AFFORDABLE HOMES FIRST:
Advancing a Green New Deal for Los Angeles Renters

ENERGY EFFICIENCY FOR ALL

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ACKNOWLEDGEMENTS

This study was completed as part of Energy Efficiency for All (EEFA), a multistate initiative that works to make multifamily housing healthy and affordable through energy and water efficiency. EEFA provides technical expertise and coordination support to a national network and 12 state-based coalitions to increase investments in energy and water efficiency, and to support EEFA partners in their efforts to make the strongest possible case for efficiency investments in affordable housing. EEFA is cofounded by Elevate Energy, Energy Foundation, National Housing Trust, and the Natural Resources Defense Council (NRDC), with funding support from The JPB Foundation.

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This report is produced by Energy Efficiency for All (EEFA), a national initiative dedicated to advancing affordable and healthy clean energy in the historically underserved multifamily housing sector.

REPORT PARTNERS

The project team for this report includes the following organizations:

Global Green USA, the American affiliate of Green Cross International, is a national environmental nonprofit with more than 20 years of experience. Global Green works to create green cities, neighborhoods, affordable housing, and schools to protect environmental health, improve livability, and support our planet's natural systems; to address climate change and create resilient and sustainable communities.

The **California Housing Partnership Corporation (CHPC)** is a leader in helping preserve California's existing affordable homes through financial consulting, training, research, policy, and advocacy to ensure low-income Californians can live in homes that foster healthy, productive lives.

Elevate Energy is a nonprofit organization that designs and implements comprehensive energy- and water-efficiency programs in low-income communities. Elevate's mission is to help people do more with less energy.

The **Los Angeles Alliance for a New Economy (LAANE)** is a nationally recognized advocacy organization dedicated to building a new economy for all. Combining dynamic research, innovative public policy, and strategic organizing of broad alliances, LAANE promotes a new economic approach based on good jobs, thriving communities, and a healthy environment.

Optimal Energy provides energy-efficiency consulting services to investor- and municipally owned utilities, program administrators, state and federal energy offices, regulatory commissions, advisory councils, and advocacy groups. Optimal specializes in assessing, developing, designing, planning, and launching efficiency programs that effectively address the needs of all stakeholders in a cost-effective, balanced fashion.

BW Research Partnership is an applied research firm that provides data and analyses to support better investments, policies, and decisions. BW Research is focused on economic, workforce, customer, and community research, as well as strategic planning and evaluation services.

Los Angeles Housing + Community Investment Department (HCIDLA) is the city's agency that promotes a livable and prosperous Los Angeles through community engagement, the development and preservation of decent, safe, and affordable housing, neighborhood investment, and social services.

Association for Energy Affordability (AEA) provides energy-efficiency services for buildings, including green building design for new and existing construction, energy audits, modeling, and project work scope and specification development.

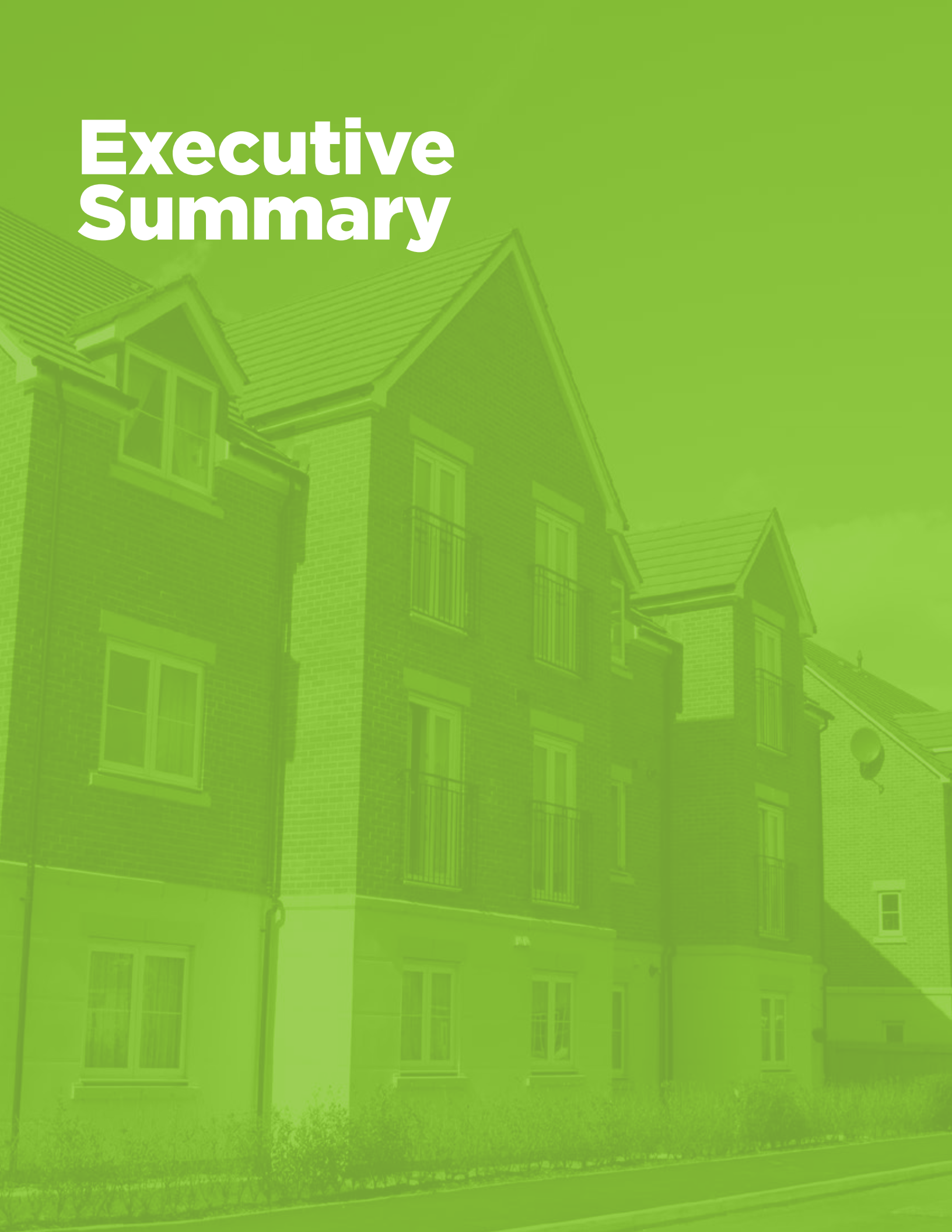
The **LA Energy Atlas**, a project of UCLA's Center for Sustainable Communities, provides the largest set of disaggregated energy data in the nation, which can be used to inform energy planning and research in Los Angeles and throughout California. The database connects address-level energy consumption to building characteristics and census information.

Natural Resources Defense Council (NRDC) is an international nonprofit environmental organization with more than 2.4 million members and online activists. Since 1970, its lawyers, scientists, and other environmental specialists have worked to protect the world's natural resources, public health, and the environment.

This report is supported by the EEFA Los Angeles coalition, which is committed to advancing holistic energy-efficiency solutions for underserved renters in Los Angeles. The coalition consists of LAANE, NRDC, CHPC, and Global Green, among others.

Table of Contents

Executive Summary



Los Angeles, which has made great strides in creating a clean energy economy, could be reducing energy use and greenhouse gas (GHG) emissions on a scale in line with meeting the Paris Climate Agreement targets if it more effectively made energy-efficiency programs available for low-income residents of multifamily buildings. By doing so, the city would not only further advance its efforts to stem climate-change but also make its buildings healthier and more affordable for one million of the city's most economically vulnerable renters.

and cost-effective, but also comes with meaningful economic and environmental benefits.

All of this could be accomplished by making an investment with a 200 percent return. That is, each dollar invested by the Los Angeles Department of Water and Power (LADWP) in its residential customers' efficiency programs through 2030 would result in savings worth two dollars in benefits, for example, from reduced supply-side investments and bill savings for Los Angeles residents.

Analyses commissioned by NRDC show the following significant benefits could be achieved through 2030:[1,2]

$68 MILLION IN ANNUAL UTILITY BILL SAVINGS for participating residents, an average annual savings of approximately $207 per participating household

Up to **300 GIGAWATT-HOURS (GWH) IN ELECTRICITY SAVINGS AND 22 MILLION THERMS IN GAS SAVINGS,** enough to fully power 50,000 households

22 PERCENT AVERAGE ELECTRICITY USAGE REDUCTION AND 25 PERCENT AVERAGE GAS USAGE REDUCTION PER HOUSEHOLD. This translates to savings of 1009 kilowatt-hours (kWh) and 56 therms per household in 2018[3]

220,000 METRIC TONS OF CARBON AVOIDED—comparable to the annual pollution from 42,000 passenger vehicles

3,000 FULL-TIME, HIGH-QUALITY JOBS installing energy-efficiency improvements

These renters are the hardest hit by California's housing crisis, pay the highest percentage of their incomes on energy bills, and are among the most vulnerable to climate-change related disasters, including more frequent and intense heat waves and wildfires.

This report finds that expanding effective programs to better serve this population not only is possible

And, these results could be achieved by an annual LADWP investment of $75 million through 2030**,** according to NRDC's conclusions from its commissioned analyses, shown in Appendix A.[4]

In addition to determining the potential for energy savings through programs targeted at lower-income, multifamily residences, this report assessed the barriers to reaching this full potential, and recommends strategies to fully realize it.

The principal barriers are:

- **Unnecessary Complexity:** LADWP's existing residential energy-efficiency programs have varied eligibility criteria, enrollment procedures, and points of contact. The types of improvements offered are often unsuitable for multifamily buildings, which makes it difficult for owners to understand their options and see the benefits that would otherwise drive participation.[5]
- **Underserved Customer Segment:** None of LADWP's efficiency programs were designed specifically for multifamily buildings using industry best practices. This has resulted in long-standing inequities and underinvestment in multifamily customers (property owners and their low-income tenants) compared with single-family homeowners and commercial and industrial customers.
- **Insufficient Commitment and Funding:** LADWP has no energy-efficiency target or dedicated budget for this sector and lacks the infrastructure to scale up multifamily programs that provide meaningful savings to tenants and owners. This stands in stark contrast to the fact that multifamily customers in two or more-unit complexes comprise 55 percent of LADWP's customers.[6]
- **Untimely Funding and Inflexibility:** Property owners have limited access to adequate and properly timed incentives; this can make programs offering piecemeal cost reimbursements, rebates or limited, prescriptive direct-install measures difficult or infeasible for many.

Recommendations

Achieving the potential GHG reductions and equity benefits outlined in this report necessitates action on two levels: the development of new resources and programs as well as of the associated funding, policies, and program infrastructure to ensure broad uptake. The following recommendations, developed from the studies, are meant to serve as a guide to policymakers in Los Angeles as well as at LADWP.

These new resources and programs are needed to complement existing programs:

1. LADWP should **expand the city's direct-install Home Energy Improvement Program** by creating a tailored offering for multifamily properties. To reach the scale needed, this program would need to expand the Utility Pre-Craft Trainees (UPCT) program and give priority to UPCT and unionized contracted workers performing as much work as possible.
2. LADWP should **develop a comprehensive, customized energy- and water-efficiency program that targets, but is not limited to, households in deed-restricted properties**. By developing a partnership with the California Department of Community Services and Development (CSD), LADWP could build on existing infrastructure established for the Low Income Weatherization Program.

3. The City of Los Angeles, in coordination with LADWP**, should develop a single outward-facing resource center or one-stop shop for its multifamily program offerings and support it with robust technical assistance and tailored outreach.** This resource center could be expanded from the Los Angeles Better Buildings Challenge services; however, the City of Los Angeles in coordination with LADWP should identify the appropriate entity.

To ensure these programs realize their maximum potential, this report recommends that LADWP and the City of Los Angeles provide robust funding, policies, and program infrastructure. These efforts should include the following:

4. **FUNDING: Meaningfully deploy LADWP's $100 million in affordable housing, energy-efficiency funding through 2023, followed by a stage two commitment for an additional $725 million in a seven-year program run from 2024 to 2030.** During the initial period through 2023, LADWP and the City of Los Angeles can address existing capacity and internal barriers while paving the way for a broader investment in workforce and infrastructure from 2024 to 2030. The funds should be applied to the three programs listed above and could be used only for electric energy saving and fuel-switching measures through LADWP or for a more comprehensive scope of implementation through a partnership with the CSD. Alternatively, in the short run, they could be shared with Southern California Gas Company to achieve efficiency in the use of natural gas.

