

•GRADIENT

# Window Heat Pumps

Connecticut Multifamily Housing  
Innovations Network Lunch & Learn  
June 27 2025

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# Gradient at a Glance

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**Product deployment:** Pioneered inverted-U heat pumps in 2022, with units operating in 36 states

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**Key partnerships:** NYSERDA, NYCHA

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**Key awards:**



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**Location:** San Francisco, CA

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# Agenda

1. Window heat pumps:  
Market overview, competing technologies, advantages
2. Gradient product overview:  
Installation, specs, capabilities, etc.
3. Case studies:  
examples of installations, what went well, measured performance



# Window Heat Pumps: Introduction



# A Massive Market Left Behind: Pre-1980s Multifamily

TRADITIONAL HEAT PUMPS HAVE < 9% PENETRATION IN PRE-1980S BUILDINGS<sup>1</sup>,  
DUE TO FUNDAMENTAL DEPLOYMENT CHALLENGES

Traditional heat pump solutions require extensive permitting, construction, retrofits, and skilled labor



HIGH INITIAL  
COST



INFRASTRUCTURE LIMITS:  
DUCTING, ELECTRICAL



PERMITTING, SKILLED  
LABOR SHORTAGES



ASBESTOS,  
TENANT DISPLACEMENT

1. 50% lower penetration of heat pumps in pre-1980s buildings. Source: <https://www.eia.gov/consumption/residential/data/2020/hc/pdf/H0%206.3.pdf>

# What we want:

## Better for climate

- **Efficient:** predictable, verifiable performance
- **Electric & Variable Speed**
- **Refrigerant** management

## Better for people

- **Reliable:** high uptime, low maintenance cost
- **Networked:** remote control, troubleshooting, coordination
- **Comfort / Health:** ventilation, air quality, humidity, noise, aesthetics

## Cost-effective & Scalable

- Easily / quickly **Installable**, scalable workforce
- **Modular:** local comfort, mass-producible, leak-free, minimal on-site configuration
- **Deployable:** compatible with as many climates/buildings as possible
- **Data-driven** performance, load monitoring, control

# The Gradient Solution: Connected, Easy-to-Deploy Heat Pump Technology

## ADAPTABLE, MODULAR DESIGN

All-season comfort: operates down to -13°F

3-5x more efficient than resistance heat

Plugs into a standard 120-volt outlet

LL97 Compliant: 95% lower direct emissions

MERV 13 filter option for improved air quality



All-Climate Electric Heating /  
Cooling & Air Purification

## HASSLE-FREE, LOW COST

No permits, drilling, technicians, or  
electrical complexities

30-minute install by 2 non-professionals

Removes single point of failure and  
increases uptime of heating/cooling

No maintenance beyond filter replacement

## SMART & CONNECTED

Demand response integration

Cloud-based energy management

Enhanced air quality control

# The Gradient All-Weather 120V Window Heat Pump

\*GRADIENT



# Competitive Advantage

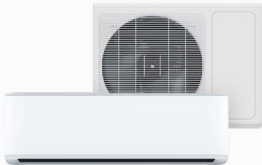
Professionally installed systems suffer from high labor costs and refrigerant management issues, while conventional window ACs are inefficient and obtrusive.



Gradient



WINDOW AC



MINI-SPLIT



CENTRAL/DUCTED  
HEAT PUMP

Installation	No Refrigerant Handling	✓	✓	✗	✗
	Plug-in Installation	✓	✓	✗	✗
	Avoid Building Modifications	✓	✓	✗	✗
Operation	Cold Climate Heating	✓	✗	✓	✓
	Zonal Control	✓	✗	✓	✗

# Gradient Product Overview



# Applications



## Today

- Ideal solution for older multifamily buildings with boilers, radiators, no AC / window AC

## Near Future

- ADUs, single-family homes
- Enabling renters to take electrification into their own hands
- Form factors for other window types

## Long-Term Vision

- Smaller, more integrated, **nearly invisible**
- Incorporate: **ventilation, ERV/HRV**, smart **light control, air quality** control
- A full comfort system—not just heating and cooling



# Spotlight: Condensate Management

The outdoor unit of some (not all) window heat pumps can handle condensate without any additional installation/configuration of drain lines





# Air Flow and Filtration

## Air Flow

- Up to 400 CFM airflow
- Dual outlet design
- Variable speed

## MERV 13 Filter Replacements

- Captures finer pollutants
- Healthier indoor air
- Wildfire smoke protection
- Less dust, lower maintenance
- Smarter building design





# Installation

## Minimal Window Efficiency Loss

- Third party results at NYCHA showed average air leakage increase was 3.1cfm at 75Pa pressure difference. 4 out of 7 windows that were tested showed improved window sealing after unit installation.

