Making Sense of Your Multifamily Housing Stock

A Framework for Cities and Municipalities

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ELEVATE ENERGY
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Introduction

The purpose of this document is to provide a framework for city policymakers, program administrators, and energy efficiency advocates to characterize and segment a community's multifamily[1] building stock as a tool to promote water and energy efficiency and combat climate change. Its sheer size makes multifamily housing key to meeting city-wide water and energy efficiency goals. It accounts for approximately 25 percent of all housing units in the United States[1] and houses 20 million families.[2] Research has shown that the multifamily market is an untapped reservoir of energy savings. The part of the multifamily market that is affordable to lower-income households could save up to 30 percent on electricity and gas costs with off-the-shelf energy efficiency improvements.[3]

And yet, despite its size and savings potential, the multifamily market is underserved by existing energy efficiency programs. The primary reason is a lack of data and understanding about the multifamily housing stock in most cities in the public and private sectors. Another barrier to effective delivery of energy efficiency programs to the multifamily market is its diversity and complexity. The multifamily building stock is characterized by:

- **Building types** that range from low-rise walkups to skyscrapers with elevators.
- **Construction materials** that might be brick and mortar, steel and glass, or something else.
- **Ownership structures** that include owner-occupied two-unit buildings to a 100-unit building that is part of an investor-owned portfolio of structures. The needs and resources of a small multifamily building and an investor-owned high-rise building with sophisticated commercial heating and cooling systems and full time building management staff are very different. The public sector can also be an owner of thousands of units though a municipal housing authority.
- **Ambiguous treatment by energy efficiency programs and city regulations.** Straddling the residential and commercial sectors, multifamily buildings resist neat classifications as industrial, commercial, or residential that utilities typically use. In Chicago, for instance, multifamily utility-run energy efficiency programs serve two-to-four unit multifamily buildings through their single family programs and multi-use multifamily buildings typically fall under "low-income" residential energy efficiency programs.
- **Confusing codes** for housing and energy that were not designed with multifamily buildings in mind. Chicago's building code, for example, considers a multifamily building either residential or commercial depending on the number of above-grade stories it has.
- **Meter rate structures** that vary within a single building. In larger multifamily buildings, common areas such as lobbies, hallways, and storage areas can be subject to a commercial electricity or gas rate, while tenant spaces are subject to residential rate structures. Further adding to the complexity, tenant spaces can be individually metered for electricity or gas, and they can also be subject to a master meter account for the building.

A general one-size-fits-all approach to energy efficiency is ineffective when trying to serve a building type as diverse and challenging as the multifamily market. The first step toward understanding a community's complex multifamily buildings is to complete a **market segmentation and characterization**. This approach divides the multifamily market according to its building characteristics, ownership structures, tenant affordability, and financing.

1 This document uses "multifamily" to refer to residential buildings with five-or-more units. Depending on the building stock, a municipality may define multifamily differently. One example is Chicago, where 28 percent of the residential building stock is comprised of buildings with two-to-four units. For an in-depth analysis of Chicago's multifamily housing stock, see "Segmenting Chicago Multifamily Housing to Improve Energy Efficiency Programs," a complementary report to this framework.

Characterizing the multifamily stock at the local level has several uses. It enables stakeholders to:

- Advance energy and water efficiency policies
- Construct a database of buildings for an energy "benchmarking" or baselining ordinance
- Design better programs tailored to the building and owner needs
- Conduct targeted outreach to building owners who would benefit most, and
- Drive significant investment in energy and water efficiency.

Using the Framework

This guide will help community stakeholders embark on a segmentation of the multifamily market.

- Section 1 outlines data sources from the city, county and/or state that may be available at different levels of granularity.
- Section 2 offers a methodology for accessing data sources, ensuring data privacy and drawing upon expertise from the housing, real estate, and utility sectors.
- Section 3 provides examples of market segmentation being used to improve energy efficiency programs in New York City, Chicago, and Los Angeles.

1. Potential Data Sources

Cities and municipalities can draw upon several data sources when delving into its multifamily building stock, including:

Municipal Open Data Portals

Governments are increasingly sharing data with the public, often via online portals. Cities, including Chicago, New York, and Los Angeles publish data regarding city finances, health outcomes, environmental indicators, public safety, and building and construction permits. These datasets are usually accompanied by an application programming interface (API) and other tools that enable software developers to use the datasets. The National Neighborhood Indicators Partnership is an example of an initiative that promotes the assembly, transformation, and dissemination of municipal data. Partner cities include Chicago, Milwaukee, Pittsburgh, and Oakland.[4]

Universities and Housing Agencies

Municipalities are often home to experts in academia and government who focus on understanding the housing stock, its affordability, and trends over time. Examples include the Furman Center at New York University, the Joint Center for Housing Studies at Harvard University, the Center for Community Capital at the University of North Carolina, and the Institute for Housing Studies at DePaul University in Chicago. The New York City Department of City Planning is a good example of a government entity that provides rich housing, rental, and real estate data. Its PLUTO database is a cross-agency source at the tax-lot level that includes ownership type, building class, number of units and geospatial data.