5. **GOALS AND METRICS: Set ambitious program performance goals with transparent indicators of success. Specifically, the city in tandem with LADWP should commit to:**

   - Reducing actual energy use in all lower-income multifamily buildings by at least 20 percent by 2030[7]
   - Serving a minimum of 25,000 low-income households annually in order to benefit at least 275,000 low-income, rental households by 2030

- Creating inclusive and transparent public infrastructure, such as a low-income advisory board, and a detailed performance indicator report for the lower-income multifamily sector within LADWP's Equity Metrics Data Initiative

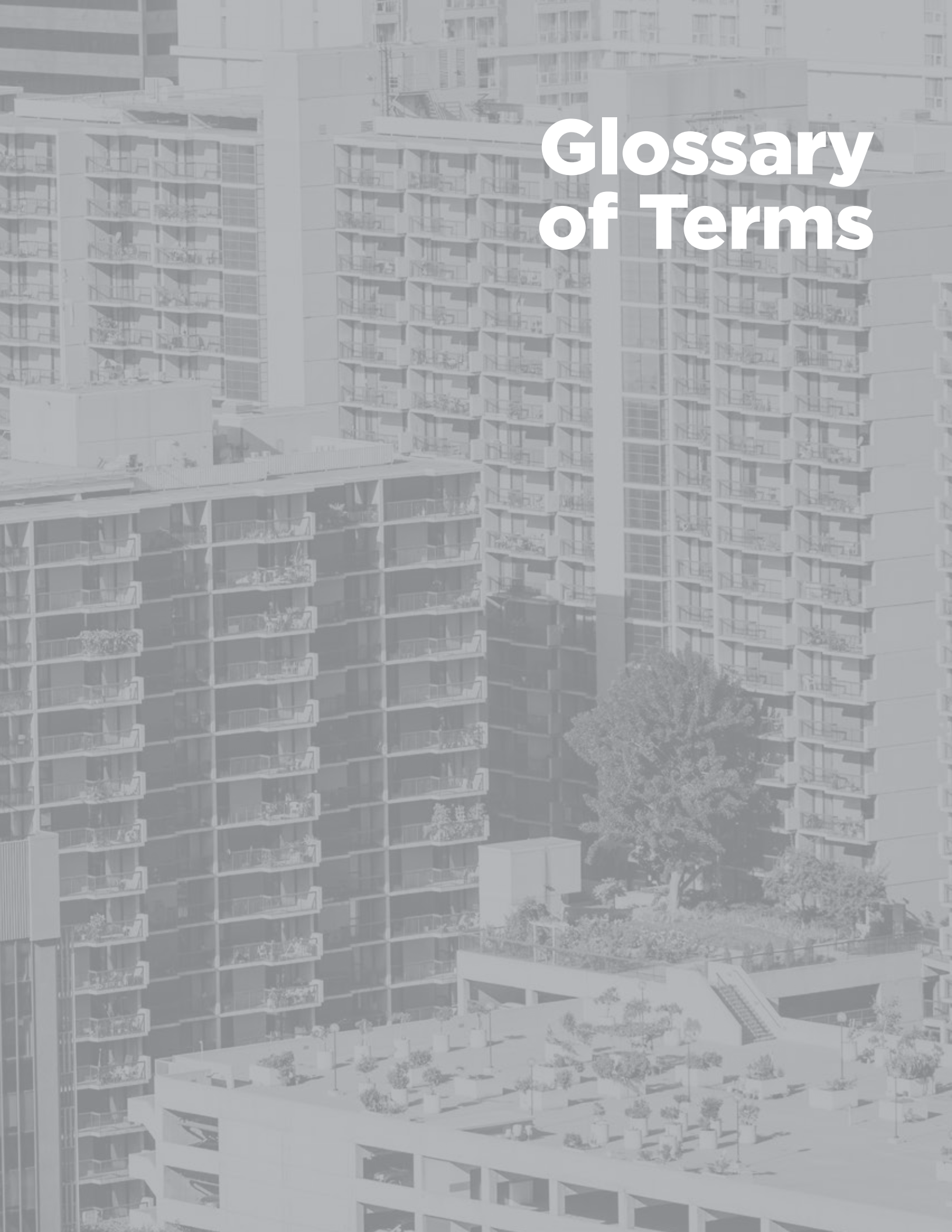
6 **PARTICIPATION AND CUSTOMER VALUE: Improve program access, participation, and value for owners, renters, and the local economy.**

LADWP should scale up program access and participation by:

- Providing robust technical assistance to affordable housing owners
- Augmenting LADWP's existing Community Partnership grants program for nonprofits and providing quality, multilingual community-based outreach
- Coordinating the timing of outreach for efficiency programs with Los Angeles' benchmarking ordinance (requiring properties over 10,000 square feet to report their energy usage to the city), seismic retrofits, tax credit renewals for affordable housing developments, and multifamily housing inspections through the Housing + Community Investment Department in Los Angeles
- Targeting outreach so that priority is given to investments in areas with the greatest energy burdens (the percentage of income spent on utility bills) and need, such as the San Fernando Valley and South Los Angeles
- Redesigning efficiency-program incentives and requirements to consider and minimize renters' risk of displacement during and following upgrades
- Encouraging programs to hire locally and pay contractors living wages
- Exploring opportunities to leverage financing and funding for health, safety, and climate resiliency building improvements. Possibilities may include partnering with community development financial institutions or programs such as the state's Transformative Climate Communities (TCC) and the California Air Resources Board's (CARB) Community Air Protection Program (CAPP).[8,9]

This report includes detailed energy analysis and economic models, and uses quantitative and qualitative research methods. In total, it outlines the scale of what's possible, why it's not happening today, and how LADWP and the city can achieve multiple benefits through adopting integrated approaches.

Policymakers at LADWP and the City of Los Angeles have an unprecedented opportunity to support smart energy-efficiency investments in the housing stock of its most vulnerable renters, and to realize broad environmental and economic benefits for all its customers and residents in return.



Glossary of Terms

Affordable Housing

In this report, we generally use "affordable housing" to mean both housing that is subsidized and that which is naturally occurring (housing that is accessible to low-income Angelenos without subsidies).

Deed-Restricted Property

This refers to government-subsidized multifamily rental housing where rents are restricted according to the terms of affordable housing financing or land-use concessions (e.g., density bonuses) under one or more programs. In this report, we refer to such properties as "deed restricted" because rent restrictions are transferred from one owner to another through a property's deed. A deed for such a property is used to enforce affordability restrictions or related conditions, and is required when various government subsidies or land-use concessions are part of the development process. Deed-restricted properties include housing funded through the federal and state Low-Income Housing Tax Credit programs; tax-exempt mortgage revenue bonds through federal private activity bond resources; residual receipt loans; and grants or rental assistance through federal, state, or local government subsidy programs. They also include properties operated by public housing authorities as well as those which have received various land-use concessions, such as density bonuses.

Disadvantaged Communities (DACs)

These are areas throughout California that are most affected by economic, health, and environmental risks. For the purposes of this report, disadvantaged communities are defined by the California Environmental Protection Agency pursuant to Senate Bill 535 (K. de León, 2012), using the California Communities Environmental Health Screening Tool (CalEnviroScreen).[10] DACs are identified by census tracts and are those that have scored at or above the 75th percentile in the CalEnviroScreen rankings.

Large Multifamily Properties

The American Community Survey splits its data into 5–49 units and 50 or more units, defining the 50-or-more unit properties as large properties. The Housing + Community Investment Department of Los Angeles (HCIDLA) defines large properties as those with more than 25 units. The LA Energy Atlas defines large multifamily properties as buildings that are larger than 20,000 square feet. This report identifies which definition is being used in any given context.

Low-Income Housing Tax Credit (LIHTC)

Developers must apply to state housing finance agencies to obtain LIHTCs, and at least 10 percent of credits must go to housing developed by nonprofit organizations. The tax credit is based on a project's development costs less the costs of land acquisition, marketing, and financing. The annual credit is determined by multiplying this adjusted qualified basis by 9 percent or 4 percent. (Actual rates vary slightly each month since they are calculated by the U.S. Treasury.) The application process for 9 percent credits is competitive while obtaining 4 percent credits is much easier and these credits are often combined with tax-exempt mortgage revenue bond financing. Investors receive the tax credits for ten consecutive years.

Multifamily Affordable Housing

For this report, "multifamily affordable housing" generally refers to buildings with five or more units that are subsidized by federal or state programs.

Market-Rate Housing

"Market rate" is a broad term referring to rental units that do not receive government rental subsidies. This encompasses some of the city's most luxurious units, but also those that have lower rents as a result of being in communities where the average median income (AMI) is 80 percent or less of average median income. For this reason, market-rate units and properties are defined as "market rate higher-cost housing" and "unsubsidized lower-cost housing." This study's analysis covers unsubsidized low-rent housing as well as deed-restricted affordable housing.

Multifamily Housing

For this report, this is a residential building that has five or more units. It includes deed-restricted or government-subsidized housing and market-rate housing. Other definitions of multifamily housing are broader and include smaller properties of two to four units.

Neighborhood

Also referred to as communities, "neighborhoods" are recognizable geographical units within a larger jurisdiction. There are 143 neighborhoods in the City of Los Angeles.

Resyndication

This describes the process for an existing LIHTC, deed-restricted property to reapply for and obtain a new allocation of tax credits to pay for major improvements. Under current LIHTC regulations, all new housing must remain affordable for at least 55 years. A private equity investor is in the deal for the first 15 years, known as the initial compliance period. Once this 15-year window expires, building owners usually resyndicate. By the time a LIHTC property is resyndicated, appliances and major systems are usually worn and out of date.

Section 8 Rental Assistance Programs

There are two types of Section 8 rental assistance. The version most familiar to the general public is tenant-based assistance, now known as the Housing Choice Voucher. Participants find their own housing to rent in the open market and pay a portion of their income toward rent. The local housing authority contracts with the owner and subsidizes the balance of the monthly rent in direct payments to the owner. If tenants move, they can take their vouchers with them to other rental units, which is why the subsidy is called "tenant-based." The Housing Authority of the City of Los Angeles administers this program in the city and there are tens of thousands of households on the waiting list for vouchers. The other type of Section 8 rental assistance is "project-based." This assistance is tied to housing units at a particular development; if a tenant moves out of one of these units, the next one to move in will benefit from the same type of assistance. This type of assistance has often been provided for older Federal Housing Administration-insured affordable housing developed in the 1960s and later.

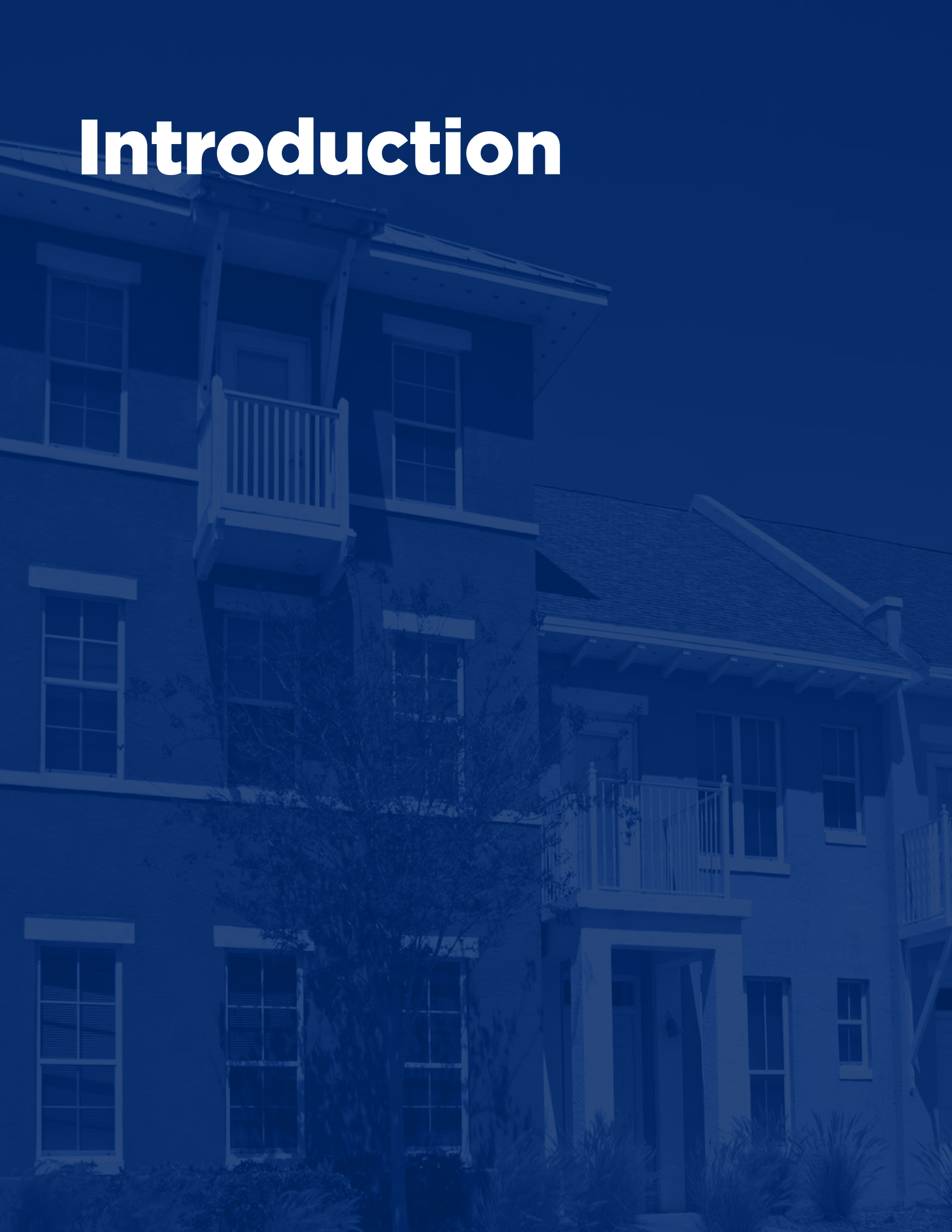
Small Multifamily Properties

The American Community Survey splits its data into 5– 49 units and 50 or more units, defining the 5–49 unit properties as small properties. HCIDLA defines small properties as those with less than 25 units. The LA Energy Atlas defines small multifamily properties as buildings that are less than 5,000 square feet. CoStar, an information and marketing services provider to the commercial and multifamily real estate industry, defines smaller multifamily properties as those with fewer than 20 units. This report identifies which definition is being used in any given context.