## Security

- Off-the-shelf window locks interface well with window heat pumps.
- 3 individuals attempted theft on the outside of first floor apartment and were unsuccessful.



# Features of Window Heat Pumps

## Commissioning

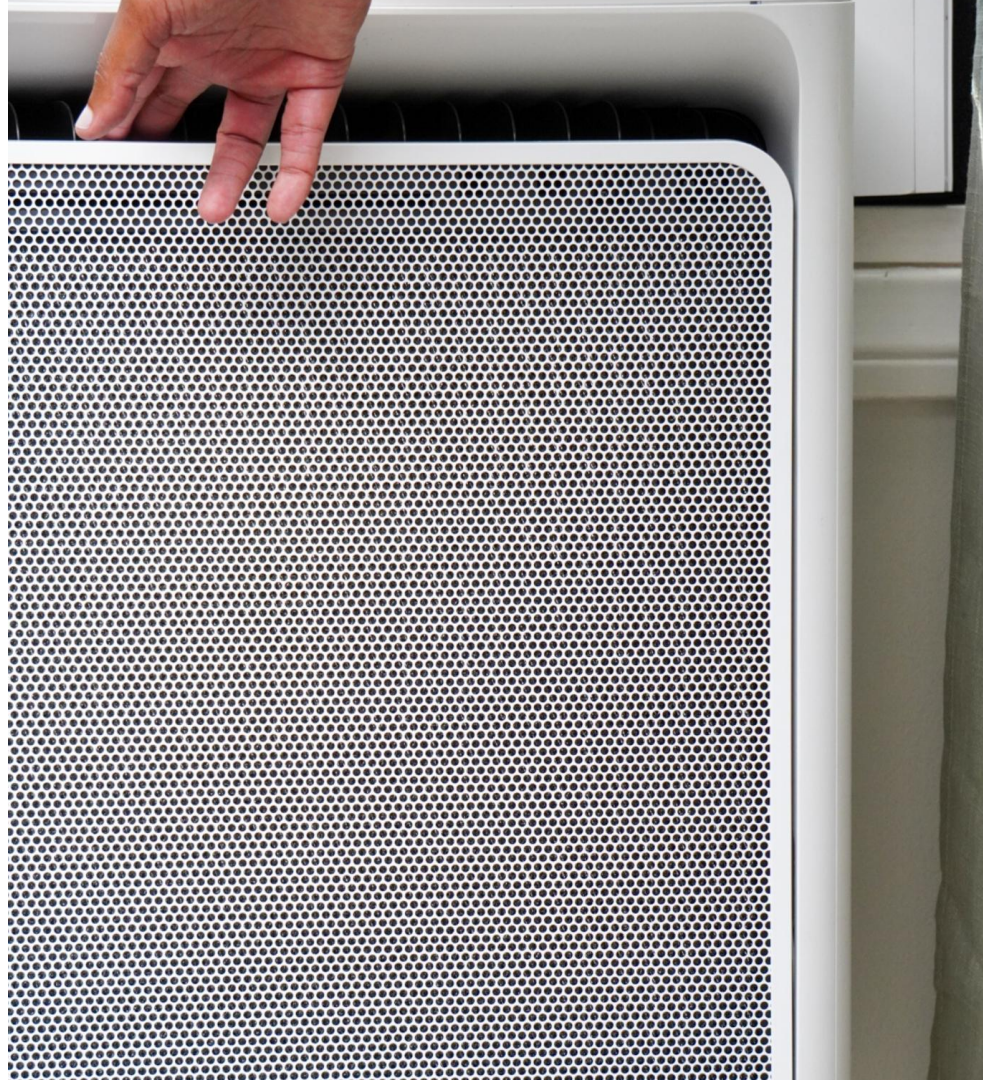
- No commissioning required by installer; plug & play installation

## End of Life

- System removed just as quickly as install, with no damage to building
- System/refrigerant can be recycled similar to any window AC

## Code Compliance

- Similar to window AC, no permit required



# Efficiency Ratings

## CEER

- ▶ Combined Energy Efficiency Ratio (CEER) is the Seasonal Cooling Efficiency
- ▶ An approximate crosswalk between CEER and SEER2 can be calculated

CEER	SEER2	EER2
16.8	19-23	13.6

## HEER

- ▶ Heating Energy Efficiency Ratio (HEER) is the Seasonal Heating Efficiency
- ▶ HEER and HSPF2 can be directly crosswalked because they involve the same test procedures
- ▶ ENERGY STAR has published their HEER testing methodology for reverse cycle room air conditioners (window heat pumps)

