The State of the Stock: New York State's First Multifamily Building Inventory

Tracey DeSimone, NYSERDA, Albany, NY[1]; Conner Geery, Cadmus, Oakland, CA; Elizabeth Boulton, NYSERDA, Albany, NY; Brian Cabezas, NYSERDA, Albany, NY

ABSTRACT

Retrofitting multifamily buildings is critical to achieving New York State's (NYS) climate and equity goals. However, this sector has historically lacked detailed data, making it harder to design effective energy programs. While NYS has conducted residential, commercial, and industrial building stock studies, multifamily buildings have been more difficult to assess due to outreach challenges with owners and managers.

To address this, NYS initiated its first Statewide Multifamily Baseline Study (SMBS)[2] in 2022, completing it in 2025. This paper focuses on the building stock assessment, one of three components of the SMBS, alongside a market assessment and an image analysis dashboard. The study's primary goal is to establish an accurate baseline of multifamily building and energy-use characteristics to support the development, implementation, and evaluation of clean energy and energy efficiency programs.

The building assessment involved 1,337 surveys with building owners and managers, 135 occupant surveys, and 434 site visits. These efforts gathered data on building infrastructure, HVAC and water systems, lighting, appliances in common areas, building automation and management systems, and on-site energy generation and storage.

This paper presents key findings, including energy use intensity (EUI) by building vintage, the number of buildings by typology, and saturation rates for heating, cooling, lighting, refrigeration, and other energy-using equipment. Results are broken down by multifamily typology and geographic region, offering a detailed snapshot of the sector's current state and highlighting opportunities for targeted energy improvements across NYS.

Introduction

The multifamily sector in NYS has historically been the most opaque and least understood segment of the state's energy landscape. One of the primary barriers to understanding this sector is the complexity of building ownership and management structures. Determining the appropriate point of contact, whether it be the property owner, manager, or tenant, is often difficult, especially given the high turnover rates among occupants. This lack of clarity has hindered data collection and, by extension, the development of targeted energy efficiency programs.

Yet, the importance of this sector cannot be overstated. Multifamily buildings account for over 2.6 million dwelling units, representing approximately 35% of New York's housing stock (Census Bureau 2021). According to the most recent energy consumption data, the residential sector, including multifamily, accounts for about 22% of total energy use in New York State (EIA 2025). Given this substantial share, understanding and improving energy performance in multifamily buildings is essential to achieving the state's climate and equity goals.

NYSERDA has long recognized the need for accurate, sector-specific baselines to inform its statewide initiatives. As the agency responsible for implementing clean energy programs for all New

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[1] The views expressed in this paper are those of the authors and do not necessarily reflect the views of the New York State Energy Research and Development Authority.

[2] https://www.nyserda.ny.gov/About/Publications/Evaluation-Reports/Building-Stock-and-Potential-Studies/Statewide-Multifamily-Building-Study

Yorkers, regardless of income or housing type, NYSERDA must ensure that every ratepayer has access to programs that meet their needs. To responsibly plan and evaluate these initiatives, a robust and up-to-date baseline of energy usage is essential.

To this end, NYSERDA has undertaken a series of building stock assessments across key sectors. These include:

- Two completed single-family residential building stock studies (with a third currently underway), focusing on single-family homes and multifamily buildings with 4 or fewer dwelling units;

- One commercial building stock study (with a second in planning);

- One industrial building stock study;

- And, most recently, the multifamily building stock assessment, examining buildings with 5 or more dwelling units—the focus of this paper.

Each of these studies is designed to be updated every five years, allowing NYSERDA to track trends, measure progress, and recalibrate its strategies based on the most current data. The SMBS represents the first comprehensive effort to characterize the multifamily sector in New York State. Through a combination of surveys, site visits, and advanced image analysis, the SMBS provides a foundational dataset that will inform policy, guide investment, and support equitable decarbonization across the state's multifamily housing stock.