Syndication

Developers rarely use LIHTCs themselves; instead they sell these credits to private investors, usually with the help of syndicators. Syndication allows developers to obtain capital upfront for developing property, while investors retain limited partnership interests in the property and benefit from the LIHTCs.

Introduction



The Intergovernmental Panel on Climate Change (IPCC) recently concluded that if our fossil fuel dependent systems are not drastically overhauled so as to reduce greenhouse gas (GHG) emissions by 40 percent from 2010 levels by 2030, the consequences will be irreversible.[11] California is already bearing a high cost from global warming and will experience increasingly extreme climate hazards, from sea level rise to an increase in wildfires, if emissions are not immediately curbed.[12]

In order for California to combat these trends, all of its cities must uphold the climate commitments outlined in Senate Bill (SB) 100 (K. de León, 2018) and Executive Order (EO) B-55-18 (E. Brown Jr., 2018). SB 100 establishes a 100 percent clean electricity requirement for the state and EO B-55-18 creates a target to achieve carbon neutrality—both by 2045. Clean generation of the energy California consumes, more efficient use of energy, and decarbonizing the state's buildings are among the most urgent steps needed to avoid the worst impacts of climate change and to keep global temperature increases below 2 degrees Celsius.[13]

While Los Angeles has been a leader in improving energy efficiency, it can, and must, do even better if it is to reach its climate goals. Improving energy efficiency is a critical component of achieving these goals, and the city has demonstrated its commitment to doing so by setting itself the goal of reducing by 30 percent the energy usage in its buildings by 2035.[14]

One of the most effective ways Los Angeles can improve energy efficiency—and simultaneously make housing more affordable, more comfortable, and healthier for lower-income residents—is to improve its energy-efficiency programs for lower-income multifamily buildings. Such a strategy has this powerful two-pronged impact because lower-income renters are likely to both pay a disproportionately large share of their income for energy-related expenses and live in some of the least energy-efficient housing.[15]

Based on these studies, which are fully outlined in Appendix A, the benefits that would pay for themselves through 2030 include:[16]

$68 MILLION IN ANNUAL UTILITY BILL SAVINGS for participating residents, an average annual savings of approximately $207 per participating household

Up to **300 GIGAWATT-HOURS (GWH) IN ELECTRICITY SAVINGS AND 22 MILLION THERMS IN GAS SAVINGS,** enough to fully power 50,000 households

22 PERCENT AVERAGE ELECTRICITY USAGE REDUCTION AND 25 PERCENT AVERAGE GAS USAGE REDUCTION PER HOUSEHOLD. This translates to savings of 1009 kilowatt-hours (kWh) and 56 therms per household in 2018[3]

220,000 METRIC TONS OF CARBON AVOIDED—comparable to the annual pollution from 42,000 passenger vehicles

3,000 FULL-TIME, HIGH-QUALITY JOBS installing energy-efficiency improvements

Focus of This Report

This report describes the potential for energy savings through comprehensive energy-efficiency upgrades in lower-income multifamily housing. It further explains the co-benefits that can be derived from these energy saving measures. It then details the challenges confronting Los Angeles in realizing that potential and presents recommendations on how those obstacles could be overcome. The report's findings are based on research commissioned by NRDC and conducted by Optimal Energy and BW Research Partnership.

The high end of the potential savings—300 GWh of electricity and 22 million therms of natural gas – are what Optimal Energy calls the *available economic potential*, the cost-effective potential possible if programs are designed to maximize energy savings based on LADWP's cost-benefit methodology.

The study also identified the least costly measures that have the greatest potential for energy savings. For electricity savings, the top three are:

- LED lighting, including standard LED (in-unit) and specialty lighting (in-unit)
- Installing high-efficiency Common-area laundry measures (washers and dryers)
- WiFi thermostats to manage heating and cooling systems

The three least costly measures with the greatest potential for natural gas savings are:

- Water heater pipe wrap
- Demand controls for domestic hot water (DHW) recirculation pumps
- Retrocommissioning, including HVAC controls[18]

To facilitate removing GHG emissions from buildings, the study also recommended these measures be considered for inclusion in holistic upgrades, packaged with measures that are guaranteed to reduce energy bills:

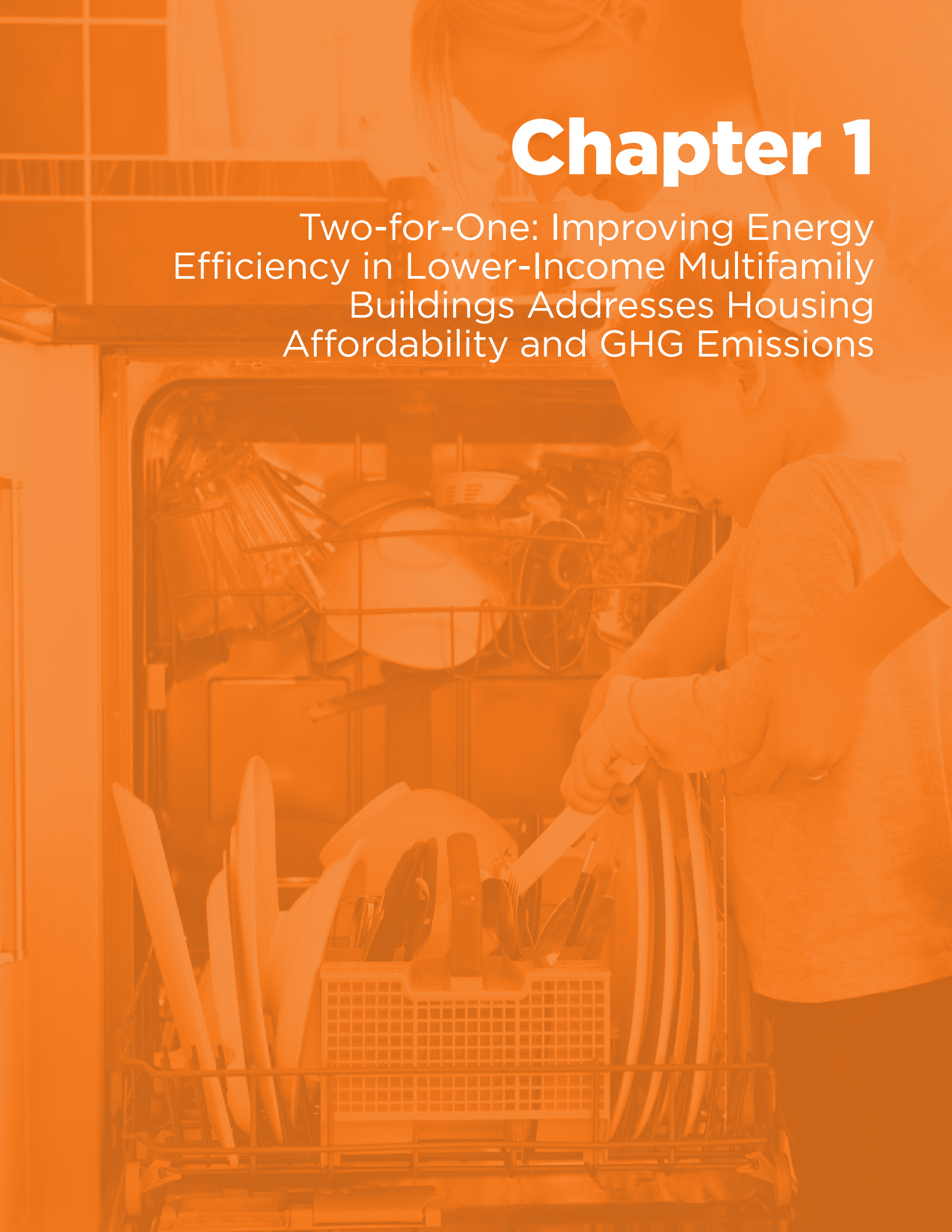
- Heat-pump water heaters, in-unit and central system
- Air-source heat pump—for in-unit air conditioning

Chapter 1 describes Los Angeles' housing crisis and how tackling energy efficiency in lower-income multifamily buildings can simultaneously help to reduce GHG emissions and alleviate the affordable housing crisis as well as provide other benefits for lower-income residents.

Chapter 2 describes the various barriers to improving the energy efficiency of lower-income multifamily residences.

Chapter 3 includes recommendations for how these obstacles can be overcome.

The appendices provide in-depth explanations of the methodology used in the studies that support the report's findings. There is also an analysis of Los Angeles' housing and neighborhood characteristics to support targeted outreach and program design. This analysis also informs a catalogue of existing programs, their limitations, and recommended strategies for improvement.



Chapter 1

Two-for-One: Improving Energy Efficiency in Lower-Income Multifamily Buildings Addresses Housing Affordability and GHG Emissions

Los Angeles faces both a climate crisis and an affordable housing crisis. This chapter describes the linkages between these two crises and establishes that a significant effort to improve energy efficiency in lower-income affordable housing can address both these challenges while also producing co-benefits in the form of job creation.[19]

Los Angeles' Housing Crisis Is Driving Homelessness and Displacement

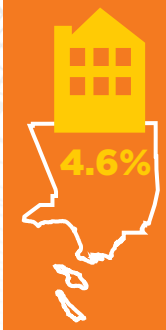
Los Angeles is one of the least affordable housing markets in the country. (Affordability here is measured by comparing median rents to median incomes.) In the city as of 2018, the average rent accounts for 41 percent of the median household income, and in 2017 rents climbed by 5.7 percent, a rate second only to San Francisco.[20]

As a result of the affordability crisis, Los Angeles is also facing an unparalleled homelessness crisis. The number of homeless people in the city surged 75 percent over the past six year—from 2010 to 2017.[21] Existing affordable housing is also in danger of becoming scarcer than it already is. A recent California Housing Partnership Corporation (CPHC) report found that 11,400 units of multifamily affordable housing are currently at risk of being converted to market-rate properties over the next five years as federal contracts for rental subsidies expire.[22] In addition, privately owned buildings subject to Los Angeles' rent control ordinance in many areas are being converted to condos or substantially increasing rents when long-term tenants move or are evicted.

Energy Insecurity Is Integral to the Housing Crisis

The affordability crisis in Los Angeles is inextricably linked to energy insecurity. Low-income families who can't afford the rising price of housing also struggle with the cost of utilities.

With rents for high-quality new construction out of reach for lower-income families, paying affordable rents often means settling for substandard and unhealthy housing. The homes and apartments of low-income Angelenos are predominantly old and energy and water inefficient. In fact, most households that earn less than 80 percent of the area median family income are in the most energy intensive neighborhoods in Los Angeles.



Los Angeles area lower-income residents spent an average of 4.6 percent of their income on energy, with 25 percent spending as high as 8 percent or more of their income on energy; the city average, by comparison, is 2.8 percent.[23] In 2018, utility disconnections in California were at a rate unseen since 2009, during the Great Recession.[24]

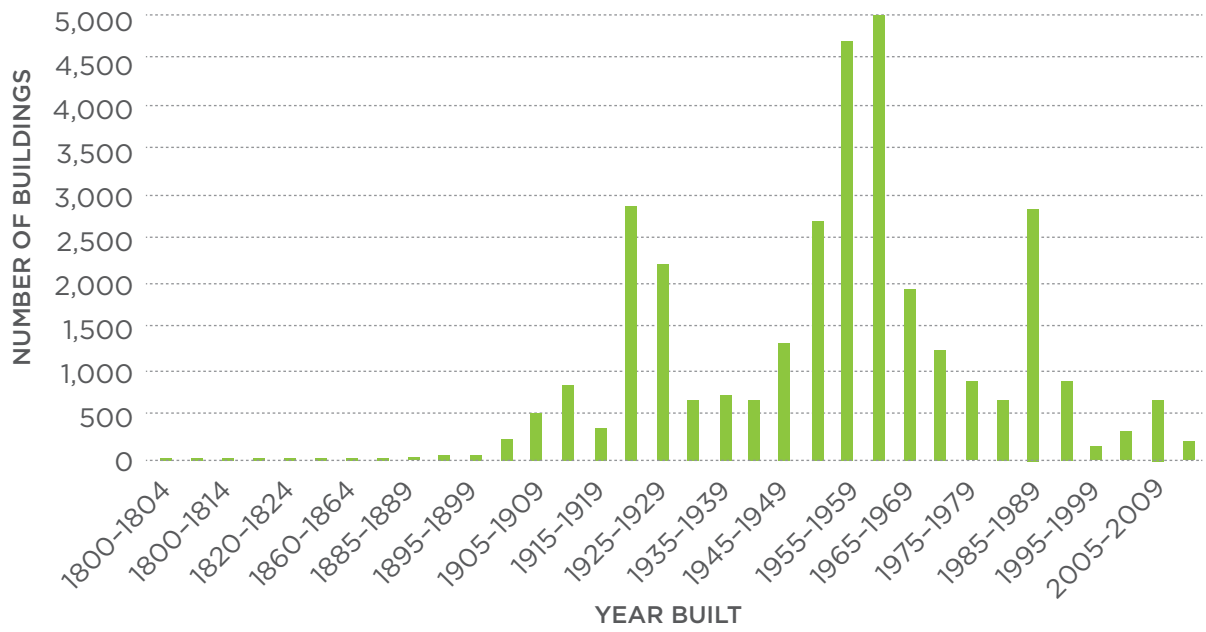
A 2018 study by The Utility Reform Network (TURN) found that utility shutoffs may be a hidden driver of housing displacement; as of 2017 one of ten California customers who have service disconnected are never reconnected, suggesting that occupants left and never returned.[25] This figure is even higher (31 percent) for Southern California Gas Company (SoCalGas) customers in the area we looked at. Maintaining a utility service connection can be a requirement for some subsidized housing programs, so loss of utility service may even become grounds for eviction.[26] The high price of utilities therefore, in some cases, contributes to displacement of vulnerable Angelenos.