HEER	HSPF2	Capacity Ratio @ 5°F	COP @ 5°F
9.4	9.3	80%	2.06

# Performance / spec sheet summary

Electrical Requirements	Voltage	Frequency	Circuit Amps
	120 V	60 Hz	15 A
Thermal Performance	Outdoor Temp	Capacity	Efficiency
	95 °F	9300 BTU/h	13.6 (EER)
	47 °F	9000 BTU/h	4.04 (COP)
	17 °F	9000 BTU/h	2.37 (COP)
	5 °F	7200 BTU/h	2.06 (COP)
	-13 °F	7026 BTU/h	1.59 (COP)
CEER <sup>1</sup>	16.8	HEER <sup>2</sup>	9.4

<sup>1</sup>GRADIENT

# Performance Specifications

Heating Performance			Capacity Level		
Outdoor Temperature	Indoor Temperature		Minimum	Rated	Maximum
47 °F	70 °F	Capacity (BTU/h)	3,130	9,000	13,976
		Consumed Power (kW)	0.21	0.65	1.28
		COP	4.29	4.04	3.19
17 °F	70 °F	Capacity (BTU/h)	3,200	9,000	10,092
		Consumed Power (kW)	0.41	1.11	1.35
		COP	2.31	2.37	2.19
5 °F	70 °F	Capacity (BTU/h)	2,545	7,200	8,605
		Consumed Power (kW)	0.38	1.02	1.33
		COP	1.94	2.06	1.89
-13 °F	70 °F	Capacity (BTU/h)	2,320	-	7,026
		Consumed Power (kW)	0.44	-	1.30
		COP	1.54	-	1.59

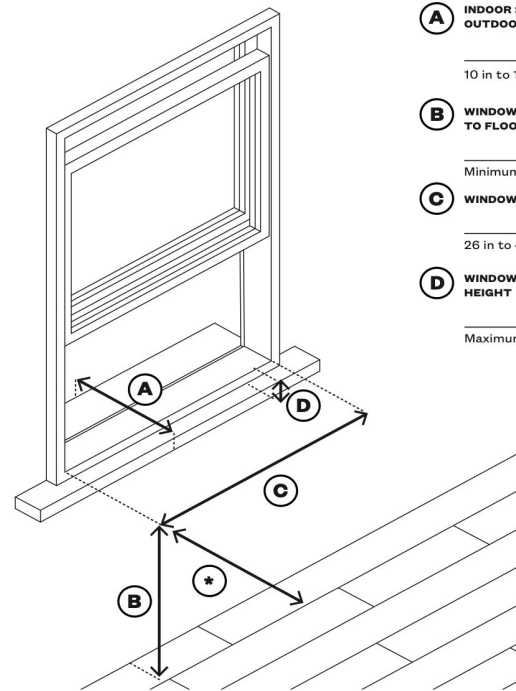
# Dimensions & Sizing Guide

Indoor unit dimensions..... 25.5"W x 8.75"D x 24"H

Outdoor unit dimensions..... 25.5"W x 14"D x 24"H

## Window Dimensions Required (at minimum)

### INSIDE

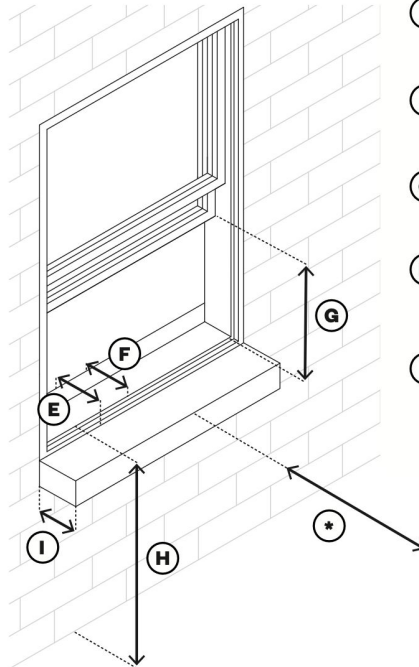


- (A) INDOOR SILL TO OUTDOOR SILL**  
10 in to 18.25 in\*\*
- (B) WINDOW FRAME TO FLOOR**  
Minimum 21 in
- (C) WINDOW WIDTH**  
26 in to 40 in
- (D) WINDOW FRAME HEIGHT**  
Maximum 3 in

\* The front of the indoor unit must have a minimum of 40 in (102cm) of space without obstructions.