Statewide Multifamily Baseline Study (SMBS)

Purpose and Objectives of the SMBS

The SMBS was designed to establish a comprehensive, statistically representative baseline of energy-related characteristics in New York's multifamily buildings. Its primary objectives were to develop a detailed profile of multifamily buildings and their equipment saturation, building infrastructure, and energy management practices to support NYSERDA, utilities, and other stakeholders in program planning, implementation, and evaluation, as well as enable more accurate energy savings calculations and inform future market assessments.

Components of the Study

Building Stock Assessment
The core of the SMBS, the building stock assessment, involved direct data collection through surveys and site visits. It provided granular, verified data on building systems, infrastructure, and occupant behavior. This paper focuses on the design, execution, and findings of this component, which serves as the foundation for understanding energy use in New York's multifamily sector. The overarching study also included a separate market assessment and image analysis component, described below, that were performed outside of the core building stock assessment and will not be addressed in the remainder of this paper.

Market Assessment
The market assessment component of the SMBS aimed to understand the broader context in which multifamily energy systems operate. It included surveys and interviews with architects, engineers, contractors, and energy consultants to gather insights into current practices, technology adoption, and

barriers to energy efficiency upgrades. This component focused on four key areas: HVAC systems, water heating, building envelope improvements, and electrification readiness. The findings helped identify gaps in market readiness and informed the development of targeted strategies to accelerate clean energy adoption in the multifamily sector.

Image Analysis Dashboard

To complement the surveys and site visits performed in the core building stock assessment, the SMBS incorporated an innovative and novel image analysis technique that examined over 650,000 aerial photographs of buildings across NYS (Geery et al). This approach used advanced algorithms to automatically interpret visual features in the images. Through this process, the study extracted detailed information on more than 130,000 multifamily buildings, including attributes such as building height, window-to-wall ratio, roof type, and visible heating and cooling equipment. These data were compiled into an interactive, searchable dashboard designed to support stakeholders in identifying potential retrofit candidates, estimating the market size for specific technologies, and prioritizing investments based on building characteristics. This scalable and cost-effective tool represents a significant advancement in the analysis of building stock at a statewide level.

Study Design and Methodology

The SMBS was a multi-year initiative that required significant investment in both time and resources. The project spanned approximately three years, from early planning and design in 2022 through data collection and analysis in 2024, culminating in final reporting in early 2025. This extended timeline was necessary to accommodate the complexity of the multifamily sector and the breadth of data collection methods employed. This also enabled the integration of dynamic sampling techniques into analysis and computer vision into the final population data, which both significantly enhanced the accuracy and scalability of the assessment.

The study was led by Cadmus as the prime contractor, supported by a network of subcontractors including Steven Winter Associates, GDS Associates, Ridgeline Energy Analytics, Res-Intel, and APPRISE. In total, more than 50 contracting staff members contributed to the project across survey design, fieldwork, data analysis, and reporting. Field operations alone involved over a dozen trained technicians conducting 434 site visits across all major climate zones in New York State.

The building stock assessment was the largest and most data-intensive component of the SMBS. It was designed to capture a statistically representative snapshot of New York's multifamily buildings across a range of characteristics shown in Table 1.

Table 1. Building population stratification

Variable	Stratification
Building size	Low-rise (1-3 stories) Mid-rise (4-7 stories) High-rise (8+ stories)
Ownership type	Affordable subsidized Affordable unsubsidized Co-ops and condominiums Market-rate rentals
Climate zone (geographic region)	4A – NYC

Variable	Stratification
	4B – Long Island and Westchester
	5 – Central and western New York
	6 – Northern New York
Metering type	Direct metered
	Building-level metered
Disadvantaged community (DAC) designation	Yes
	No

The sampling plan was developed in collaboration with NYSERDA and utility stakeholders to ensure that the study would achieve 90% confidence and ±15% precision at the regional level (regions shown in Figure 1), and ±10% precision at the statewide level for most parameters.