Energy Consumption in Los Angeles' Housing Stock Increases GHG Emissions and other Criteria Air Pollutants

Multifamily buildings in Los Angeles are responsible for 16 percent of overall energy usage in the city.[27] The vast majority of multifamily buildings in Los Angeles (82 percent) were built before 1978, when energy codes were first implemented, as shown in Figure 1, and account for more than half (55 percent) of all multifamily energy use in the city, with particularly high gas consumption as compared to buildings built after 1978.[28] Therefore, targeting these buildings can result in significant greenhouse gas savings.

Of those multifamily properties, 61 percent are occupied by lower-income households who earn less than 80 percent of the area median income (AMI).[29] Further, most low-income households are located in the city's highest energy intensive neighborhoods—those with the greatest energy usage per square

FIGURE 1: NUMBER OF LOW-INCOME MULTIFAMILY BUILDINGS WITH GREATER THAN 5 UNITS IN LOS ANGELES, GROUPED BY DATE OF CONSTRUCTION INTO 5-YEAR PERIODS. SMALL, MEDIUM, AND LARGE BUILDINGS ARE INCLUDED. (LA ENERGY ATLAS, 2015)



foot—with concentrations in the San Fernando Valley and South Los Angeles.

As a result, addressing energy and water efficiency in these properties can have a meaningful impact on reducing Los Angeles' GHG emissions as well as on the well-being of these residents.

In addition, since clean energy is the fastest growing sector in America's workforce, and energy efficiency is the basis for most of the good-paying, high road jobs in the clean-energy sector, energy efficiency investments to upgrade low-income housing can also result in more jobs for Angelenos.[30,31]

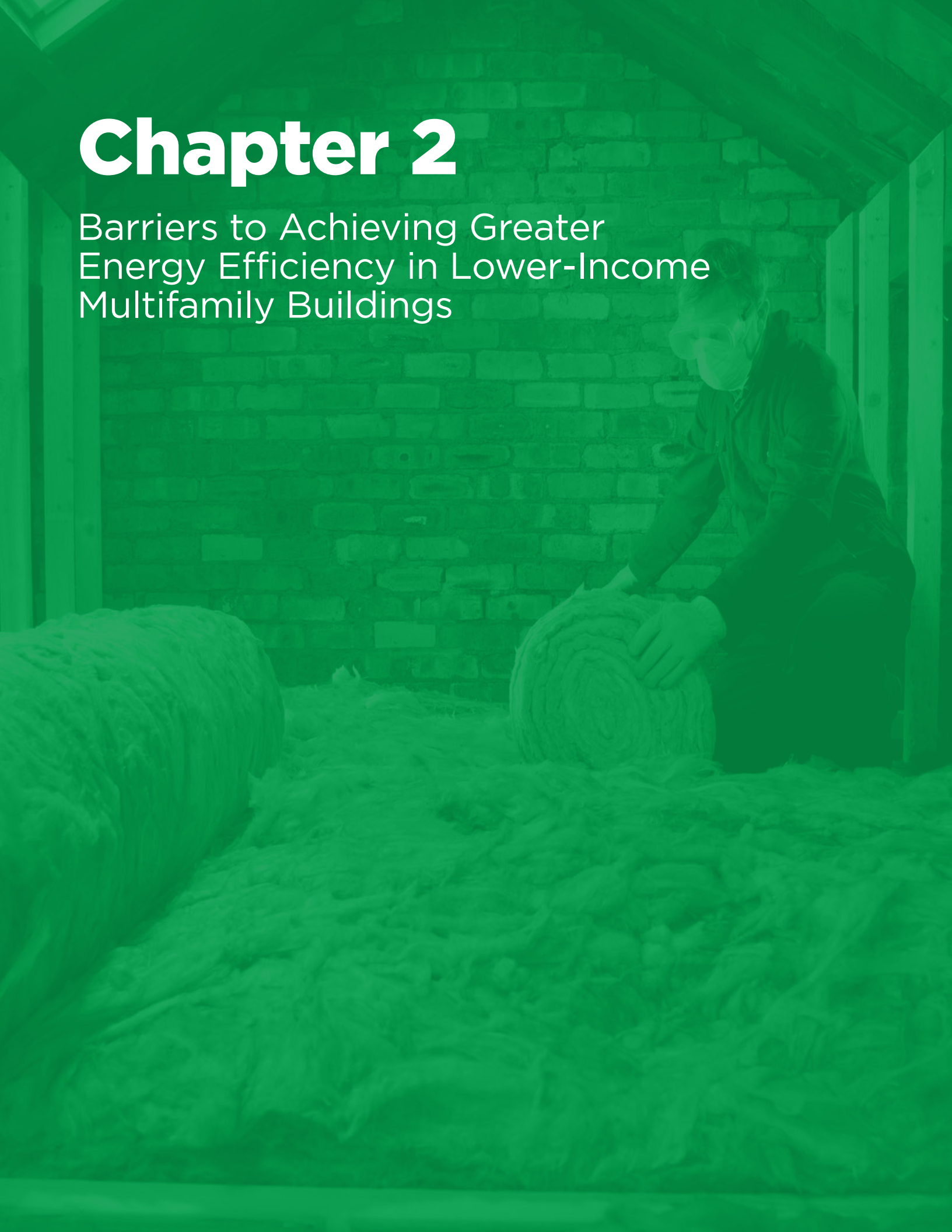
Investing in Holistic and Accessible Multifamily Programs Will Reduce Bills, Create Jobs, and Lower Greenhouse Gas Emissions and Criteria Air Pollutants

Los Angeles recognizes the need to upgrade the city's buildings and to center the economy and equity in the process. The city's first-ever sustainability plan, launched in 2015, has the goal of transforming Los Angeles into a global leader in the environment, economy, and equity and set time-bound objectives to do so. For example, the Mayor's plan sets these energy-efficiency targets:

- **Energy Use:** Reduce energy use per square foot below 2013 baseline—for all building types—by at least 14 percent by 2025 and 30 percent by 2035.
- **Energy Efficiency:** Use energy efficiency to provide 15 percent of all of the city's projected electricity needs by 2020 through rebates, incentives, education, and other strategies.[32]

In 2018, the city took further steps to reduce the GHG consumption of its buildings, passing a resolution to establish aggressive 2028 and 2038 building electrification targets for existing and new development which would put the City on track to meet or exceed its climate goals, including that of reducing GHG emissions by 60 percent before 2035.[33]

This report examines how focusing on the city's low-income multifamily housing stock can be a key driver to meeting the city's energy and environmental goals, and makes the case that the city should focus on this housing stock in its efforts.



Chapter 2

Barriers to Achieving Greater Energy Efficiency in Lower-Income Multifamily Buildings

There are 40 ongoing efficiency, renewables, and health and safety programs and policies that affect the multifamily sector in Los Angeles as of the writing of this report. This includes 27 utility incentive programs and 13 programs and policies administered by federal, state, and city agencies. In addition, there are three partial financing options. See Appendix C for a detailed description of these programs.

Many of the programs currently available, however, do not reach the multifamily sector or low-income populations specifically or holistically. Because most are not intentionally designed to address the needs of multifamily buildings, and in particular those of the low-income multifamily sector, there is low utilization of these programs in this market segment. This mismatch of programs and need has meant that it has been a challenge for owners to obtain enough capital to make a transformational change in the efficiency of affordable housing in Los Angeles.

The barriers that exist range from split incentives between building owners and residents (whereby owners do not receive utility bill savings from efficiency investments in residents' units) to financial constraints on owners, according to research done for this report.[34]

Although there are a significant number of programs available to multifamily properties, most do not target the affordable multifamily market as a unique property and owner type in a comprehensive and effective way. Instead, the programs are fragmented and have limited resources, creating confusion and lack of participation from this sector.

Affordable Multifamily Owners' Financial Restrictions, Split or Shared Savings Circumstances, and Mismatched Timelines Prevent Uptake of Energy-Efficiency Programs

Multifamily housing owners experience financial constraints that prevent their implementation of energy-efficiency upgrades. Most multifamily affordable housing owners are not able to take on additional debt of any kind, including through the county's Property Assessed Clean Energy program (PACE), because of established funding agreements among multiple governmental and financial entities. Both for-profit and nonprofit owners often have limited access to working capital, which makes programs with retroactive rebates difficult or unfeasible.[35] There are also limits to the amount of owner staff time and technical expertise that can be devoted to implementing efficiency projects.

In addition to financial limitations, the restrictions on how owner's operational cost savings are split or

shared with residents or investors affects owners' interest in energy-efficiency upgrades. Many buildings are individually metered for electricity and gas so that any savings from upgrades in the dwelling units would flow to the residents and not to the owner making the investment in the energy upgrades. If affordable housing owners are able to realize operating savings, they often share them with existing project public lenders through residual receipts, which often results in the owner keeping less than half of generated savings.[36]

After approximately 15 years in operation, some subsidized affordable developments may have the option to conduct a major rehabilitation as part of a resyndication project, which involves reapplying for federal Low-Income Housing Tax Credits (LIHTC). But, in many cases, the consideration of energy and water upgrades does not take place early enough (ideally at year 13 or 14 of operation, which is 1-2 years before the official refinancing) to be fully integrated into rehabilitation planning and the budgeting process for resyndication. In addition, projects implemented on multifamily properties can take up to 18 months to be approved and completed. Therefore, programs with short time frames or those that do not target the owners during this unique window tend to be overlooked.

Full Participation by the Multifamily Market Is Hindered by Programmatic Design

LADWP funds more than half of the utility programs currently available to multifamily owners in Los Angeles.[37] As a result, owners have more exposure to LADWP programs than other state or utility efficiency programs. The feedback collected from these owners exposed program design issues that hinder their participation.

First, direct-install programs are largely preferred to projects requiring upfront investment or additional resources and capacity, such as project management. Direct-install programs do not require customers to pay up-front fees; low-income customers often are unable to afford the up-front costs required in rebates.

Some programs that benefit residents of multifamily affordable housing require that applications be

submitted by tenants, even though the equipment is owned by the property owner.

Owners who worked through custom programs noted that energy audits don't come with specifications to put out to bid, financing models to pursue, or case studies that can indicate likely savings. One owner said, "We need somebody to tell us how to prioritize the list of projects from energy audits based on predictability of savings and effort needed."

Given that the primary source of information for individual measure-based programs is trade allies—contractors who have an affiliation with LADWP but are not certified or endorsed by the utility––and not LADWP or other utility representatives, information can be inaccurate regarding the process, amount of rebates, or what aspects of an upgrade are, or are not, covered by rebates.

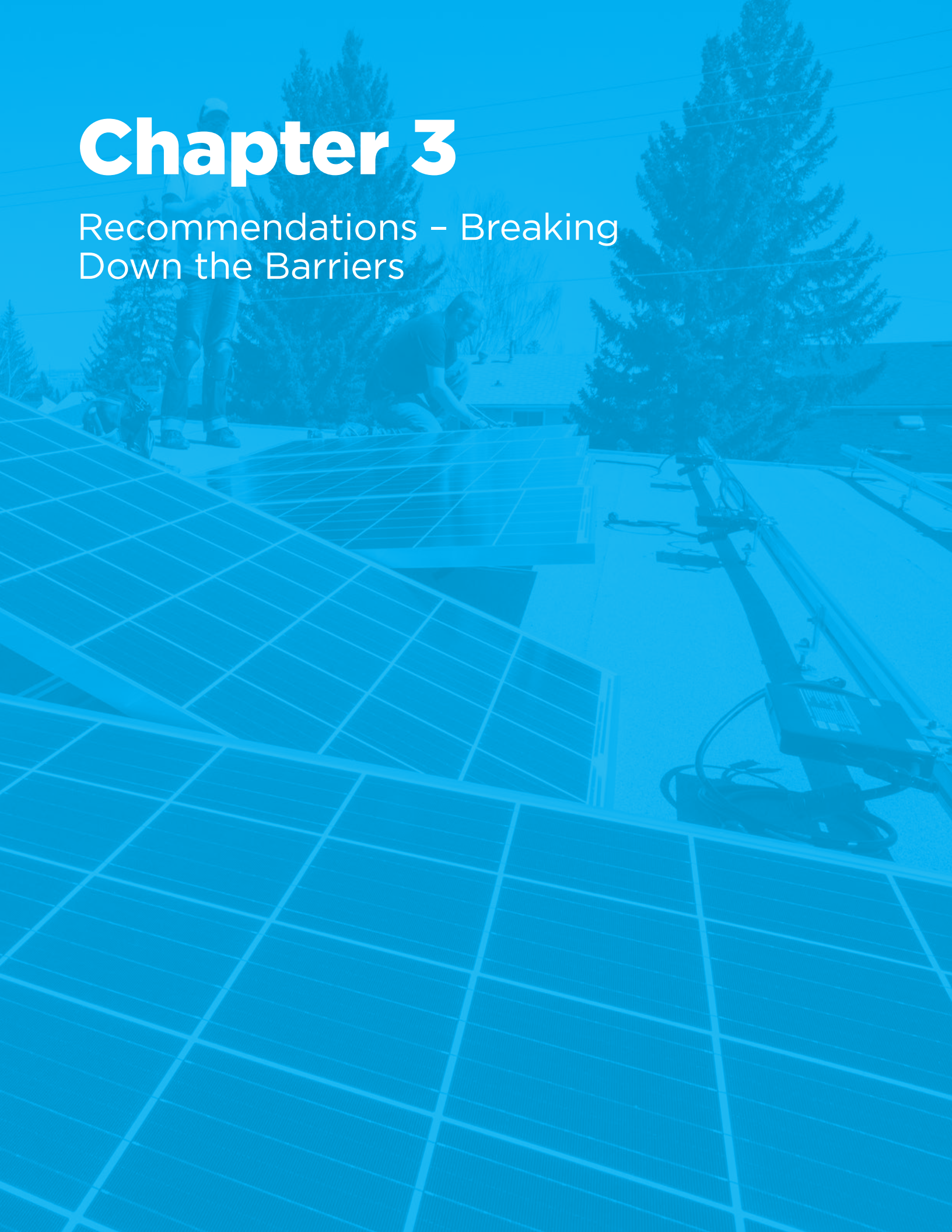
Furthermore, LADWP does not guarantee or insure its trade allies, imposing the responsibility for liability and vetting on building owners. It is also unclear if these trade allies are approved by, or partner with, LADWP for quality assurance, as work is inconsistent. These program aspects not only leave owners with the responsibility of remediating poor quality work, but also leave them with no ability to recover the costs associated with this additional work.

