New Heat Pumps Change Multi-family Landscape in NYC

Project
Loring Avenue Apartment Complex – STHP

Location
Brooklyn, NY

Comparison Date
December 16, 2022 - December 16, 2023

The Team

Owner
Arker

Project Developer
BlocPower

HVAC Engineer
McGrann

HVAC Contractor
Supercool HVAC

HVAC Distributor
Johnstone Supply – West Michigan

The Loring Avenue apartment complex was retrofitted with 113 STHP heat pumps to replace the original PTAC systems

New York City likely has the highest number of PTAC (packaged terminal air conditioner) units of any city in the nation. These systems have been used extensively in hotels, motels, hospitals and multi-family applications for decades. Their popularity is the result of low upfront cost, individual room control, and ease of replacement.

(left to right) Noel Cruz, Sandra Lopez, Damien Roberts, Shad Balram, Sebastian Ulanga, Nathan Saunders, Emmanuel Tejada, Noel Cruz Sr, Adem Dikoli, Thomas Lesko

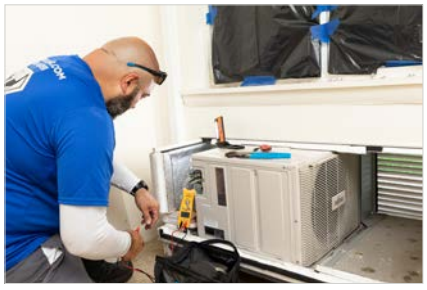
Much is left to be desired in a space conditioned with PTAC systems, however. PTACs tend to create a great deal of noise within the occupied space, produce dramatic indoor temperature swings, and consume more energy than most modern HVAC system alternatives.

As New York rapidly seeks to improve the efficiency of its infrastructure, lower demand on its electrical grid, and reduce consumption of fossil fuels city-wide, many studies are being conducted to determine how best to apply private and public funds to that end.

One such study pertaining to PTACs and viable alternatives has been underway at a group of multi-family properties in Brooklyn since 2022.

Site identification

An apartment building on Loring Ave. owned by The Arker Companies was selected for a retrofit pilot project and data analysis to compare the performance of PTACs against the new STHP (Split Terminal Heat Pump), made by Fujitsu General America.



Lead Project Manager Sebastian Ulanga completes installation of a split terminal heat pump system.

The STHP is a through-wall split system designed as a direct replacement for PTAC units. The indoor unit, which is a wall-mounted type similar to those in Fujitsu's mini-split product line, is paired with a condensing unit that mounts inside a wall sleeve occupying the original PTAC wall penetration. Available in 9,000 and 12,000 BTUh capacities, the STHP can heat or cool any space that had previously been conditioned with a PTAC.

The project site was identified by MaGrann Associates, an energy efficiency and green building consulting and engineering firm. MaGrann has worked with The Arker Companies on previous demonstration projects. MaGrann, in partnership with Fujitsu, selected The Arker Companies site to conduct a performance comparison between the STHP heat pumps and the existing gas fired PTAC systems. Jordan Dentz, VP and manager of building performance services, led the

analysis.

"MaGrann partnered with Fujitsu to prepare the project proposal and secure funding, developed the work plan and designs, and coordinated the project up until the units were installed," explained Dentz. "BlocPower, a national project developer, was brought in by The Arker Companies to manage the installations."

BlocPower acts as a one-stop-shop for HVAC and clean energy upgrades, providing engineering design, incentive capture, financing, construction management and regulatory compliance.

"Once a site is identified, BlocPower provides a turnkey service to evaluate, finance, engineer, install, and commission projects," said Ryan Merkin, VP of business development at BlocPower. "We've completed more than 1,000 energy efficiency and electrification projects nationwide."

Though the initial pilot project included 36 retrofits, 113 STHP systems have been installed at the Loring Ave. property to date.

"This work involved removing the gas-fired PTAC, installing the STHP wall sleeve, placing the condenser inside, running line-sets to the indoor unit, and hanging the evaporator," explained Noel Cruz, owner of Supercool HVAC LLC. "It takes about one day per apartment with two technicians." Supercool HVAC conducts roughly a dozen heat pump retrofit projects as a subcontractor for BlocPower each year.

Noel Cruz, owner of Supercool HVAC LLC.

"This retrofit project is congruent with The Arker Companies' goals to reduce energy and fossil fuel consumption while increasing tenant comfort," said Ilsoo Kim, facility manager for Progressive Management, the management arm of The Arker Companies. "In my line of business, the lack of comfort complaints is the greatest sign of success, and that's exactly what we've experienced from the units that have been retrofitted."

Initial energy improvements

To conduct the preliminary data analysis, one full year of utility data was collected from a sample of apartments to evaluate energy, cost, and emissions of the newly installed Fujitsu STHP systems compared to existing gas fired PTACs.