Figure 1. NYS Climate Zones
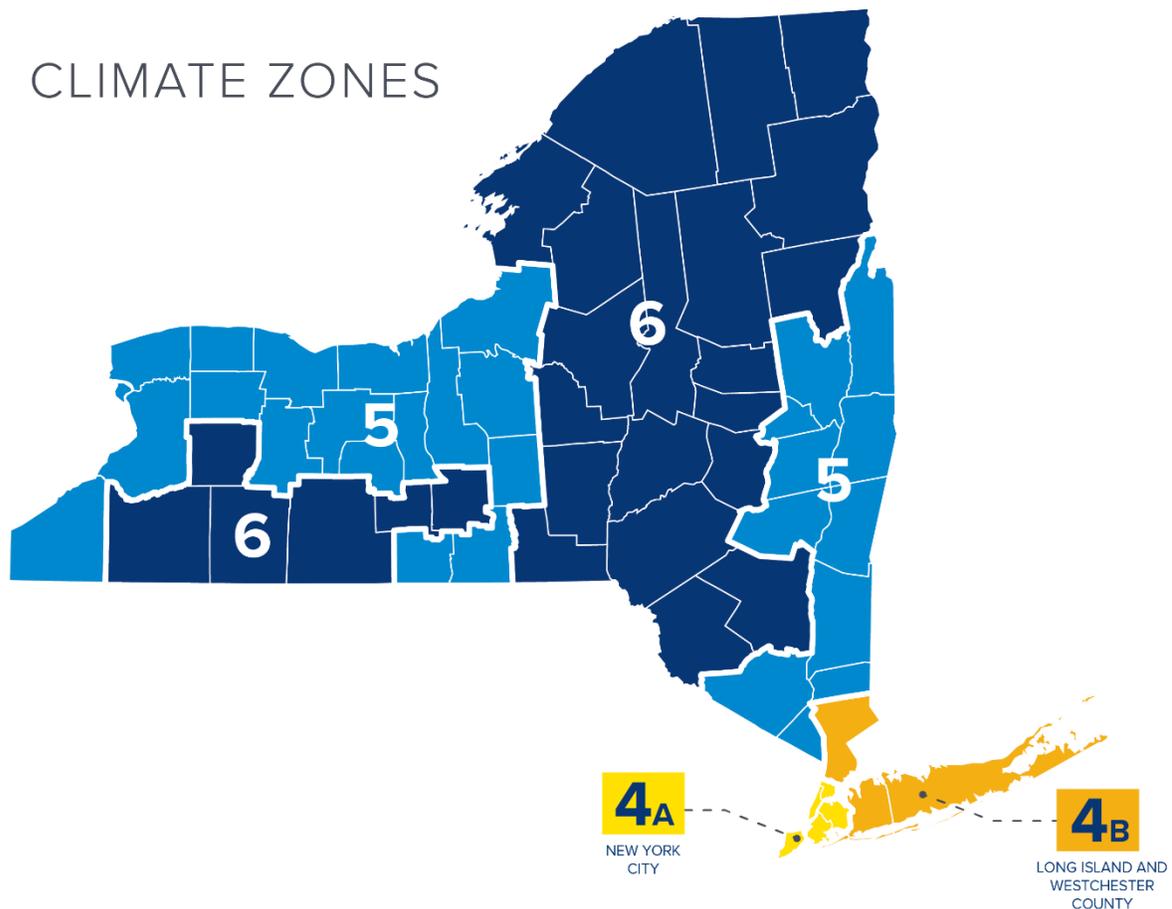
Population Data Development

Prior to this study, no comprehensive dataset existed detailing the attributes and energy usage of every multifamily building in NYS. To support image analysis and building stock assessment, Cadmus and

Res-Intel developed a population dataset identifying approximately 130,000 multifamily buildings across NYS (Geery et al).