Utility Programs Are Fragmented, Unreliable, and Do Not Justify Multifamily Owners' Investment

LADWP's and SoCalGas' direct-install, prescriptive, and custom rebate programs are offered to multifamily owners with the goal of reducing energy and water use and costs. Although the number of programs available is quite high compared with those of other jurisdictions, not many of the programs are specific to multifamily, much less affordable multifamily. This creates barriers for the affordable multifamily sector to participate, including the following:

- Fragmented programs cause significant administrative burden on owners.
  - Varied eligibility criteria, enrollment procedures, and improvements offered (many of which are often unsuitable for multifamily buildings) make it difficult for owners to understand their options and see the benefits, deterring them from participation.
  - Several programs' enrollment procedures are tenant driven, and thus are burdensome, if not impossible, for owners to coordinate. Small-appliance rebate programs are particularly hard to manage. Although the energy savings and value to tenants might be great, owners find it challenging to manage separate applications for each unit or appliance.
- LADWP's lack of recognition of affordable multifamily housing as a unique property type leads to an underserved market, especially for whole-building energy retrofits.
  - Without sufficient incentives, owners of individually metered buildings cannot justify investing in capital improvements if they cannot recover savings from reduced energy use. This phenomenon is known as the split incentive.
  - Without sufficient incentives, owners of master-metered buildings cannot recover their investments because regulatory agreements (in the case of subsidized affordable housing) and rent restrictions (for those properties covered by Los Angeles' rent stabilization ordinance) prevent that option, unless the owners undertake energy improvements under larger rehabilitation or refinancing projects.
  - One owner noted, "If there was a list of programs and case studies, I would come into the resyndication with a different mindset…"

For additional information on barriers in existing programs, see Appendix C.



Chapter 3

Recommendations – Breaking Down the Barriers

In order to take advantage of the significant energy savings opportunities that exist through making low-income multifamily buildings more energy efficient, action must be taken at two levels: the development of new resources and programs as well as the provision of robust funding, policies, and enhanced program design to ensure broad uptake. While some existing programs can be expanded or adapted to meet the need, the current array of efficiency programs and policies are not flexible enough to fully, or even adequately, serve this complex market. The following recommendations, developed from the findings of the study, are meant to serve as a guide to policymakers in Los Angeles as well as at LADWP.

Key Recommendations

These new resources and programs are needed to complement existing programs:

1. LADWP should **expand the Home Energy Improvement Program (HEIP), the city's direct-install program,** by creating a tailored offering for multifamily properties. To reach the scale needed, this program would need to expand the Utility Pre-Craft Trainees (UPCT) program and give UPCT and unionized contract workers top priority for performing work.

2. LADWP should **develop a comprehensive, customized energy and water-efficiency program that targets, but is not limited to, households in deed-restricted properties**. By developing a partnership with the California Department of Community Services and Development (CSD), LADWP could build on existing infrastructure established for the Low Income Weatherization Program.

3. The City of Los Angeles, in coordination with LADWP**, should develop a single outward-facing resource center or one-stop shop for its multifamily program offerings and support it with robust technical assistance and tailored outreach.** This resource center could be expanded from the Los Angeles Better Buildings Challenge services; however, the City of Los Angeles in coordination with LADWP should identify the appropriate entity.

To ensure these programs realize their maximum potential, this report recommends that LADWP and the City of Los Angeles provide robust funding, policies, and program infrastructure to ensure broad uptake, including:

4. **FUNDING: Meaningfully deploy LADWP's $100 million in affordable housing energy-efficiency funding through 2023, followed by a stage-two commitment for an additional $725 million in a seven-year program run from 2024 to 2030.** During the initial period through 2023, LADWP and the City of Los Angeles can solve existing capacity and internal barriers while paving the way for a broader investment in workforce and infrastructure from 2024 to 2030. The funds should be applied to the three programs listed above. They could be used only for electric energy saving and fuel-switching measures through LADWP or for a more comprehensive scope through a partnership with CSD. Alternatively, in the short term, they could be shared with SoCalGas to achieve efficiency in the use of natural gas.

5. **GOALS AND METRICS: Set ambitious program performance goals with transparent indicators of success. Specifically, the city in tandem with LADWP should commit to:**

- Reducing actual energy use in all lower-income multifamily buildings by at least 20 percent by 2030[38]
- Serving a minimum of 25,000 lower-income households annually in order to benefit at least 275,000 lower-income rental households by 2030
- Creating inclusive and transparent public infrastructure, such as stakeholder groups or a low-income advisory board, and a detailed performance indicator report for the lower-income multifamily sector within LADWP's Equity Metrics Data Initiative

6 **PARTICIPATION AND CUSTOMER VALUE: Improve program access, participation, and value for owners, renters, and the local economy. LADWP should increase program access and participation by:**

- Providing robust technical assistance to affordable housing owners
- Augmenting LADWP's existing Community Partnership grants program for nonprofits and providing quality, multilingual community-based outreach
- Coordinating the timing of outreach for efficiency programs with Los Angeles' benchmarking ordinance (requiring properties of more than 10,000 square foot to report their energy usage to the city), seismic retrofits, tax credit renewals for affordable housing developments, and multifamily housing inspections through the Housing + Community Investment Department in Los Angeles (HCIDLA)
- Targeting outreach so that priority is given to investments in areas with the greatest energy burdens (the percentage of income spent on utility bills) and need, such as the San Fernando Valley and South Los Angeles
- Redesigning efficiency-program incentives and requirements to consider and minimize renters' risk of displacement during and following upgrades
- Encouraging programs to hire locally and pay contractors living wages
- Exploring opportunities to leverage financing and funding for health, safety, and climate resiliency building improvements. Possibilities may include partnering with Community development financial institutions (CDFI) or programs such as the state's Transformative Climate Communities and the California Air Resources Board's Community Air Protection Program.

Detailed Recommendations – New Resources and Programs

1. HEIP

LADWP should expand HEIP, the city's direct-install program, by creating a tailored offering for multifamily properties. To reach the scale needed, this program would need to expand the UPCT program and give UPCT and unionized contract workers top priority for performing work.

HEIP is an LADWP program aimed at reducing customer energy and water usage. HEIP does an assessment of a home or residential building, identifies potential improvements, and of those, it will make the following: building envelope (weather strip and insulate attic); air conditioning replacement; LED lighting installation; toilets, showerhead and sink aerator replacements; carbon monoxide detector installation; and gas leak testing. Customers are often referred to other LADWP direct-installation programs, such as the AC Optimization and Refrigerator Exchange programs, to maximize energy savings. Direct installations are offered at no cost to customers.

LADWP targets but does not limit HEIP participation to low-, moderate-, and fixed-income households. Single-family households comprise the majority of the households served.

TABLE 1: HEIP Program Overview. Data provided by LADWP's Energy Efficiency Director and the California Department of Water Resources

Number of Households	GWh Savings FY 16–17	Job Years Created	Program Budget FY 16–17
P200 per month (totaling 6,000 between July 2015 and December 2017)	34	41	$7

BARRIERS: Technically, multifamily residents are eligible to receive HEIP installations, but there are challenges to their participation in HEIP. The HEIP application requires a minimum participation of 50 percent of the renters within a multifamily building, and all renters are required to submit their own print applications. This creates a burden for individual renters to coordinate to reach the threshold, and to obtain their landlord's approval.

RECOMMENDATION: Program implementers should work directly with the owner and easing participation requirements for multifamily housing residents would eliminate the barriers that residents face in attempting to receive HEIP installations.

HEIP's UPCT Program

One benefit of HEIP is that rather than using private contractors with unclear standards for performance or job quality, LADWP directly runs the UPCT program and uses the trainees to complete its energy-efficiency installations.

Formed in 2011 as a collaboration between International Brotherhood of Electrical Workers (IBEW) Local 18 and LADWP, the UPCT program is an apprenticeship program that gives individuals the opportunity to learn various crafts and construction trades necessary to be competitive for permanent jobs at LADWP.[39] This program was formed in response to large waves of retirement of long-time craft workers at LADWP.

Trainees rotate through project areas in order to gain exposure to different power and water construction work. According to the UC Berkeley Labor Center 2016 Training for the Future II report, which analyzed the UPCT program, "Trainees receive $16 per hour plus health and retirement benefits, considerably better compensation than most entry-level workers earn for weatherization work."[40] The program participants receive union representation and benefits through IBEW Local 18. Since the program's inception, as of April 2018, a total of 175 UPCTs were hired. Out of those hired, 88 percent are still working as either UPCTs or as LADWP or City of Los Angeles permanent employees.

The program is especially successful in opening doors for people of color, women, and low-income and formerly incarcerated individuals who face employment barriers at LADWP. Roughly half (50.3 percent) of the trainees are Latinx. By comparison, 28.5 percent of construction workers nationwide are Latinx. More than one in five UPCTs (22.1 percent) are African-American. Women comprise 12.7 percent of UPCTs, while nationwide, women represent 2.6 percent of the construction workforce. More than two-thirds of UPCTs came from zip codes in which more than half the population lived below the federal poverty level. Thus, the UPCT program not only benefits the environment, but also supports economic growth in underserved communities.[41]

BARRIERS: Because of budget constraints, there are only two UPCT classes per year that produce the trainees that service roughly 2,400 households with HEIP installations. The limited availability of classes has led to a massive waitlist, averaging two to three years. The UPCT program also currently lacks a business plan and permanent funding from LADWP. Lack of long-term funding seriously impacts the timing and scale of HEIP Program expansion.

RECOMMENDATIONS: To expand the HEIP program over the next fiscal year, LADWP should, at a minimum, double the number of UPCT classes to four per year. The classes should consist of no more than 25 trainees each so as to maintain a solid trainee-trainer ratio. LADWP should also work with IBEW Local 18 to create a business plan, and the department should allocate permanent, additional funding for the program to reduce the long backlog of interested UPCT trainees. A greater, more secure funding source for the UPCT program would allow HEIP to grow, and adding more UPCT trainees will help the utility find the qualified workers it will need in the future to fill the jobs of retiring baby boomers.

2. A Comprehensive Upgrade Program: The Low Income Weatherization Program

LADWP should ***develop a comprehensive, customized energy- and water-efficiency program that targets, but is not limited to, households in deed-restricted properties***. By developing a partnership with CSD or its authorized program implementer, currently the Association for Energy Affordability, LADWP could build on existing infrastructure established for the Low Income Weatherization Program.

The Low Income Weatherization Program for Multifamily Properties (LIWP-MF) is an energy-efficiency, electrification, and solar program that helps homeowners and renters reduce utility bills. This is a state-level offering, administered by CSD and funded by California Climate Investments (with Cap-and-Trade resources). Information about LIWP-MF is available at https://camultifamilyenergyefficiency.org/.

The program has two overarching goals. First, LIWP is designed to maximize environmental benefits such as GHG reductions. To accomplish this, the program incentivizes owners and renters to install energy-efficient measures and use renewable energy (e.g., solar photovoltaics) within multifamily buildings in disadvantaged communities. Any measure that reduces GHG emissions is eligible for installation under the program. Second, LIWP aims to maximize economic benefits. The program fosters job creation and direct investment in disadvantaged areas and households. Direct investment includes "employment, job training, and supporting the ongoing presence of affordable housing stock in these communities," according to CSD.[42]

To be eligible for LIWP-MF, at least 66 percent of a building's units must be occupied by families at or below 80 percent of the area median income (AMI) and the properties must be in the top CalEnviroScreen percentiles (5 percent to 15 percent) of Disadvantaged Communities. Owners initiate the application process.[43]

For LIWP-MF, CSD works with the Association for Energy Affordability (AEA), which is the technical service provider for this program, to determine how to best carry out program goals. Social service nonprofits and affordable housing nonprofits like the California Housing Partnership Corporation (CHPC) serve as local program outreach and intake representatives.