Utility Energy Efficiency Potential Studies

Studies projecting potential energy savings from energy efficiency interventions are common in the utility sector. These studies make broad assumptions to estimate the potential energy savings of the building stock in a utility's service area. They estimate different levels of energy efficiency potential, including:

- Technical potential, which considers all of the savings that are possible given available technology

- Economic potential, or the portion of the technical potential that is cost-effective, and
- Achievable potential, which is the cost-effective portion that is feasible given existing barriers.

Utilities across the United States have conducted energy efficiency potential studies, and the American Council for an Energy-Efficient Economy (ACEEE) maintains a database that includes many of them. These studies can help inform a multifamily market characterization by providing estimates of commercial, industrial, and residential building stock and associated energy use characteristics. A recent ACEEE paper provides a starting point to gain background about the field of "potential" studies.[5] Some researchers, however, have cautioned that the findings of utility potential studies be reviewed carefully given the complexity and uncertainty inherent in their estimates.[6] Also, many potential studies were developed for a specific intent, and thus the findings may not be readily transferrable to research with different motivations.

Energy Use Sources

The ideal data source for energy use in multifamily buildings would reflect building-level annual usage by fuel type. This data, however, is rarely accessible or available due to data privacy concerns and the cost of acquiring the data. At the state and national levels, energy data is collected by:

- The U.S. Environmental Protection Agency via Portfolio Manager, a tool that building owners can use to benchmark the energy use of their buildings.
- The U.S. Energy Information Agency (EIA) via the Residential Energy Consumption Survey (RECS) that in 2009 surveyed more than 12,000 U.S. households about their energy use, appliances, heating fuels, and other characteristics. Based on the survey, RECS published regional energy use estimates and trends over time. EIA also conducts the Commercial Building Energy Consumption Survey (CBECS).
- The U.S. Department of Energy's Building Performance Database (BPD) that publishes anonymized energy use data from commercial and multifamily buildings across the country.

Water Sources

Heating water accounts for 17 percent of residential energy use,[7] second only to heating and cooling air. The energy efficiency field is increasingly pursuing a cross-discipline approach with municipal water stakeholders, given that water conservation delivers efficiency benefits on the water and energy sides. Given that a central utility frequently provides water for an entire metropolitan area, water use data is often available at the municipal level. Many cities subject to drought and water restrictions have led the industry on water efficiency and conservation. Similarly, many water-rich areas have begun to focus on water efficiency due to rising water prices, extreme weather events, and municipal budgetary woes. Elevate Energy has found that multifamily building owners, in particular, are interested in managing their water costs in concert with their energy expenses.

Private Real Estate Databases

Several fee-based services provide building- and property-level real estate information for appraisers, investors, and brokers. These databases, such as CoStar and Xceligent, contain information on appraised value, number of units, asking rents, building amenities, and more. They tend to focus on large apartment buildings and lack information on smaller ones. In Chicago, for example, CoStar provided data for 9,000 multifamily buildings out of a total stock of approximately 20,000. The sources of these data are not published publically, but typically include local assessor filings as a primary source. Companies often supplement assessor data by engaging research analysts who scour multiple listing services (MLS) websites, contact building owners, and visit buildings in person. Real estate transactions for smaller multifamily buildings usually take place via the local MLS rather than commercial real estate sites like CoStar. For example, in January of 2017 there were 1,193 active listings for two-to-four unit buildings on MRED (Midwest Real Estate Data), which is the MLS for the Chicago area.[8] The

report authors recommend speaking with a local MLS representative to get a sense of the breadth and type of listings would inform a segmentation study.

Public Surveys and Data Sources

Surveys administered by the U.S. Census and other federal agencies can provide much-needed context for a multifamily market characterization. These include the American Community Survey (ACS), an annual survey of a random sample of households that includes information on employment, education, income, and the number of renter- versus owner-occupied households. The ACS provides estimates at the census tract level, which can be aggregated to the desired level of analysis, which may be a city, county, or metropolitan statistical area.

2. Best Practices

The Energy Efficiency for All (EEFA) initiative has conducted or is in the process of conducting multifamily market segmentation analyses in three cities, discussed in the next section. Below are the best practices that came out of the analyses.