This dataset was built by consolidating multiple incomplete sources such as NYS tax assessor data, GIS parcel data, NYC PLUTO, NYC Open Data, and commercial databases like Costar and Reonomy into a more reliable, unified resource. A particularly innovative aspect of this effort was the use of LiDAR and oblique aerial imagery, analyzed through computer vision techniques, to estimate building-level characteristics such as height, footprint, and roof type. This approach allowed the team to overcome limitations in traditional datasets, validate or verify existing data, and create a first-of-its-kind statewide multifamily building inventory. Since most existing data were at the parcel level, the team used building footprints from GIS systems, OpenStreetMap, and Bing Maps, along with LiDAR-derived height data, to disaggregate parcel-level information into individual building records.

The project team estimated building characteristics such as number of floors and residential units by combining reported data with spatial and structural measurements. Starting from over 500,000 potential buildings, the team applied filters to exclude non-qualifying structures, ultimately producing a refined dataset of multifamily buildings that met NYSERDA's definition (five or more residential units per building).

This approach also presented challenges, including the need for extensive data cleaning and validation, and limitations in accurately capturing certain attributes (e.g., interior systems or occupancy details) without supplemental field data. For others considering a similar approach, the importance of integrating multiple data sources early and investing in robust quality control protocols should be emphasized. While a more thorough data-focused approach up front can be resource-intensive, this strategy offers a powerful foundation for large-scale building assessments, particularly in jurisdictions lacking centralized building data.

Data Collection Methods

The SMBS employed a multi-modal, multi-phase data collection strategy:

1. Building Representative Surveys

A total of 1,565 surveys were completed with property owners, managers, and other building representatives. These surveys were conducted online and by phone and collected data on:

- General building characteristics (e.g., year built, number of units, number of floors).
- HVAC and water heating systems (type, fuel, age, and efficiency).
- Lighting and appliance types in common areas and dwelling units.
- Energy management systems and maintenance practices.
- Awareness of and participation in energy efficiency programs.

Recruitment was a major challenge due to the difficulty of identifying and reaching the correct building contact. The study team used a combination of email campaigns, postcards, phone outreach, and partnerships with trade organizations. Incentives were increased over time—from $50 to $200 per survey—to improve participation rates (Boulton et al).

The final response rate was approximately 1.2%, based on outreach to over 130,000 identified multifamily buildings. While this did not meet the initial study targets based on sampling goals, this rate is typical for voluntary surveys in the multifamily sector and was sufficient to meet the study's confidence and precision goals, achieving ±10% precision at the statewide level and ±15% precision at the regional level for most key parameters. The increase in incentives significantly boosted participation, particularly among market-rate and co-op/condo buildings, which were initially underrepresented.

The study also tested various engagement strategies, including partnerships with trade organizations and tiered incentives, offering valuable insights into effective outreach methods for hard-to-reach building owners and managers. The project team identified that for the multifamily sector, social media marketing was particularly helpful in recruiting participants, and forming partnerships with organizations that had established relationships with building owners was effective in hard-to-reach areas. However, certain strata such as high-rise buildings in upstate regions remained difficult to recruit, suggesting that future efforts may benefit from additional targeted outreach or pre-established partnerships with regional housing organizations.

2. Occupant Surveys

In parallel, 135 surveys were completed by building occupants. These surveys focused on:

- In-unit equipment and appliance usage.
- Satisfaction with heating, cooling, and hot water systems.
- Presence and use of smart or connected devices.
- Household demographics and income levels.

Occupants were typically recruited through building representatives who had already agreed to participate in the study. Incentives included $30 for completing the survey and an additional $50 for allowing a site visit to their unit.

3. Site Visits

Site visits were conducted at 434 multifamily buildings across the state. These visits were critical for validating survey responses and collecting detailed technical data that could not be reliably self-reported. Field technicians documented a variety of data, including:

- HVAC and water heating equipment (make, model, efficiency, and condition).
- Lighting systems and controls in common areas and dwelling units.
- Building envelope characteristics, including insulation levels, window types, and roof materials.
- Electrical service capacity and metering configurations.
- On-site renewable energy systems and EV charging infrastructure.