As of October 2018, LIWP-MF had served two Los Angeles properties and other projects were underway and projected. Of the two completed projects, three buildings were served (117 households or about 187 people) and 754 MT CO_2 (metric tons of carbon dioxide equivalent) were expected to be reduced over the life of the upgrades.[45]

When the program launched in 2016, it quickly became popular. By December 2017, Los Angeles' affordable housing owners saw the value of the program's unique one-stop-shop approach and had

submitted applications for LIWP screening of more than 6,020 households within the city, and there is ample opportunity for reaching more affordable housing owners.[46]

For more information about the program, see Appendix C.

BARRIERS: Barriers to maximizing use of the program include difficulties aligning the timing and financing of projects with the timeline and deadlines of the program), lack of gap funding or viable financing options, and limited utility incentives to leverage with the program.[47]

RECOMMENDATIONS: LAWDP should tap into existing, successful program infrastructure and resources that are provided through LIWP-MF. That will enable it to serve a greater number of multifamily households. In doing so, LADWP can also provide its own additional utility incentives to help leverage program dollars further.

BARRIERS: The LIWP-MF program does not define wage standards in its program guidelines. Because the LIWP-MF program allows owners to choose their own contractors, data on wages and job quality is limited. The decision to grant contractors choice was made deliberately based on owners' feedback about the importance of having flexibility to choose their contractors, in part for quality control.

RECOMMENDATIONS: LADWP could push the state to track this data, and depending on the findings, work to ensure the program offers living-wage and high-road jobs to its workers. In advocating for living wages and high-road jobs, it will be important to balance the needs of time- and resource-constrained affordable housing developers. Any workforce policies that may result in higher retrofit costs should be coupled with state and local strategies to close project funding gaps that are otherwise likely to widen. Without this, the primary barrier preventing many affordable housing owners from doing LIWP-MF energy retrofits that directly benefit their residents will only be heightened.

3. Packaging Los Angeles' New Programs and Resources: A One-Stop-Shop Program Design

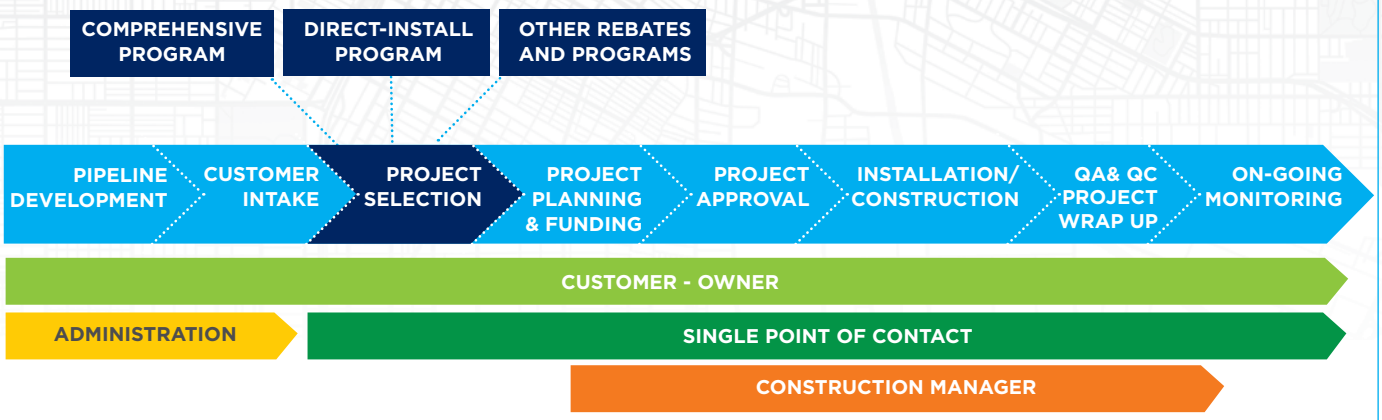
The City of Los Angeles, in coordination with LADWP***, should develop a single, outward-facing resource center or one-stop shop for its multifamily program offerings, supported by robust technical assistance and tailored outreach.*** This resource center could be expanded from the Los Angeles Better Buildings Challenge services, through an approach identified by the city or LADWP.

A resource center or one-stop-shop model offers a full-service approach to multifamily building efficiency upgrades. It would provide building owners with concierge-type services to gain access to efficiency programs, identify contractors, manage onsite work needed to complete efficiency upgrades, and monitor progress. The key figure in this concierge model is the single point of contact assigned to every owner. The single point of contact would coordinate a team of experts to spearhead the major building upgrades and guide busy property managers through the entire retrofit process.

The process arrows in Figure 2 illustrate a potential one-stop-shop service model for Los Angeles. A building owner, or customer, would work with the one-stop-shop staff from intake through the identification and installation of efficiency measures, and maintain contact throughout the construction and closeout process. The owner would submit one application for a building and the single point of contact would review the owner's eligibility for all utility programs and present the options to the owner. The single point of contact would guide owners in determining the best path for their properties, whether that is the LIWP-MF for a whole-building retrofit, HEIP for a direct-install approach, or a combination of various programs.

The single point of contact would also provide assistance with bidding work to contractors, inspections, identifying and applying for utility rebates and other financing, and monitoring energy use pre- and post-retrofit to verify that savings are being achieved. Usually, an energy analyst would serve as the single point of contact or coordinator, but this may vary in the Los Angeles market. The single point of contact model would help keep owners engaged and motivated to see projects through to the end. With the one-stop shop, portfolio owners would have the added benefit of one entity providing consistent, coordinated assistance for their entire portfolio.

FIGURE 2: A ONE-STOP-SHOP SERVICE MODEL FOR LOS ANGELES



The process steps for a one-stop resource center illustrated in Figure 2 above are described below:

- **Pipeline Development**
  Resource center staff develop a pipeline of participants by gathering information from affordable housing sources, such as the state weatherization program, apartment and neighborhood associations, property management industry groups, CHPC, databases, and trade associations.

  Recommendations for program design:
  - LADWP or an appropriate third-party entity should dedicate program staff to outreach to and management of affordable multifamily buildings in the program. This staff group should include a team of single points of contact (e.g. program staff or a call center), energy auditors, and construction experts.

- **Customer Intake**
  During customer intake, owners enroll in the one-stop-shop program through an online application portal that is reviewed by program staff.

  Recommendations for program design:
  - LADWP or an appropriate third-party entity should streamline the application process such that program participants only need to complete one application to gain access to all suitable LADWP programs. The application should be concise and preferably available online.
  - If it is not already in place, LADWP or an appropriate third-party entity should use a customer relationship management tool to store all customer and retrofit information so that it is easily accessible by the single point of contact.
  - A single point of contact should be assigned to all program participants to support them throughout their project and to work with them again on other buildings in their portfolios.
  - The single point of contact coordinates a preliminary utility energy analysis to help the owner understand the costs and benefits of participating. This could be done by benchmarking.

- **Project Selection**
  For LIWP-MF, an energy auditor performs an on-site assessment to identify energy- and water-efficiency measures and rank those that would be the most cost-effective utility saving investments. The energy auditor develops a scope of work that would include a comprehensive set of improvements, installation costs, available utility incentive programs, available financing options, and economic benefits. For prescriptive, custom, and direct-install programs, the project selection would be based on existing LIWP-MF program requirements.

  Recommendations for program design:
  - The single point of contact coordinates the energy audit on behalf of the owner and

ensures that specific facility staff are on-site for a brief interview about the building and its operations.

- The audit report, produced by the program energy auditor, presents the applicable utility incentives (including funding amount and expiration dates) available from all local, state, and federal programs so that the owner can make an informed decision.
- Program staff should accept other types of energy audits, including the efficiency-related modules required for physical deeds assessments used by lenders, to reduce the time and material expense for owners.

Project Approval

The scope of work is presented to the property owner to determine a project plan.

Recommendations for program design:

- The single point of contact supports the owner's decision-making process by serving as a technical liaison to ease the administrative burden on owners.
- The single point of contact transfers the owner's information for applications to all other relevant LADWP programs to integrate all programs and leverage additional sources of funding.
- LADWP should consider processing incentive payments during the construction phase for work completed or at major points of completion to overcome cash-flow barriers. This is something that LIWP-MF does.
- The single point of contact should consider leveraging the California Master Metered Multifamily (MMMF) on-bill repayment (OBR) program as a financing tool as well as partnerships with local CDFIs.[48]

Construction

Once an owner approves a project plan and financing is secured, the single point of contact coordinates with the program's construction expert to manage construction and installations.

Recommendations for program design:

- The single point of contact facilitates the coordination and scheduling of all work to ease the administrative burden on owners.
- The program construction expert develops the statement of work, which includes a timeline and target completion dates for each aspect of the project; provides support to the owner through contractor bid solicitation and selection; and serves as the owner's representative on the job site to ensure the statement of work is adhered to.
- The program should provide flexibility for the type of contractors that can perform the on-site work.

Quality Assurance and Quality Control Inspection and Project Wrap-Up

The program construction manager, and in some cases the financing source, are responsible for quality assurance (QA) and quality control (QC) for each part of the work plan and obtain a signed statement of completion from the building owner or manager. Every project is inspected to ensure that the work has been installed in accordance with specifications, energy code requirements, and best practices. Contractors are required to correct inadequate work prior to project closeout and payment. The owner completes a customer survey to provide feedback on the program and provides input for lessons learned.

Recommendations for program design:

- The single point of contact, with support from the program construction expert, manages the QA/QC process to ensure a smooth project wrap-up.
- The single point of contact responds to customer concerns and, if quality issues arise, works with the contractors to remedy any issues.

Ongoing Monitoring

After construction is completed, the single point of contact monitors utility data to ensure the acceptable realization of energy savings goals.

Recommendations for program design:

- Program staff tracks participation and performance metrics generated by this market segment, e.g., percentage of owner uptake.
- Program staff establishes a public comment process to seek feedback from stakeholders on the program design and implementation.

The one-stop-shop model, which has been successfully implemented in communities across the country, increases program participation and supports Los Angeles' energy savings goals.[49] It also provides the following short- and long-term benefits to LADWP customers living in affordable multifamily housing:

Simplified program participation
Owners previously inundated by requests to participate in programs that serve their commercial common areas and residential units separately or facing barriers when choosing to complete efficiency projects on their own can now have a single point of contact that offers a centralized enrollment process and project guidance from the audit to post-construction monitoring.

Streamlined retrofit process
A streamlined process minimizes the time and resources required of owners to complete work and provides a full package of technical and financial resources to move buildings through comprehensive retrofits. The one-stop-shop approach can increase the likelihood of significant energy-efficiency improvements being made in the short run.

Clearly identified savings opportunities
Benchmarking helps building owners measure and manage their building's energy, and ultimately prioritize projects. The audits and recommendations will serve as guiding documents for deep retrofit opportunities for several years.

Reduced energy costs
Energy-efficiency programs that target or are accessible to affordable multifamily buildings and provide comprehensive services have been shown to reduce energy costs for tenants, thereby easing their rent burdens, as well as operating costs for building owners.

Increased asset value
The buildings will most likely realize an increase in value, and be viewed as being of improved quality by existing and potential tenants.

Healthy and comfortable indoor environment
Better indoor air quality, lower temperature variability, and improved occupant safety lead to less tenant complaints, reduced tenant turnover, and a more equitable housing environment for those community members most in need.

Detailed Recommendations – Funding and Program Design Considerations

Funding

Meaningfully deploy LADWP's $100 million in affordable housing energy-efficiency funding through 2023, followed by a stage two commitment for an additional $725 million in a seven-year program run from 2024 to 2030. During the initial period through 2023, LADWP and the City of Los Angeles can reduce existing capacity and internal barriers while paving the way for a broader investment in workforce and infrastructure from 2024 to 2030.

In June of 2018, the LADWP board of commissioners voted to invest $100 million over five years to improve energy efficiency in lower-income multifamily rental housing. The funding was allocated as part of a broad resolution that included reducing investment in the repowering of an out-

of-state fossil-fuel plant.[50] As of February 2019, the majority of these funds had yet to be allocated to well-functioning programs. We recommend that LADWP focus on allocating these funds to the HEIP and LIWP-MF programs and simultaneously address any policy, infrastructure, and workforce issues that may be preventing these programs from increasing their scale.

Research for this report indicates that a total investment of approximately $825 million is cost-effective and would achieve at least 20 percent utility bill savings for Los Angeles' 409,000 low-income rental units in multifamily housing.[51] To achieve the city's climate and electrification targets, we recommend the bulk of this funding be administered through LADWP or in partnership with other electrification programs, such as the LIWP, once infrastructure challenges to scaling up programs have been resolved.