MaGrann collected electricity and gas meter readings monthly for a selection of apartments at Loring Ave. served by STHPs and similar baseline apartments with the existing gas PTACs. The apartments were split into groups by size and location:

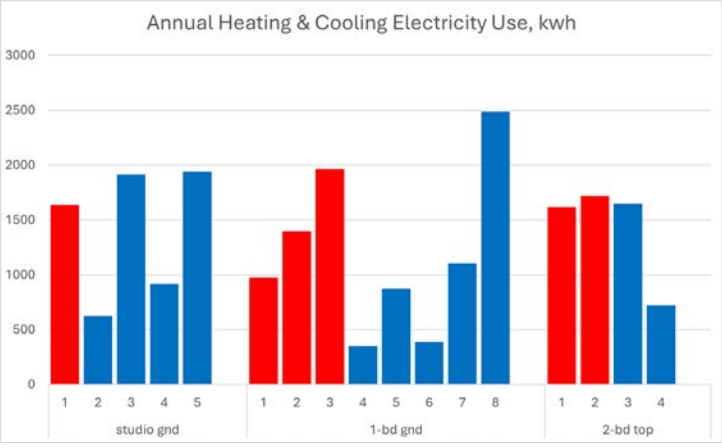
- Group 1: ground floor studios
- Group 2: 1-bedroom ground floor units
- Group 3: 2-bedroom top floor units

Each group has at least one full year of occupied data. Electricity, gas use and costs and emissions were compared within the same group. All data was from the same time period: from Dec. 16, 2022 to Dec. 16, 2023.

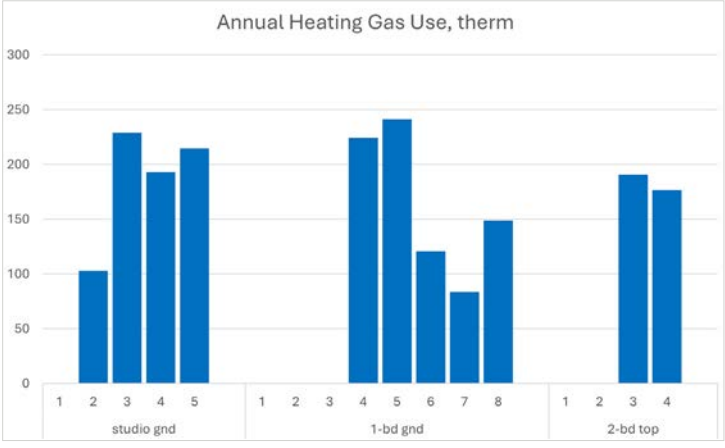
Natural gas is used for cooking in all apartments and, in the baseline apartments, for space heating. In the baseline apartments, electricity is used by the PTAC compressor in cooling mode and blower in heating and cooling mode, and other miscellaneous, plug and lighting loads. In the STHP apartments, electricity is used for all heating and cooling as well as miscellaneous, plug and lighting loads.

For both electricity and gas use, a baseload was determined using the average of the three lowest consumption months for each apartment. That baseload amount was then deducted from each month's use to estimate monthly heating and cooling use. For cost analysis, an electric rate of $0.25/kWh and a gas rate of $1.29/therm were used (based on utility bills from the site). For emission analysis, NYC Local Law 97 2024 emission factors were used: 0.29 kg CO2/kWh for electricity and 5.3 kg CO2/therm for gas.

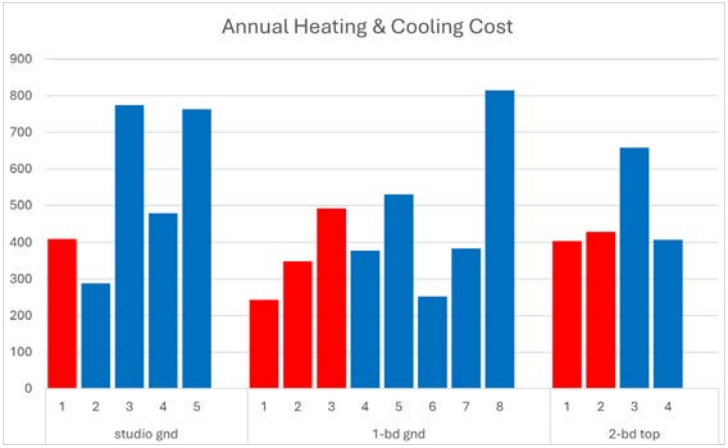
Annual heating and cooling uses, costs and emissions of apartments are shown in the following graphs.