Technicians used a standardized, tablet-based data collection tool with built-in quality checks. This custom tablet-based tool ensured consistent data capture across hundreds of buildings and included offline functionality and automated syncing, which improved data integrity and reduced manual errors. Each visit included inspections of mechanical rooms, rooftops, and at least one or two dwelling units per building.

4. Remote Sensing and Image Analysis

To complement in-person data collection, the study employed a novel computer vision approach to analyze aerial imagery and extract building-level data. This method enabled the team to systematically identify and characterize over 130,000 multifamily buildings statewide using LiDAR and oblique image analysis, programmatically extracting features such as building height, window-to-wall ratio, roof type, and visible HVAC equipment.

This remote sensing component provided a scalable, cost-effective way to assess building stock characteristics and identify retrofit opportunities, especially in areas where site visits were not feasible. Where possible, stratification criteria within the population data for the building assessment was reinforced with findings from the image analysis performed. This adjusted population data was used in tandem with site visit and survey data analysis to determine results for the study.

Lessons Learned

Several aspects of this study went particularly well and helped ensure the robustness of the final dataset. The stratified sampling framework, organized by building size, ownership type, climate zone, and disadvantaged community (DAC) status, enabled statistically representative insights at both regional and statewide levels. The integration of aerial imagery and LiDAR data proved especially valuable, allowing the team to characterize over 130,000 multifamily buildings and providing a scalable, cost-effective complement to traditional site visits. Field staff benefited from a standardized, tablet-based data collection tool with built-in quality checks, which ensured consistency and completeness across the 434 site visits. Additionally, strong collaboration with many NYSERDA team, NYS utilities, and trade organizations helped refine the study design and improve outreach strategies.

Despite these successes, the study faced several notable obstacles. Recruitment of building representatives was particularly challenging due to a high degree of outdated contact information, complex ownership structures, and low response rates, especially outside of New York City (Boulton et al). The initial population frame was built from disparate and incomplete datasets, including tax assessor records, PLUTO, and commercial databases, which required extensive cleaning and merging to produce a usable foundation. Certain strata, such as high-rise affordable census block buildings, remained under-sampled despite targeted outreach, which limited the precision of estimates in those segments. In some cases, survey responses did not align with field observations, particularly regarding equipment types and insulation levels, necessitating post-hoc reconciliation.

To address these challenges, the study team made several key adjustments throughout the project. Incentives for building representatives were increased significantly—from $50 to $200 for survey participation and from $150 to $250 for site visits—to improve response rates. Outreach channels were expanded to include partnerships with trade associations, a paid social media campaign, and postcard mailings to supplement email and phone outreach. When initial sampling targets were not met, recruitment strategies were adapted and resources reallocated to focus on underrepresented segments. Where discrepancies arose between survey and site visit data, the team applied engineering judgment and benchmarking to determine the more reliable source.

Data aggregation and insight generation were central to the success of the SMBS. The population dataset was constructed by synthesizing multiple sources and using building footprints, LiDAR-derived heights, and spatial overlays to estimate unit counts and building characteristics. Survey and site visit data were weighted to reflect the statewide population, with precision targets of ±10% at the state level and ±15% at the regional level. Remote sensing data was used to validate survey findings and identify retrofit opportunities, particularly in areas where site visits were not feasible. Ultimately, findings were disaggregated by building typology, climate zone, and DAC status to inform targeted program design and policy recommendations. Future studies will support a stronger analysis of baseline data and establish patterns that may otherwise be missed by a single initial study.