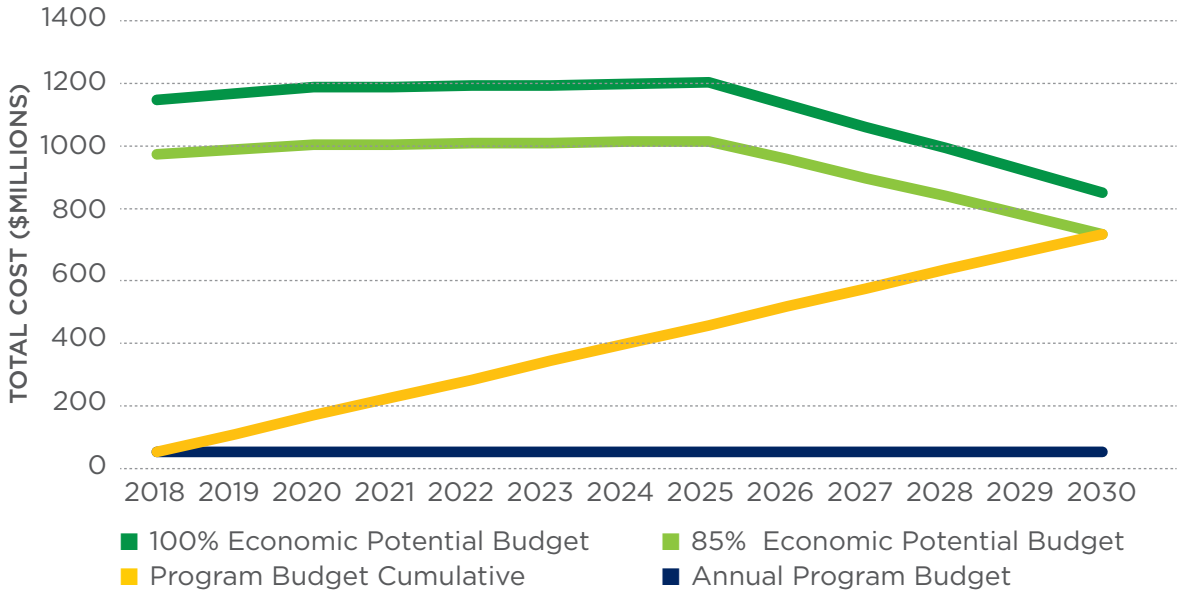
Table 2 presents the cumulative benefits and costs associated with capturing available economic potential through 2030.[52] Capturing all economic potential, which would mean that all measures are taken that have a benefit-cost ratio greater than 0.3 according to the total resource test, would result in a portfolio-level benefit-cost ratio of 1.5 in 2018 and 2.1 through 2030. For more information on this analysis, see Appendix A.

An annual combined (gas and electric) program budget of $75 million would be required to capture 85 percent of available economic potential energy savings by 2030, according to NRDC's review, presented in Figure 3.

Table 2: Benefits and Costs ($millions) of Available Economic Potential in LADWP Service Territory by Year (Benefit Cost Ratio-BCR)

	2018			2020			2025			2030		
	Costs	Benefits	BCR	Costs	Benefits	BCR	Costs	Benefits	BCR	Costs	Benefits	BCR
Electric	$ 508	$658	1.3	$510	$665	1.3	$470	$669	1.4	$269	$484	1.8
Gas	$1,045	$1,706	1.6	$1,123	$1,905	1.7	$1,294	$2,375	1.8	$989	$2,156	2.2
Total	**$1,553**	**$2,366**	**1.5**	**$1,633**	**$2,569**	**1.6**	**$1,764**	**$3,044**	**1.7**	**$1,258**	**$2,640**	**2.1**

FIGURE 3: TOTAL PROGRAM SPENDING REQUIRED TO CAPTURE 100 OR 85 PERCENT OF ECONOMIC POTENTIAL THROUGH 2030



The assumption that LADWP would be able to capture at most 85 percent of the available economic potential is based on taking into account practical constraints that LADWP may face, such as the potential that a subset of multifamily customers may be hard to reach or may not want to participate in LADWP's programs.

Administrative (including marketing) costs of running a program, which NRDC assumed are 15 percent of a measure's total incremental cost, are included in the costs presented in Figure 3. NRDC further assumed that LADWP, for low-income housing programs, would subsidize an average of 90 percent of a measure's incremental cost.

Policy: Workforce Considerations and Tenant Protections

Job Creation

Energy-efficiency program expansion is only one way LADWP can alleviate energy cost burdens for Los Angeles residents. Ensuring that these programs create jobs that pay fair wages is another. Many Angelenos are currently low-wage workers who are particularly susceptible to displacement or homelessness caused by escalated rents. And, as outlined in Appendix A, investing in multifamily upgrade programs to their cost-effective potential could create 3,000 long-term, high-paying jobs.

It is therefore essential to ensure that any expanded LADWP renter-focused energy-efficiency programs include high-road career and training pipelines for residents in disadvantaged communities, similar to the utility's UPCT program. Many workers who would install the energy-efficiency upgrades are likely themselves to be multifamily renters affected by Los Angeles' affordable housing shortage and LADWP customers. LADWP has a great opportunity to attract, hire, and train residents most affected by the housing crisis and to ensure that they receive wages that allow their families to keep up with rising housing costs.

Doing so will also help fulfill LADWP's workforce needs that will increase over the next several years as baby boomers continue to retire.[53] By ensuring that high-road job standards exist for the workers who install its energy-efficiency retrofits in an expanded program, LADWP would play a role in helping low-income Angelenos achieve financial stability and retain their housing while also attracting more labor.[54]

Workforce Opportunities and Trade Allies

In the short run, to ensure that owners get the most current information about existing programs, LADWP should maintain accurate and up-to-date program information, supply vendors with approved program information to distribute to owners, and ensure clarity among its agents and all trade allies around customer rights and savings options. To ensure that work completed in buildings is of sufficient quality to realize the expected energy savings, the utility programs should regularly vet the pool of trade allies for work quality and require business licensing. Bottom line: offering transparency regarding performance, complaints, and business license status of trade allies can result in increased participation from the affordable housing sector.

Tenant Benefits and Protections

Special attention is needed to ensure that energy improvement policies and programs deliver the level of tenant benefits intended, and that tenants' housing affordability and stability are not jeopardized by unwarranted rent increases or displacement.

To protect against rent increases and displacement for buildings that aren't protected by the existing Rent Stabilization Ordinance (RSO), policies that provide incentives for undertaking energy improvements should be carefully evaluated for safeguards.[55] Policymakers must balance the need to protect tenants from financial harm where the risk is reasonably foreseeable, with the need to encourage sufficient program participation by a wide variety of owners that may only benefit indirectly.

Various factors may be important in such evaluations, including:

- the size of the investment,
- how much of the total cost the owner is paying,

- the projected energy savings for tenants,
- ownership type (hands-on, or small or large rental business) and motivations,
- benefits, if any, to the owner (including reduced turnover and reduced common-area operating expenses),
- physical condition of property,
- rent levels (including their relationship to market levels that could be charged),
- current and projected neighborhood market dynamics,
- neighborhood market area and recent and projected dynamics, and
- administrative costs and burdens for owners.

As an example of how these factors could affect the need for protections, small investments of less than $2,000 per unit with no owner contribution that would serve units in a variety of local housing markets would probably require less restrictive policies than whole-building energy retrofit programs costing in excess of $10,000 per unit that promise substantial reductions in tenant energy bills. In strong rental markets like most of Los Angeles, the risks facing non-RSO tenants are high, so policy should err on the side of protecting tenants. If program goals are jeopardized, the balance can be reevaluated.

Where energy-efficiency programs support significant investments and can be used by rental housing owners in stable, strengthening, or strong neighborhood rental markets, some form of tenant protection is probably necessary. Both the specific content and the form of those protections are important. For example, concerning content, it will be important to consider whether the restriction prevents rent increases above a certain level, and for what period of time. Concerning form, should the policy be established by an agreement between the owner and the program administrator with notice to the tenants, or by a required lease addendum, or both? Should the agreement be recorded so that it's binding on new owners? Key to developing both the optimal content and form is ensuring that the intended tenant benefits and protections can be effectively monitored and enforced by both program administrators and tenants themselves.

Precedents exist for efficiency programs to ensure benefits flow to tenants and to provide appropriate renter protections. Some precedents that should be considered include:

- Federal – The federal Weatherization Assistance Program (WAP) mandates that state administrators of WAP funds ensure that benefits from weatherizing rental units accrue primarily to low-income tenants. Probably the most significant issue for WAP and any energy investment program is the specific content of rent increase restrictions and whether they are part of leases and directly enforceable by tenants, judging from a National Housing Law Project review of how states have implemented the WAP mandate.[56]
- New York – Building owners receiving WAP funds are required to sign a Multifamily Building Owner Agreement, which includes provisions prohibiting rent increases that result from program improvements.[57]
- Massachusetts' multifamily program covering whole-building measures requires owners' agreement that 50 percent or more of a building's units will continue to house tenants with incomes at or below 60 percent of AMI for ten years following the building upgrade, and that rents will not be increased because of any increase in the property's value attributable to the improvements.[58]
- California's LIWP, also supporting whole-building energy retrofits, requires owners to make at least 10-year commitments to serve low-income households. For projects without these agreements, one method for safeguarding affordability is to maintain rents for at least 66 percent of the tenant households within a specified affordability standard.[59]

The New York and California agreements also seek to reduce the threat of displacement by protecting tenants from eviction without cause, as do the WAP agreements for many jurisdictions.[60]

Program Infrastructure and Design

Developing a Program Pipeline and Adopting Well-Timed Outreach Strategies

The resource center, outlined above, should develop a pipeline of potential customers and maximize its use of outreach networks for owners and renters. This can be done by gathering information from the state weatherization program, apartment and neighborhood associations, property management industry groups, CHPC's database, CoStar's database, and trade associations. Incentives should also be targeted to renter-households in DACs.

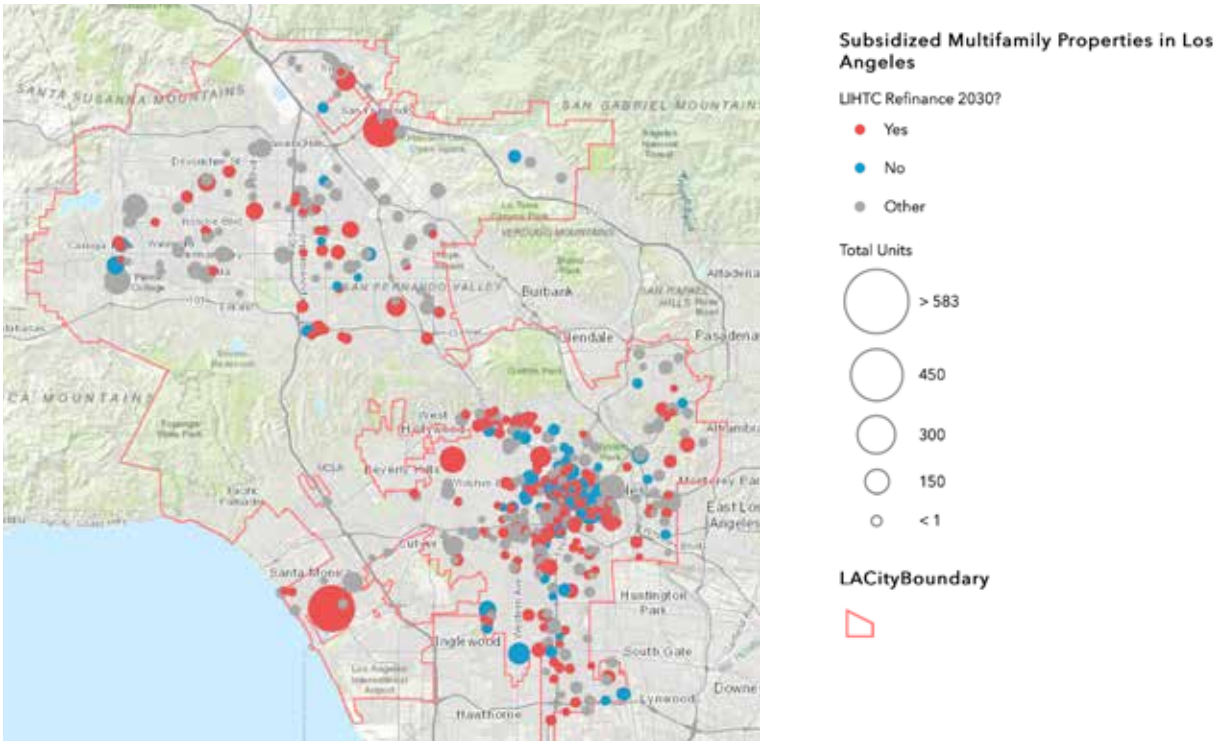
To effectively target these properties, it is critical to approach them at key points in their development cycle;

- **Lower-rent, market-rate properties** could be targeted using the HCIDLA Gateway-to-Green (G2Gsurvey results). The G2G survey has gathered detailed data on potential energy and water saving improvements for more than 81,971 multifamily rental properties that were inspected from July 2014 to July 2018. The majority of these properties are small in size and 68 percent showed potential for energy- or water-conservation improvements. These properties should be approached during financing events and when contractors are procured to make significant improvements.
- **Deed-restricted properties** should be targeted before financing cycles end or during an LIHTC resyndication to influence the work scope for greater energy savings. From 2018 to 2030, there will be 220 LIHTC funded properties, representing 13,348 units, due for refinancing, a time when capital improvements are frequently implemented on properties.

Elevate Energy's tool illustrating when properties are coming up for refinancing can be used to facilitate this outreach. See Figure 4.