\*\* For sills outside of this range but within 6.25 in - 20 in, contact Gradient for support.

### OUTSIDE



- (E) INDOOR SILL TO SASH OUTER EDGE**  
Maximum 11.75 in
- (F) INDOOR SILL TO SASH INNER EDGE**  
Minimum 0.5 in
- (G) OPEN WINDOW HEIGHT**  
Minimum 16 in
- (H) WINDOW FRAME TO GROUND**  
Minimum 21 in
- (I) EXTERIOR SILL UNDERHANG**  
Maximum 4 in\*\*

\*The front of the outdoor unit must have a minimum of 40 in (102cm) of space without obstructions. The sides and back of the outdoor unit must have a minimum of 3.5 in (9cm) of space from any obstructions.

\*\* For larger underhangs up to 5.25 in, contact Gradient for support.

# Room (Window) Heat Pumps: A New Product Category

The Consortium for Energy Efficiency (CEE) has published their specification and publicly available qualified product list for room heat pumps.



Level	CEER	HEER	COP@ 17	COP@ 5	Defrost	Capacity Ratio
CEE Tier 1	≥ 13.2	≥ 5.8	N/A	N/A	Passive	N/A
CEE Tier 2	≥ 14.4	≥ 7.0	≥ 1.75	N/A	Active	≥ 70% at 17° F/47°F
CEE Adv. Tier	≥ 15.1	≥ 8.5	N/A	≥ 1.75	Active	≥ 70% at 5F/47° F
Gradient AW120V	16.8	9.4	2.37	2.06	Active	100% at 17° F/47°F, 80% at 5F/47°F



# Typical amperage draw

Gradient is designed for a typical 120V residential wall outlet.

Approximate current draw at rated capacities are below:

**95 °F - 7.5 A**

**47 °F - 5.5 A**

**17 °F - 8.5 A**

**5 °F - 7.5 A**

**-7 °F - 7 A**



# Case Study

# Clean Heat for All Challenge

- NYPA, NYCHA, & NYSERDA program with goal of cost effectively meeting LL97 targets
  - Inspired by 1996 program for refrigerators
  - Followed by 2024 program for battery stoves
- Key specs
  - Window install, cord connected, factory charged (no EPA 608 license required)
  - 8,300-9,000 BTU/hr with 1.85-2.35 COP at 17°F
  - Meltwater and condensate management
  - Strict targets for air leak and heat leak
  - No auxiliary resistance heat
- Gradient was awarded a contract for 10,000 heat pumps
  - Initial 36 deployed in December 2023



# Clean Heat for All Challenge: 3rd-Party Measurement & Verification Study

## Report Design / Structure

NYSERDA contracted Taitem Engineering, a leading high performance building firm, to perform Measurement and Verification (M&V) of the initial heat pumps installed.

## Key Research Questions

- Do the window heat pump units provide **adequate heat** at the **coldest outdoor temperatures**?
- What does the **installation** prep and process look like?
- What is the impact on **electrical consumption** and peak demand?
- Are **residents comfortable and satisfied** with the heat pumps?

Watched by City/State Agencies, Non-Profits  
(broad visibility of program)



Building Performance Consultants  
(advise building owners on HVAC)

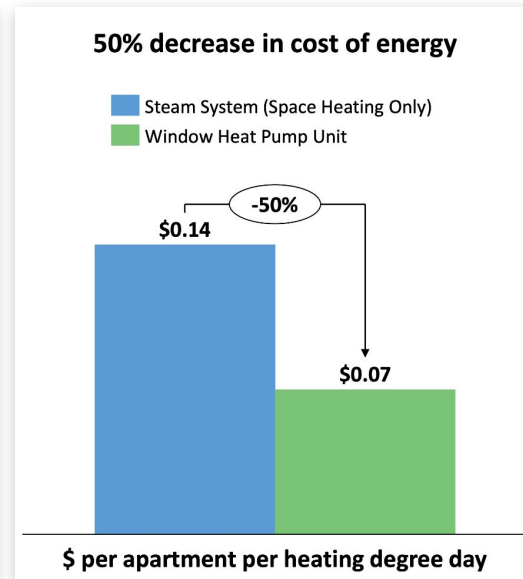
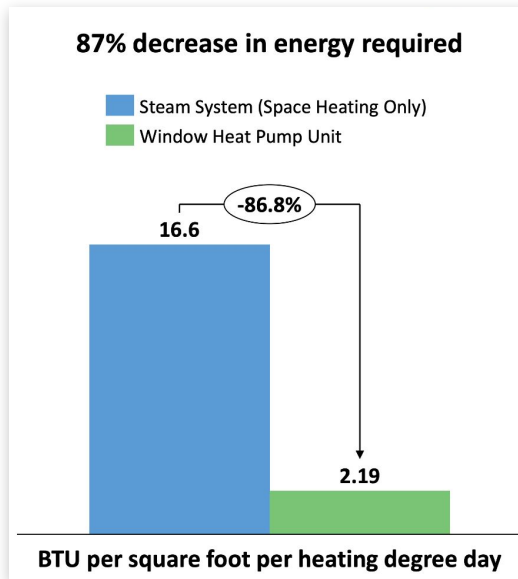