Key Findings from the Study

The SMBS yielded a wealth of data that provides a detailed picture of New York's multifamily building stock. The findings span energy use patterns, equipment saturation, building typologies, and regional disparities. Below are the major insights drawn from the study, with more detailed findings and data provided in the published report online (NYSERDA 2025).
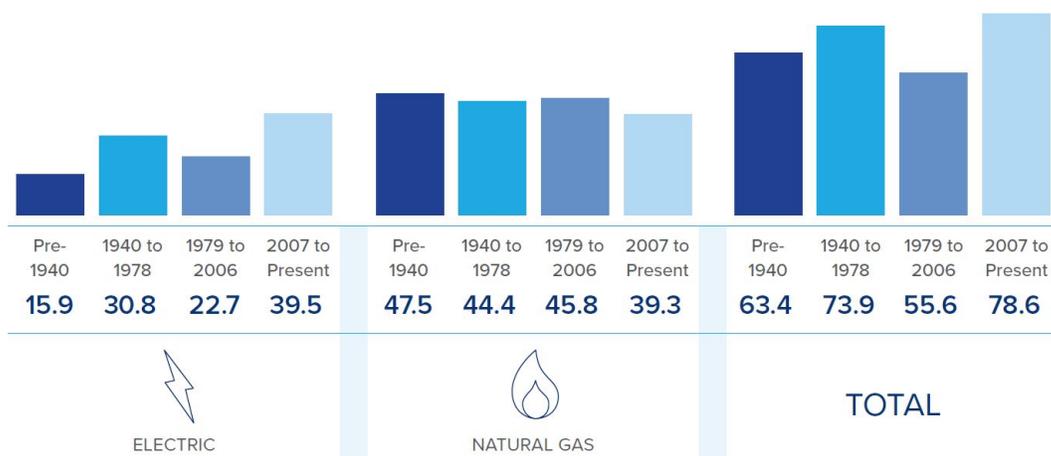
Disadvantaged Communities

Findings from the 2022 SMBS show that DAC buildings have an energy profile with a higher reliance on natural gas for domestic hot water (63% vs. 53% in non-DACs) and cooking (71% vs 64%). These patterns suggest that electrification initiatives in DACs may need to be paired with infrastructure upgrades, such as panel capacity improvements, to support increased electric load. Additionally, DACs show a lower adoption of ENERGY STAR® -rated appliances, despite newer equipment in some categories, which points to a need for targeted appliance efficiency programs that emphasize both affordability and performance. Overall awareness of and participation in energy efficiency programs remains consistent between DACs and other areas, which may mean that awareness and access mechanisms are functioning equitably across communities. However, it also implies that participation rates may be constrained by broader systemic factors that affect all building types, such as program complexity, limited incentives, or misalignment with building needs. Increasing overall uptake may require streamlining application processes, enhancing financial incentives, or offering more tailored technical support. For DACs specifically, where building conditions may be more challenging, utilities could consider layered support models that combine energy efficiency with health, safety, or resilience upgrades to make participation more impactful and feasible.

Energy Use Intensity (EUI) by Building Vintage

One of the most surprising findings was that newer buildings, constructed after 2006, tend to have higher total energy use intensity (EUI)[3] than older buildings, as shown in Figure 2 below. This trend is primarily driven by increased electricity consumption, likely due to the inclusion of more energy-intensive amenities and systems such as elevators, central air conditioning, and in-unit laundry. In contrast, older buildings, while often less insulated, rely more heavily on natural gas and tend to have simpler mechanical systems, resulting in lower overall EUI. This finding challenges the assumption that newer buildings inherently use less energy and underscores the importance of evaluating actual performance rather than relying on building age as a proxy for efficiency.

Figure 2. Energy use intensity (kBTU/sqft) across building vintages

	ELECTRIC				NATURAL GAS				TOTAL		
	Pre-1940	1940 to 1978	1979 to 2006	2007 to Present	Pre-1940	1940 to 1978	1979 to 2006	2007 to Present	Pre-1940	1940 to 1978	1979 to 2006	2007 to Present
	15.9	30.8	22.7	39.5	47.5	44.4	45.8	39.3	63.4	73.9	55.6	78.6

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[3] *Total Building EUI (kBTU/Sqft) is calculated as the total of electric EUIs, natural gas EUIs, and other fuel EUIs. The EUI weighting accounts for the presence of each fuel - i.e. the fuel saturation. Other fuels that are included in the total building EUI include fuel oil, propane, and steam, and represent 6-12% of fuel saturation across geographic regions.*

**Multifamily Building Typology and Distribution**

The study confirmed that low-rise buildings (1–3 stories) dominate the multifamily landscape outside of New York City, while mid- and high-rise buildings are more prevalent in urban centers. The image analysis component provided additional detailed metrics on building size, height, and configuration. For example, low-rise buildings often have larger dwelling units and more direct metering, while high-rise buildings are more likely to have centralized HVAC systems and building-level metering. Mid-rise buildings showed the highest incidence of roof issues, such as water leaks and structural sagging.

