	(0.2)	(0.0)
		November	(5.0)	(0.4)	2.6	0.2	(2.3)	(0.2)
		December	(11.1)	(0.9)	5.9	0.5	(5.3)	(0.4)
Annual Total			(53.1)	(4.4)	29.0	2.4	**(24.1)**	**(2.0)**
				Value of Avoided Emissions (2025 USD)			**$ 3,859**	**$ 322**

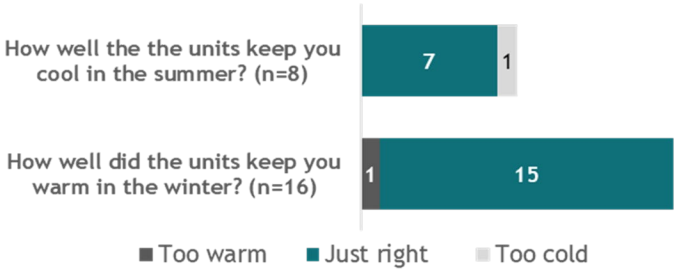
[15] McKinsey &Co.'s 2010 report Global GHG Abatement Cost Curve v2.1 estimates a marginal abatement cost of fuel switching measures of $43-86 per $MTCO_2e$, while a 2021 Environmental Defense Fund report on Marginal Abatement Cost Curves for U.S. Net-Zero Energy Systems estimates a range of $60-250 per $MTCO_2e$ under deep decarbonization (all costs converted to 2025 USD for accurate comparisons). The McKinsey and Co.'s report can be found here: https://www.mckinsey.com/about-us/new-at-mckinsey-blog/a-revolutionary-tool-for-cutting-emissions-ten-years-on. The Environmental Defense Fund report can be found here: https://www.edf.org/sites/default/files/documents/MACC_2.0%20report_Evolved_EDF.pdf.

[16] Applying the ACEEE's per-apartment average lifecycle cost estimate $603 per year for 24 years (see Footnote 13) to the GHG estimates from the Gradient beta test, NYCHA could expect to pay an annual GHG removal cost of about $302 per $MTCO_2e$ per year ($603 annual lifecycle cost per apartment / 2 $MTCO_2e$ abated annually per apartment = $302 per $MTCO_2e$ abated per year), which is slightly above the high end of the fuel switching abatement cost estimates in the literature ($250 per $MTCO_2e$).

[17] New York State emissions factors are updated periodically. For this analysis, the Evaluation Contractor referenced the following: NYS Department of Environmental Conservation (2023). Establishing a Value of Carbon: Guidelines for Use by State Agencies. https://extapps.dec.ny.gov/docs/administration_pdf/vocguide23final.pdf.

Comfort Benefits

Figure 4. Tenant Survey: How well did the WHP units keep you cool in the summer and warm in the winter?



> *"[The Gradient WHP] is very useful and keeps the space fresh and comfortable."*
>
> *– Woodside Houses Resident*

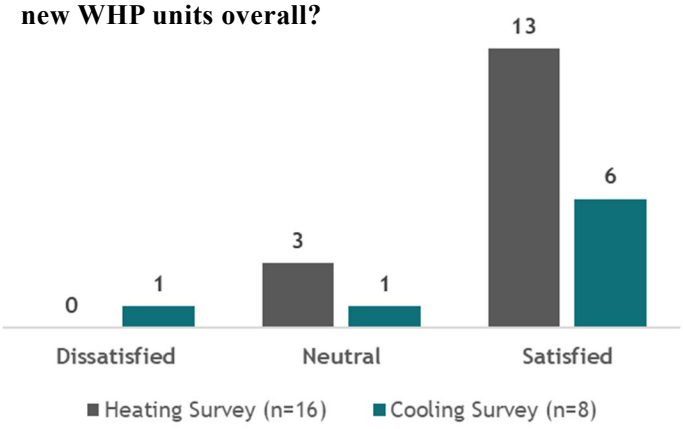
Tenant survey responses suggest that tenants experienced improved thermal comfort and other benefits during the Gradient beta test. Over 90 percent of tenants felt satisfied with the temperature in their apartments, sharing that the WHP units kept them adequately warm in the winter (15 of 16 respondents) and cool in the summer (seven of eight respondents). No tenants reported being too warm in the summer or too cold in the winter (**Figure 4**).[18] A representative open-ended comment on the first wave heating survey noted, "[The Gradient WHP] is very useful and keeps the space fresh and comfortable." In addition to thermal comfort benefits, a representative from Gradient was approached by a tenant during a site visit who had experienced air quality improvements too. The tenant shared that they had lung issues but could "breathe more easily" with the radiators removed.

Nearly 80 percent of tenants surveyed (19 of 24) felt satisfied with their units overall, 17 percent felt neutral (four respondents), and one individual was dissatisfied (**Figure 5**).[19] About 83 percent of tenants (20 respondents) felt the units were easy to use, but two individuals mentioned that the user interface was not intuitive for older adults. The most common complaints were related to size (six respondents thought the units were too large), appearance (five respondents noted discoloration in the plastic or simply didn't like how the units looked), installation quality (four respondents experienced rainwater leakage), and noise (three respondents found the units too loud).

Product Design Improvements

Gradient has made several upgrades to its WHP prototype based on feedback from the beta test. First, Gradient replaced the comfort control dial with a touch screen and buttons to improve user interface accessibility for the elderly and non-English speakers. Then, the company updated its installation procedures based on suggestions from the NYCHA staff who installed the units at Woodside Houses. Finally, Gradient is in the process of addressing issues related to condensation and corrosion that arose during the beta test.