Distinguish between Primary and Secondary Sources

The first step when investigating data sources for a multifamily segmentation is to settle on the primary data source that appears to be the most complete and comprehensive. Once its strengths and weaknesses are well understood, researchers should identify secondary data sources to fill in the gaps. Ideally, the secondary datasets can be joined via a unique identifier rather than an address, which often requires extensive cleaning. When deciding upon a primary data source, it is important to consider its original intended purpose. A set of data provided by a city's open data portal on building permits, for example, might not be intended to capture every building that exists in the city, whereas a county assessor would want to include every property within its jurisdiction. Likewise, certain variables within a dataset might take primacy over others; one data source might have more accurate contact information for building owners, while another has best information for building construction material and energy fuel mix.

Property assessor data is often the primary data source when conducting a multifamily market segmentation, however, county assessor offices vary in their commitment and resources to provide comprehensive tax assessment and property information to the public. Also, data from the assessor is usually incomplete and full of duplicate properties. Nevertheless, assessor data can be a rich source of building-level information, and report authors recommend it be a first stop for stakeholders interested in understanding a community's multifamily building stock.

Secondary data sources can include datasets that are less complete, valid, or granular than the primary data source. For example, a city might share energy or water data at the neighborhood level rather than customer level in an effort to protect the privacy of individual residents. Because the data is at the neighborhood level, it cannot be linked to an individual building, but it is still valuable to characterize neighborhoods. With this specific example, it would not make sense to attempt a market characterization with this type of secondary data source.

Understand Privacy and Data Sharing

Once primary and secondary data sources are established, the next step is to take stock of the privacy requirements associated with each dataset. If the goal of a market characterization is to ultimately share a data file with a broad audience, it is critical to ensure that subsidiary data sources can be widely shared. Some data

sharing agreements prevent such wholesale sharing of data, but allow sharing of manipulated or transformed data.

Consult Local Experts

Experts in housing, real estate, and energy policy can be invaluable partners in a market characterization study. They often have deep knowledge of the datasets available and the associated challenges. They can also assist with framing and communicating findings for various audiences. Advocates for affordable housing and experts in local housing markets, in particular, can provide context for working with the subset of affordable multifamily housing in a given market.

Use an Affordability Lens

An important step in conducting a market segmentation is understanding the community's subsidized multifamily housing and its role in the larger multifamily market. For its three analyses, EEFA and its partners segmented the market into subsidized, lower-cost unsubsidized, and market-rate housing. Lower-cost unsubsidized housing refers to housing located in low- or moderate-income neighborhoods but not associated with a subsidy. This category of housing can be sizable. In Chicago, for example, subsidized housing represents 17 percent of all multifamily units, while lower-cost unsubsidized housing represents 34 percent, or twice the number of units.[9]

Because cities are so different from one another, there is no universal method for characterizing the affordability of the local multifamily stock. Ideally, anonymized rent and mortgage cost information would inform this analysis but in the absence of such data, publicly available survey data provides a next best alternative for estimating the household income, ownership rates, and the percent of income devoted to housing costs.

Different agencies use different methods to calculate a household's income eligibility. The report authors recommend that researchers follow the lead of the local utility-based energy efficiency programs. Many utility-run programs use the Federal Poverty Guidelines (FPG) to determine low-income eligibility. It is instructive to also consult the Area Median Income (AMI), which is tied to the actual median income of the metropolitan area and reflects a larger share of the population than FPG. As an example, the table below shows the 2014 AMI for Chicago ($72,400) compared to the 2014 FPG ($23,850).

Table 1. Income Guidelines Used by Federal Agencies

Income Measure	Establishing Authority	Relevant Programs (selected)	Geography	Income Equivalent*	Low-Income Designation for a Census Tract	Low-Income Equivalent*
Area Median Income (AMI)	Department of Housing and Urban Development (HUD)	Housing Choice Voucher (Section 8), Local Housing Authorities	Metro Fair Market Rent Area	$72,400	At least ½ of households earn <=80% AMI	$57,920
Federal Poverty Guideline (FPG)	Department of Health and Human Services (HHS)	Head Start, Medicare, Supplemental Food and Nutrition (SNAP)	National	$23,850	At least 2/3 of households earn <=150% FPG	$35,775

*For a family of four in Chicago in 2014

3. Applications

Market segmentation analyses are being used in New York City, Chicago, and Los Angeles to design better energy efficiency programs for multifamily buildings. In New York City, two initiatives demonstrate how market segmentation can lead to targeted programs for multifamily building segments. Analyses in Chicago show how market segmentation can be applied to different building types. In Los Angeles, market segmentation holds promise in bringing together the data and stakeholders needed to launch an affordable multifamily efficiency program.