This typological diversity shows that different building types may require different retrofit strategies, and thus different engagement approaches.

Heating and Cooling Systems

Natural gas remains the dominant heating fuel across the state, used in approximately two-thirds of multifamily buildings. Electricity is more present in newer buildings, however, as shown in Figure 3. Central boilers are the most common heating system, especially in older buildings. However, newer buildings are more likely to use electric resistance heating or heat pumps.

Figure 3. Primary heating fuel in buildings
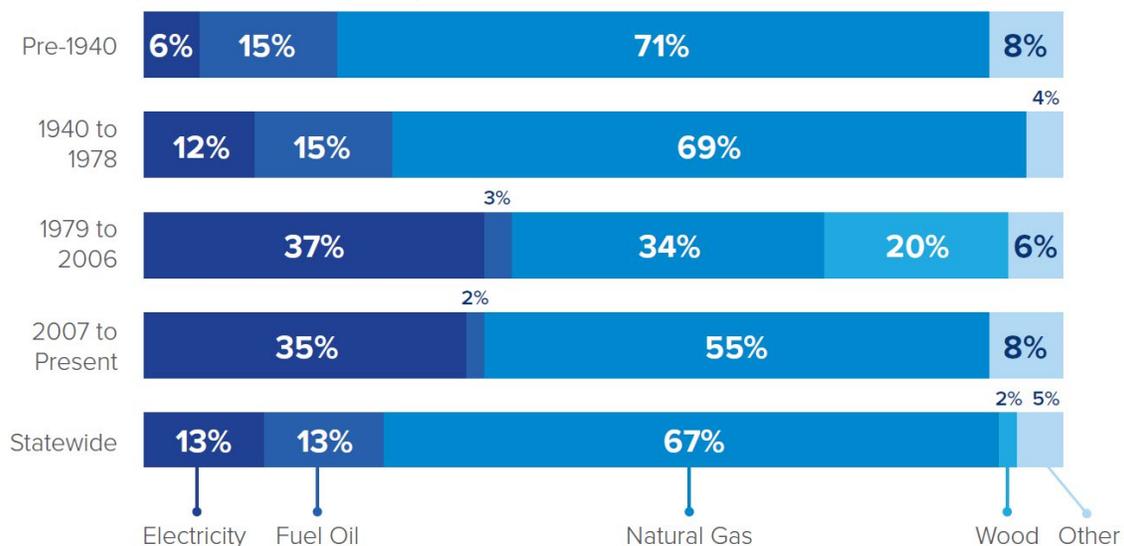
Cooling is not often provided at the building level and thus was analyzed from dwelling unit site visits. Cooling is primarily provided by window air conditioning units, which are present in over 60% of dwelling units. Central air conditioning and ductless mini-split systems are less common (see Figure 4) but more prevalent in co-ops, condos, and newer buildings. Smart thermostats are rare, with only 2% of units using them despite existing smart thermostat programs under multiple NYS utilities, indicating a significant opportunity for modernization and demand-side management.

Figure 4. Dwelling unit cooling across ownership types

TYPE OF AC	AFFORDABLE SUBSIDIZED	AFFORDABLE CENSUS BLOCK	CO-OPS AND CONDOS	MARKET-RATE RENTALS	STATEWIDE
Central Direct Expansion	11%	9%	14%	12%	9%
Packaged Terminal AC	0%	0%	0%	0%	0%
Portable AC	8%	6%	2%	4%	5%
Through the wall AC	20%	14%	20%	32%	24%
Window AC	61%	71%	64%	52%	62%

Lighting and Appliance Technologies

The study found that LED lighting accounts for 62% of common area lamps, while compact fluorescent and incandescent bulbs are still present in many buildings. Lighting controls are often manual, with limited use of occupancy sensors or timers.