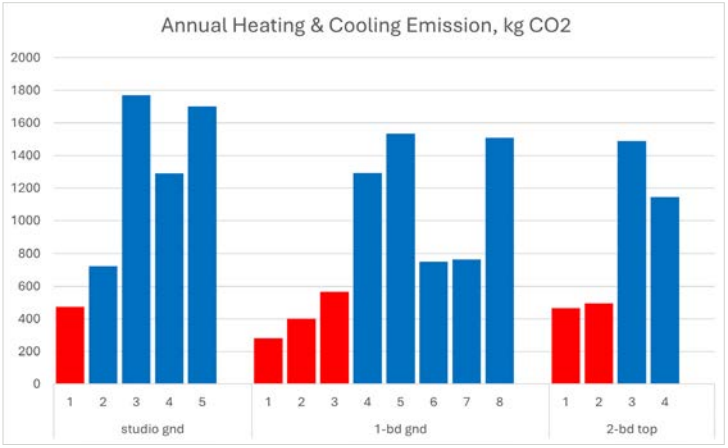
Red bars are the Fujitsu STHP units. Blue are gas PTAC units. Annual heating and cooling electricity use ranged from 350 to 2,500 kWh. STHP apartments averaged 1,550 kWh and baseline apartments averaged 1,179 kWh.



Annual heating for baseline apartments using gas PTACs.



Red bars are for apartments with STHPs and blue are baseline apartments with gas PTACs. Annual heating and cooling utility cost for STHP apartments averaged $133 less (26%) than the baseline apartments.



Red bars are for apartments with STHPs and blue are baseline apartments with gas PTACs.

Following are some key takeaways, recognizing that these are preliminary results from a limited number of apartments and not corrected for differences in occupant behavior.

- Annual heating and cooling electricity use ranged from 350 to 2,500 kWh. STHP apartments averaged 1,550 kWh and baseline apartments averaged 1,179 kWh.

Each unit the Loring Avenue multifamily housing facility is now conditioned with a Fujitsu STHP heat pump system.

- Annual heating and cooling utility cost for STHP apartments averaged $133 less (26%) than the baseline apartments.
- Annual CO2 equivalent emissions for STHP apartments averaged 822 kg less (65%) than for baseline apartments.
- Note that, with the exception of emissions, the results are within the margin of error – more comprehensive data collection and analysis is being conducted over the next year.

Further inspection

The results indicate a potential utility cost savings of 26% compared to the PTAC baseline units and a CO2 equivalent emissions reduction of 65%.

The STHP indoor unit functions identically to any Fujitsu H-Series mini-split system.

To clarify, the findings indicate that over a 12-Month period, the STHP system used 26% less electricity compared to the PTAC system, which mainly used electricity during a 4-6 month cooling season. Additionally, the STHP system also recorded a significant 65% reduction in emissions over the PTAC. These results collectively support the STHP system as a more efficient and environmentally friendly option.

"Compared to PTACs using electricity for heating, the utility cost savings from a STHP is even greater. Based on New York City's heating degree days, the COP (coefficient of performance) of the STHP system, the AFUE (annual fuel use efficiency) of a standard heat pump, and the cost of natural gas in NYC, an estimate of the true cost savings provided by the STHP system over a PTAC approaches 60%," said Khaled Bou-Hamdan, senior product manager at Fujitsu General America.

(left to right) Adem Dikoli, Noel Cruz and Shad Balram discuss the work to be done at Loring Avenue.

"While the efficiency and carbon reduction improvements are evident, the STHP offers other advantages, some of which are harder to quantify," he continued. "The STHP units provide a higher level of comfort due to more consistent indoor temperatures and are much quieter, up to 87% quieter within the occupied space."

For the installing contractor and the property owner, the benefits continue. The STHP features a 12-year parts warranty, more than twice the industry standard for PTAC systems, and its lifespan is expected to be two- to three times longer than a standard PTAC.

Improving through-wall HVAC

"When the STHP was introduced, it was the only PTAC alternative efficient enough to qualify for rebates and financing through the NYC Clean Heat program without converting to mini-splits or VRF, which simply isn't an option at many of these properties," explained Cruz. "There are other alternatives now, including more efficient PTACs, but those have all the same noise and comfort issues inherent to PTACs."

The PTAC infrastructure in NYC is huge," continued Cruz, whose 14-person company focuses almost exclusively on heat pump installations. "The STHP is a fantastic solution for efficiency, carbon reduction, and landlord bottom line. We haven't had any problems with the units we installed.

During the retrofit, the STHP outdoor unit is installed within the wall penetration that used to house a PTAC.

The build quality is great and it offers all the benefits of a mini-split in a package perfectly adapted to the application. PTACs can only do so much. This is the future for through-wall HVAC."

Supercool HVAC has 14 more STHP installations to conduct under the terms of the BlocPower contract. The schedule of this work is being determined by tenant vacancies.

"I'm bullish on the STHP technology," said Merkin. "The results we've seen at Loring Ave - with a satisfied client and happy tenants - have been very positive. The STHP increases our opportunities in facilities with existing PTAC infrastructure, where electrification would otherwise be difficult."

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