NY Utilities  
(deploy HVAC incentives)



# NYSERDA Preliminary M&V Results: Massive Energy & Cost Savings, + Happy Residents

- **87%** reduction in heating energy
- **50%** cost savings
- **70%** reduction in heating emissions
- Uniform Temperature: Consistent control, even in unheated spaces.
- Minimal electrical Impact: Only 30% of load from heat pumps at peak
- 0% of residents dissatisfied, **89%** of residents satisfied, 11% neutral



Source: BEEx Roundtable 1/16/25:

[https://be-exchange.org/wp-content/uploads/2025/01/20250116\\_CleanHeat\\_Slides-UPDATED.pdf](https://be-exchange.org/wp-content/uploads/2025/01/20250116_CleanHeat_Slides-UPDATED.pdf)



# “I was thrilled...the best thing.”

- REGINA FRED, NYC HOUSING AUTHORITY RESIDENT

“

‘They did a demonstration for me and I was thrilled,’ Fred said. Now, her grown children call the heat pump ‘the best thing’ she has in her apartment, and her neighbors have knocked on her door to check out the unit.

Associated Press, 2024

“

This is a *game changer*. Now the unit will tell me when it needs maintenance. Much better and *easier to maintain* than a boiler.

Brooklyn Co-op Super, 2025

“

This product is a *slam dunk* and a win-win for everyone.

Noel Cruz, Owner  
Super Cool HVAC, 2025

“

With these heat pumps, New York is inverting the usual pattern for new energy technology, which is usually too expensive for regular people to afford. ‘It’s the rich who are supposed to be early adopters of the *new, sexy, top-of-the-line climate tech*.’

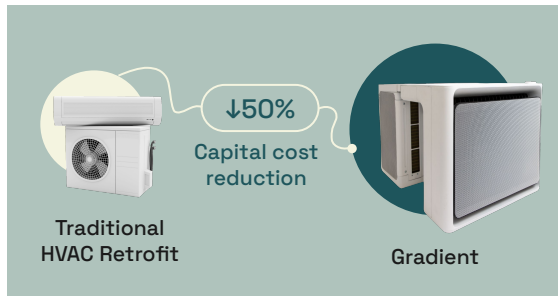
WIRED, 2024

Institutional buyers and the communities they serve are proving that Gradient delivers on its promise, further accelerating adoption in target markets.



# Winning on Cost, Control, and Comfort

MAXIMIZED SAVINGS AND EFFICIENCY, SMARTER MANAGEMENT, AND HAPPIER TENANTS



## HIGHER NET OPERATING INCOME (NOI) FOR BUILDINGS

~50% lower capex retrofit<sup>1</sup>: no asbestos mitigation, no drilling results in significantly fewer labor hours and no tenant disruption

~50% Bill savings and 87% energy savings<sup>2</sup>



## SMART HVAC MANAGEMENT

Cloud monitoring ensures **instant verification** of resident comfort, energy use, and performance

Enhanced remote diagnostics **lower maintenance expenses**.

Support for **demand response** programs creates new revenue opportunities and improves energy efficiency.



## TENANT BENEFITS SUPPORT HIGHER RETENTION

Built-in AC makes units more attractive, reducing lease-up time and increasing rental property value by up to **12%**.<sup>3</sup>

Replacing uncontrollable radiator with **smart controls** greatly improves comfort

Better **air quality** and elegant design reducing turnover costs.

1. Compared to split or VRF heating retrofit costs shown here: <https://www.urbangreencouncil.org/going-electric-2/>

2. Measured with Gradient system at NYCHA, compared to steam heat: [https://be-exchange.org/wp-content/uploads/2025/01/20250116\\_CleanHeat\\_Slides-UPDATED.pdf](https://be-exchange.org/wp-content/uploads/2025/01/20250116_CleanHeat_Slides-UPDATED.pdf)

3. According to Zillow Economic Research: <https://public.tableau.com/app/profile/zillow.real.estate.research/viz/ACPremium/ACPremium>

# Thank you!

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