Efficiency varies widely between dwelling unit and building-level appliances. While two-thirds of refrigerators in dwelling units are less than 10 years old and thus are likely to be more energy efficient, fewer than 20% of water heaters are ENERGY STAR® certified. Common laundry facilities are present in only half of buildings, and many use outdated equipment. This presents a clear opportunity for appliance upgrade programs targeting multifamily building owners.

Implications for Energy Efficiency and Clean Energy Programs

The SMBS provides a robust foundation for shaping the future of energy efficiency and clean energy initiatives in New York's multifamily sector. Its findings have direct implications for program design, policy development, and future research.

Supporting Program Development and Evaluation

The detailed baseline data enables NYSERDA and utilities to design more targeted and effective programs based on actual building characteristics and energy use patterns. Establishing accurate baselines allows for the measurement of those program impacts and energy savings. Underserved segments of the market, such as DACs and buildings with outdated equipment, can be identified and investments can be prioritized in technologies and strategies that offer the greatest potential for energy and emissions reductions.

The integration of image analysis also allows for remote identification of retrofit candidates, reducing the need for costly and time-consuming site visits.

Policy Recommendations

Based on the study's findings, several policy recommendations emerge:

- Consider layered support models that combine energy efficiency with health, safety, or resilience upgrades for programs targeting DACs.

- Expand incentives for upgrading to ENERGY STAR® appliances, smart thermostats, and high-efficiency HVAC systems.
- Support electrification by addressing electrical service limitations in older buildings, including panel upgrades and service capacity enhancements.
- Encourage the adoption of building automation systems and energy management tools, especially in larger and newer buildings.

Conclusion

The 2022 SMBS represents a landmark achievement in characterizing New York's multifamily housing sector. By combining traditional survey methods with cutting-edge image analysis, the study provides a comprehensive dataset that will inform policy, guide investment, and support equitable decarbonization.

The study's findings challenge assumptions about building efficiency, highlight disparities across regions and communities, and reveal significant opportunities for improvement. They also underscore the importance of sustained investment in data collection, stakeholder engagement, and technological innovation.

As New York advances toward its climate goals, the insights from this study will be instrumental in ensuring that the multifamily sector is both a priority and a beneficiary of the clean energy transition. With a solid baseline in place, NYSERDA and its partners are well-positioned to design and implement programs that deliver meaningful benefits to all New Yorkers, regardless of where they live or how much they earn.

References

EIA (Energy Information Administration), 2025. New York State Energy Profile. Accessed 06/16/2025 at https://www.eia.gov/state/print.php?sid=NY

NYSERDA (New York State Energy Research and Development Authority), 2024. Patterns and Trends - New York State Energy Profile. Accessed 06/16/2025 at https://www.nyserda.ny.gov/About/Publications/Energy-Analysis-Reports-and-Studies/Patterns-and-Trends

Geery, C., N. Hinkle, A. Dugan, and J. Geppner. 2024. "Seeing Is Believing: Understanding and Expanding Multifamily Building Retrofit Markets Through Large-Scale Computer Vision Analysis of Building Characteristics." 2024 ACEEE Summer Study on Energy Efficiency in Buildings.

Boulton, E., T. DeSimone, and C. Geery. 2024. "Getting Past the Doorman: Key Challenges, Solutions, and Findings of a Determined Multifamily Baseline Study Team." 2024 ACEEE Summer Study on Energy Efficiency in Buildings.

Census Bureau. 2021. American Housing Survey Table Creator: New York, Housing Unit Characteristics. Accessed 06/16/2025 at www.census.gov/programs-surveys/ahs/data/2021/ahs-2021-summary-tables.html