Figure 5. Tenant Survey: How satisfied are you with the new WHP units overall?



[18] Interestingly, one tenant felt the units kept their apartment *too cold* in the summer, and another reported being *too warm* in the winter.

[19] The dissatisfied tenant noted noise, size, and not liking the overall look of the WHP units as key factors in their unfavorable rating.

Conclusion

The results of the beta test at Woodside Houses suggest that WHPs are a promising solution for reducing energy consumption and GHG emissions, especially in older multifamily buildings with steam heating where structural retrofits are difficult and costly. The Gradient units generated an estimated 40 MMBtu of annual energy savings per apartment with a corresponding emissions reduction of 2 $MTCO_2e$ per year at a net energy cost of only $78 per apartment per year. Tenants experienced improved thermal comfort and air quality during the beta test, and Gradient incorporated tenant feedback on the user interface into product design updates. Gradient is currently addressing concerns identified by NYCHA staff related to outdoor condensation performance. While NYCHA and Gradient complete this evaluation, large-scale deployment of the Gradient window heat pump units at NYCHA has slowed, but the existing 10,000-unit contract remains in effect. Gradient's window heat pump is fully commercialized and is being sold and installed for customers nationwide. The energy savings and avoided emissions estimates from this beta test remain relevant and demonstrate the strong potential of WHPs as a cost-effective solution for decarbonizing multifamily buildings.

Appendix: Tenant Survey Information & Data Collection Instruments

M&V contractor MaGrann Associates administered the tenant survey in three waves: Waves 1 and 2 (December 2023 and May 2024) contained questions related to tenants' experience with the Gradient WHP units during the heating season, and Wave 3 (November 2024) focused on the cooling season. MaGrann received 24 total survey responses (eight per wave), but not every tenant completed a survey in each wave (**Table A1**). In addition to the response rate information in Table A1, the remainder of Appendix A contains the full text of the heating season and cooling season survey instruments.

Table A1. Number of Tenant Survey Responses by Wave

Apartment ID	Wave 1: Heating Season (December 2023)	Wave 2: Heating Season (May 2024)	Wave 3: Cooling Season (November 2024)	Total Responses
87	0	0	1	**1**
88	0	1	1	**2**
89	0	1	1	**2**
90	0	1	1	**2**
91	0	1	1	**2**
92	0	1	0	**1**
93	1	1	1	**3**
94	1	1	1	**3**
95	1	0	0	**1**
96	2	1	1	**4**
97	1	0	0	**1**
98	1	0	0	**1**
99	1	0	0	**1**
Total	**8**	**8**	**8**	**24**

Tenant Survey Instrument: Heating Season

Please answer the following questions about the new window units that were installed in your apartment this summer. Please circle your response and feel free to add comments. Please either deposit the survey in the **dropbox in the lobby**, email a photo of it to survey@magrann.com, or text a photo of it to 315-600-8544.

Optional: Name, building, and apt. number: _____

If you wish to be contacted for follow-up questions, what is the best contact method? _____

Please circle your responses below:

1. How satisfied are you with the new heating units?

Satisfied Neutral Dissatisfied Explain: _____

2. How well did the new units keep you warm this winter?

Too warm Just right Too cold Explain: _____

3. Were the new units easy to use?

Yes No Explain: _____

4. How was the sound from the units?

Very quiet Ok Too noisy

5. What do you think of their size?

Size is ok Too big

6. What do you think of their appearance?

They look great No opinion Don't like the look

7. Did the new units require any maintenance by NYCHA staff?

None Some A lot

8. Did you clean the filters?

Yes, approximately _____ times No

9. Did you experience any rainwater leakage through or around the units?

No Yes, describe where: _____

10. Please help us understand how you used the units:

a. Do you turn them off when you leave home? _____
b. Do you use all units in your apartment or only the one in the room you are in? _____
c. What temperature setpoint do you use when they are heating? _____

11. Please add any other comments below or on the back of this sheet. Thank You!

Tenant Survey Instrument: Cooling Season

Please answer the following questions about the new window units that were installed in your apartment this summer. Please circle your response and feel free to add comments. Please email a photo of it to survey@magrann.com, or text a photo of it to 315-600-8544 or return to NYCHA staff.

Optional: Name, building, and apt. number: _____

If you wish to be contacted for follow-up questions, what is the best contact method? _____

Please circle your responses below:

1. How satisfied are you with the new cooling units?

Satisfied Neutral Dissatisfied Explain: _____

2. How well did the new units keep you cool this summer?

Too warm Just right Too cold Explain: _____

3. Were the new units easy to use?

Yes No Explain: _____

4. How was the sound from the units?

Very quiet Ok Too noisy

5. What do you think of their size?

Size is ok Too big

6. What do you think of their appearance?

They look great No opinion Don't like the look

7. Did the new units require any maintenance by NYCHA staff?

None Some A lot

8. Did you change the filters?

Yes, approximately _____ times No

9. Did you experience any rainwater leakage through or around the units?

No Yes, describe where: _____

10. Please help us understand how you used the units:

a. Do you turn them off when you leave home? _____

b. Do you use all units in your apartment or only the one in the room you are in? _____

c. What temperature setpoint do you use when they are cooling? _____

11. Please add any other comments below or on the back of this sheet. Thank You!