Building Energy Exchange

In its 2015 report, "Retrofitting Affordability," Building Energy Exchange (BEEx), an independent nonprofit resource center, used energy audit and benchmarking data in New York City to categorize more than 10,000 large, subsidized multifamily buildings into 12 segments according to age, height, and heating source. The authors identified the potential to save 11 percent in base building source energy via a variety of energy efficiency measures, 70 percent of which have a simple payback of less than 10 years, and 20 percent with a payback of three years.[10] BEEx also found that two categories of efficiency measures – domestic hot water and heating and distribution systems – would provide more than 50 percent of the projected energy savings. Given the low vacancy rate and high rental costs in New York City, the authors identified specific neighborhoods with the highest potential for savings in affordable multifamily buildings.

BEEx is currently working on a follow-up study, "Turning Data into Action," which adds a second year of data to the analysis and creates "tear sheets" for each building segment with the most relevant combination of energy conservation measures. The updated study also uses energy audit and benchmarking data to create a simple equipment replacement guide that will maximize savings in each building's lifecycle.

The Pratt Center

The Pratt Center (Pratt) at New York University completed a segmentation study of the multifamily housing sector and found that small multifamily buildings accounted for two-thirds of the city's building stock and 17 percent of its carbon dioxide emissions. Moreover, there are more than 100,000 small, brick, gas-heated buildings found in all five boroughs of New York. Despite the size of this market and its contribution to carbon dioxide emissions, efficiency upgrades in the buildings are rare, averaging just 12 per year.

In a pilot program, Pratt found that buildings with these characteristics needed the same retrofit measures, which removed the need for costly energy assessments. Based on this finding, Pratt researchers developed a standard energy retrofit package that is lower cost ($3,312) and has a higher savings-to-investment ratio (1.74) than typical retrofit programs.

A second phase of the Pratt study included implementation of the standard retrofit package in eight buildings. The researchers discovered that unforeseen circumstances, such as the need for basic carpentry work and logistical issues, added time and cost to the projects. Building owners were pleased with the retrofits, but the researchers found that charging owners a small fee to participate yielded the greatest engagement. In 2015, the New York City Council awarded funding to pilot Pratt's standardized approach more widely, which will help scale energy efficiency efforts in multifamily buildings across New York City.

Elevate Energy

In 2017, EEFA and Elevate Energy segmented Chicago's 143,000 multifamily buildings into 15 segments, according to age, size, ownership structure, and energy use.[2] The segmentation analysis revealed that 93 percent of the city's multifamily buildings fall into just three of the 15 segments. These segments had similar characteristics: they were constructed before World War II, were mostly unsubsidized lower-cost housing, and were relatively small in size.[11]

The research re-confirmed Elevate's multifamily efficiency approach. In 2007, Chicago's public, non-profit and for-profit sectors launched the Preservation Compact to address the loss of affordable rental housing in the Chicago area. Market characterization and segmentation research conducted by the Institute for Housing Studies at DePaul University at the time revealed that the affordable multifamily housing stock could be a potential niche market. Project partners quantified the size of this market, conducted geographic analyses, and used the data to craft a comprehensive energy efficiency program that met their goals to both preserve affordable housing and reduce energy costs. As of December 2016, the program has served more than 26,000 units in 632 buildings, reducing the typical multifamily building's energy use by nearly 30 percent. Most of the buildings retrofitted by Elevate are old, low-rise, and brick – one of the top three segments identified in the 2017 segmentation analysis.

The 2017 multifamily segmentation built upon a previous analysis of the single-family market in Cook County, Illinois.[12] The single family analysis categorized the market into 15 segments based on age, number of stories, and construction type, and it revealed that just six housing types comprised 71 percent of the single-family stock (650,000 homes). The analysis also estimated the electricity and gas savings potential through tailoring efficiency programs to the priority single family segments.

Los Angeles

As of early 2017, Elevate Energy is conducting a multifamily market segmentation in partnership with the Natural Resources Defense Council, Global Green USA, and the California Housing Partnership Corporation. The effort includes building up fragmented data sources to create an easily accessible database to characterize the multifamily stock, identify segments to target, and inform energy efficiency program design. In addition to developing a database of multifamily buildings, the researchers have engaged the city's utilities, affordable housing owners, and apartment associations needed to design and implement multifamily energy efficiency upgrades. The final report will include a recommended multifamily energy efficiency program design based on the quantitative and qualitative analyses.

4. Conclusion

Cities across the United States have ambitious goals to stem carbon dioxide pollution and avoid the worst impacts of climate change. Given its size, the multifamily market must be part of the solution. A market segmentation can help municipalities understand their markets and design better energy and water efficiency programs. Researchers have myriad data sources to leverage to create a picture of a community's multifamily building stock based on building characteristics, ownership structures, and energy use.

[2] Energy data was available for a small subset of buildings.

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This framework is a companion piece to a report on the Chicago multifamily market, “Segmenting Chicago Multifamily Housing to Improve Energy Efficiency Programs,” published by Elevate Energy and available at www.ElevateEnergy.org.

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