

CASE STUDY

212 W 105th Street, New York, NY Steam to Heat Pump Conversion in NYC LMI Coop.

PROJECT DESCRIPTION

Taitem led a heat-pump conversion project at 212 W. 105th Street, an affordable HDFC co-op building. We believe this is the first such steam-to-heat pump conversion project that was fully monitored, providing post-installation data analysis to validate energy savings.

This building is a 5-story, 10-unit walkup, with 9,690 SF, of which 10% is common area (vestibule, corridors). The pre-retrofit steam boiler provided both space heating and DHW, with window air-conditioning units providing cooling.

Taitem services included pre-design, design, construction, and post-construction services. Pre-design services included creating a calibrated eQUEST energy model to simulate pre- and post-retrofit performance, coordinating with Daikin (which donated equipment for the retrofit), and working with Cornell University's department of mechanical engineering to involve students in an innovative real-world project.

Taitem designed the heat pump installation, including scope and bidding documents, and provided on-site project management. Taitem also scoped and designed the heat pump installation for DHW, although this has not yet been installed.

Through its Technical Review contract with NYSERDA, Taitem provided measurement and verification, including installation of monitoring equipment, data gathering, and data analysis.

PARTICIPATING STAFF INCLUDES:

Project consulting with Daikin and Cornell University:
Ian M. Shapiro, PE; Nate Goodell, PE

Design and Construction:
Yossi Bronsnick, PE; Lou Vogel, PE; Dominick DeLucia; Brendan Mangino

NYSERDA Technical Assistance:
Umit Sirt, PE, Jim Holahan;
Mahmud Burton; Dave Tedeyan, PE; Evan Hallas; George Aiken



KEY RESULTS

GHG emission reduction: 48% for the whole building for calendar year 2021. We estimate that GHG emission reductions could be 57% if the DHW was not continuing to run on the steam boiler. Tom Sahagian, an independent consultant who worked with Taitem, created this project synopsis, published in Habitat.

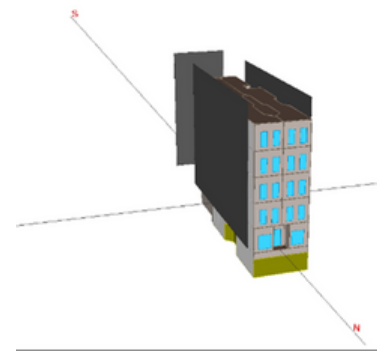
<https://www.habitatmag.com/Publication-Content/Green-Ideas/2021/2021-February/Upper-West-Side-Co-op-Steps-Into-the-Electrified-Future>



Interior building shades from Northern view

GHG Calculation for HVAC/DHW in 2021 -- tons equivalent CO2

Space Heat and DHW - Oil		Space Heat -- Heat Pumps	
Oil GHGs		Oil GHGs (for less-efficient DHW)	
164 lb/MMBtu		164 lb/MMBtu	
96,706 lbs/yr		23,902 lbs/yr	
43.9 tonnes		10.8 tonnes	
Electricity GHGs		Electricity GHGs	
0.289 kg/kWh*		0.289 kg/kWh*	
1,427.08 kg/htg		8,301.53 kg/yr	
1.43 tonnes		8.30 tonnes	
Total	45.32 tonnes	Total	19.15 tonnes
Heating Season Savings, Tons GHGs/year		% GHG Reduction	
26.17		58%	
*NYC 2019 GHG Inventory			



Pre- and Post-Retrofit Energy Use

	Comparable Revised Post-retrofit/TMY3	Comparable Revised Pre-retrofit/TMY3
Space Heating (kWh/yr)	25,774	84,709
Space Heating (gallon #2 oil/yr)	-	-
DHW (gallon #2 oil/yr)	1,044	597
Space Cooling (kWh/yr)	2,951	2,973

Heat Pump Performance Summary

Weather data, 1/1/2021 to 12/31/2021	TMY3	Typical meteorologic
Calibrated pre-retrofit, electric resistance heating	84,709	kWh/yr
Calibrated post-retrofit, ASHP heating	25,774	kWh/yr
GHG Reduction	58%	

CASE STUDY

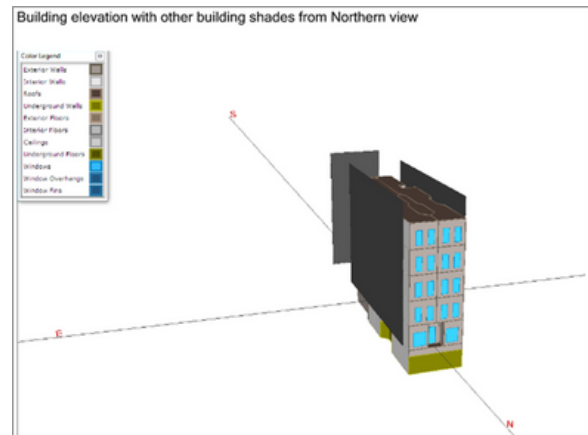
212 W 105th Street, New York, NY Background

SUPPORTING NYC HPD

Improving energy performance in New York multifamily buildings has long been a focus of Taitem Engineering. In 2002, Taitem created guidelines for Preventive Maintenance for Energy Savings for the New York City Department of Housing Preservation and Development (HPD). In 2008, Taitem completed a review of HPD's High Performance Housing program, reviewing drawings and specifications and performing final inspections on several projects.

Taitem developed best practice guidance for constructing high-efficiency multifamily buildings and summarized findings and lessons learned from the program with the aim of making future versions of the program more effective at achieving its energy savings goals. Taitem Engineering is currently leading the team providing technical assistance to HPD's Affordable Housing Retrofit Electrification Pilot. This pilot aims to demonstrate the feasibility and effectiveness of heat pump conversions, for both heating/cooling and DHW, in existing NYC LMI housing stock.

This work includes both program assistance and project-specific assistance, as HPD builds capacity to manage electrification retrofit projects with confidence. Specific tasks include training HPD staff, developing documentation to support staff, contractors, owners, and other stakeholders, and advising on new and emerging technologies, providing design and construction phase support, and post-construction services to ensure installation quality and validate project results.



MARKET RESEARCH SUPPORTING STEAM TO HEAT PUMP CONVERSIONS IN NY

Research funded through Syracuse Center of Excellence Innovation Fund

This study surveyed steam systems in NY buildings, using several data sources, including more than 500 multifamily energy audits. The study evaluated risks and challenges of conversion to VRF systems and identified further research and data needs. This study concluded that heating savings of greater than 50 percent could be achieved by converting steam heating systems to VRF heat pumps, with additional electricity savings coming from high-efficiency air conditioning. Further, the research demonstrates that conversion to VRF heat pumps offer a path to zero-energy buildings when renewable energy is used for electricity.