All multifamily properties can be targeted by leveraging several ongoing efforts. Municipal policies, including the mandatory seismic retrofit ordinance and the benchmarking ordinance, are the most robust sources of information for both developing

FIGURE 4: FEDERALLY SUBSIDIZED MULTIFAMILY BUILDING LOCATOR (NATIONAL HOUSING PRESERVATION DATABASE, 2030)[63]



pipelines and conducting outreach for programs. The Los Angeles Energy Atlas can be used to target the most energy intensive properties. Third-party program implementers can also work with existing utility outreach programs, including SoCalGas' Community Language Efficiency Outreach Program, the Pacific Asian Consortium in Employment energy savings project, and LADWP's Community Partnership Grants to nonprofit organizations.

Offering a Comprehensive Set of Measures

The top least-costly electric savings measures, based on 2018 economic savings potential, account for 73 percent of the total energy savings potential for 2018, according to Optimal Energy's potential study. LADWP consistently offers about half of these measures; the other half are being considered for the future. Table 4 presents these measures and their contribution to available economic potential in 2018.

Table 5 presents the top gas measures by savings contribution to economic potential savings available in 2018. The ten measures shown account for 90 percent of available economic potential savings.

Electrification Measures

The list of measures in Table 4 does not include heat pump water heaters because of their cross-fuel impact. However, switching appliances from conventional natural gas to electricity can greatly

TABLE 3: GREATEST SAVING (2018) ELECTRIC MEASURES FROM THE COST-EFFECTIVE PORTFOLIO. SOME MEASURES ARE OFFERED ONLY FOR SUBSETS OF THE POPULATION OR FOR SMALL SPECIFIC PROGRAMS.

Electric End Use	Measure	Contribution to Cumulative 2018 Savings (%)	Measure Already Offered by LADWP?
Lighting	Standard LED (In-unit)	29	Yes
Lighting	Specialty Lighting (In-unit)	8	No, in planning stages
Water Conservation Measures	Commercial Laundry in common area (Common area washer and dryer)	7	No, in planning stages
Other	Behavioral	6	Partial
Lighting	Standard LED (Common area)	6	Yes
Programmable Thermostats	Wi-Fi Thermostat	5	Partial (via the Energy Savings Assistance program and the Solar Team)
Appliances	Refrigerator (CEE Tier 3)	4	Yes
Power Strips	Advanced Power Strip	4	Yes
Building Design	Air Sealing	4	Yes

TABLE 4: GREATEST SAVING (2018) GAS MEASURES FROM THE COST-EFFECTIVE PORTFOLIO (WITHOUT INCORPORATING HEAT PUMP WATER HEATERS)

Gas End Use	Measure	Contribution to Cumulative 2018 Savings (%)	Measure Already Offered by LADWP?[64]
Water Heating	Water Heater Pipe Wrap	20	No (offered by SoCal Gas)
Water Heating	Demand Control for Domestic Hot Water Recirculation Pump	11	Limited
Whole Building	Retrocommissioning, HVAC Controls	10	Limited
Water Heating	Low-Flow Showerheads	10	Yes
Whole Building	Low-Flow Faucet Aerator	9	Yes
Space Heating	Efficient In-Unit Furnace	7	No (Offered by SoCalGas on very limited basis)
Water Heating	Efficient Central Boiler	6	Partial – some will be offered via the Energy Savings Assistance's Common-Area Measure program[65]
Water Heating	Boiler Pipe Insulation	6	No (Offered by SoCalGas)
Appliances	Commercial Laundry (Common area)	6	No (Offered by SoCalGas)
Water Heating	Water Heater Tank Wrap	5	No (Offered by SoCalGas)

contribute to reducing GHG emissions, and the City of Los Angeles has committed to reducing GHG emissions from residential buildings through transitioning appliances from conventional natural gas to electricity.[66]

Therefore, we recommend that LADWP consider adding heat pumps to its list of measures. Without electrifying buildings, the impact of shifting to a 100 percent renewable electric grid is limited because it does not cover natural gas use in buildings. Building decarbonization is a critical component of achieving the state's carbon goals. In pursuing decarbonization, however, it is critical to ensure that lower-income residents do not bear the cost of accelerated electrification. However, to avoid any potential negative impact on bills, program administrators should package these fuel-switching measures, such as heat-pump measures, with other standard energy-efficiency measures, like LED lighting.

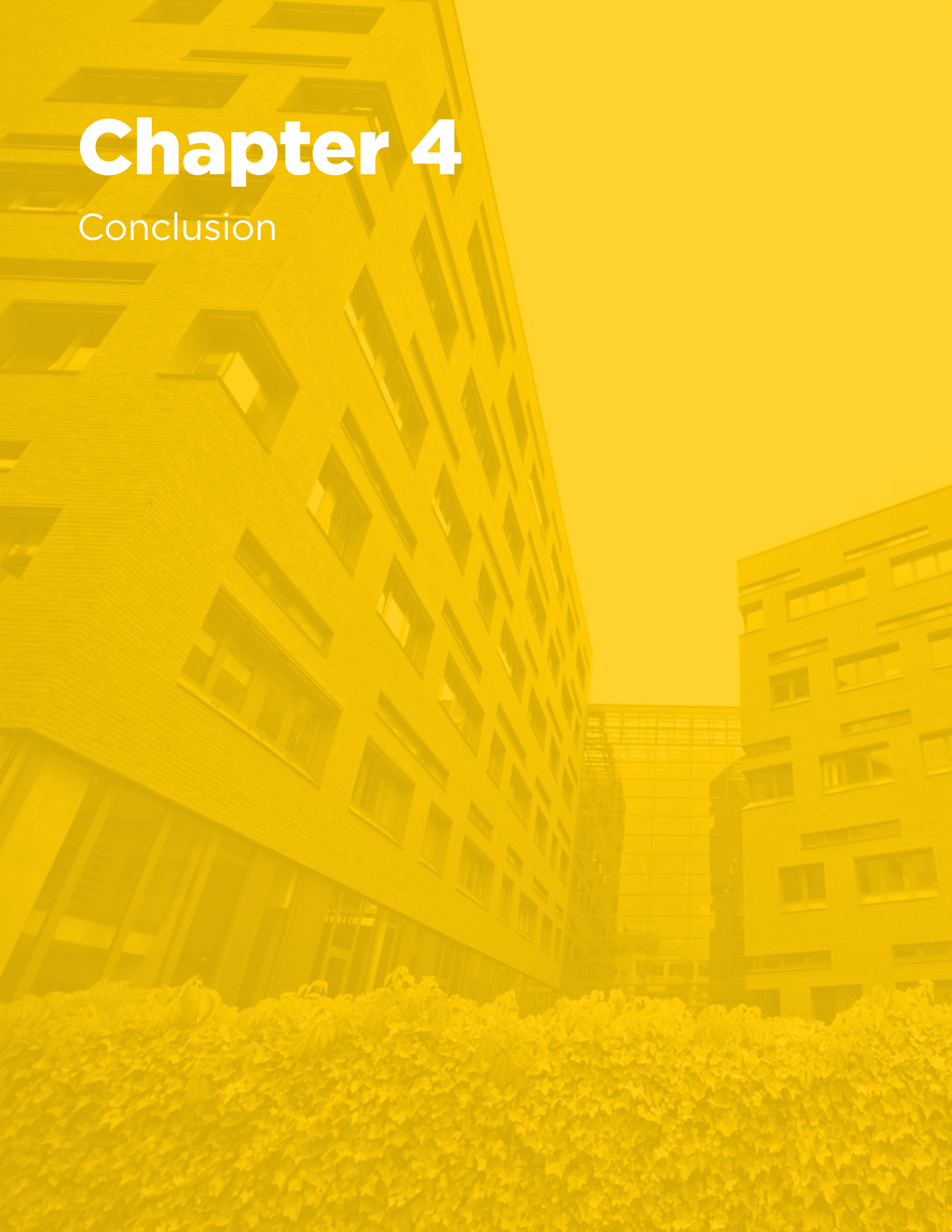
Financing

In addition to funding efficiency programs, LADWP and SoCalGas can play an important role in making financing more accessible to multifamily owners. Providing access to aggregated data for multifamily owners not only allows them to understand how their properties are performing but also incentivizes them to participate in financing programs that encourage efficiency upgrades and renewable installations. Both utilities can also support the cost of energy assessments or audits required to benchmark or apply for financing products.

TABLE 5: PER-UNIT IMPACT OF FUEL SWITCHING MEASURES ON CUSTOMER CONSUMPTION AND ANNUAL ENERGY BILLS

Measure	Additional Electric Usage (kWh)	Gas Savings (therms)	Electric Bill Increase	Gas Bill Reduction	Net Bill Impact	Total Resource Cost Test[67]
Heat Pump Water Heater – In-unit, gas storage baseline	1,309	188	$209	$156	+ $53	1.7
Heat Pump Water Heater – Central, gas storage baseline	1,309	182	$209	$151	+ $59	2.1
Efficient In-Unit HP (Air-Source), AC w/ furnace baseline (Replace On Burnout)	376	45	$60	$37	+ $23	N/A
Efficient In-Unit HP (Air-Source), AC w/ furnace baseline (Retrofit)	198	50	$32	$42	- $10	4.2

While LADWP and SoCalGas already play the role of financiers, their financing products need to be tailored to the needs of the multifamily sector. For the unsubsidized housing stock in particular, we recommend LADWP develop partnerships with local CDFIs or community-based banks to offer low-interest loan products for building owners to complete efficiency upgrades. CDFIs and community banks that already lend to the affordable multifamily sector understand the stock and often have relationships with owners that could result in a pipeline of projects for financing programs. Ideally, the products would work seamlessly with the technical assistance available through the program and the participating financial institutions would use the energy savings information from audit reports to structure loans and inform underwriting. A traditional debt product, such as a second mortgage, could be used for the low-rent, market-rate stock. For subsidized stock, an unsecured product, such as Connecticut Green Bank's Low-Income Multifamily Energy Loan, would be useful and could supplement the use of reserves for upgrades.[68]



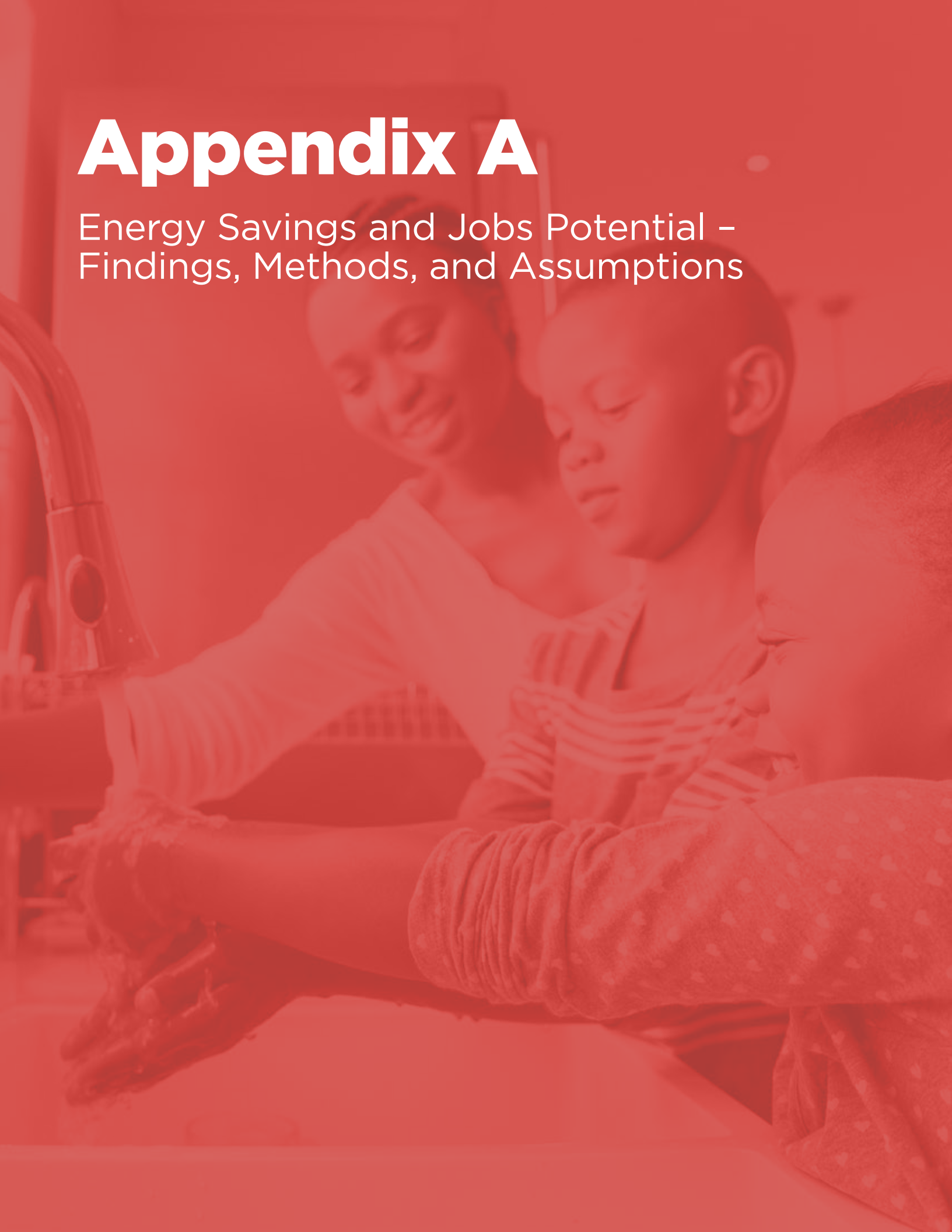
Chapter 4

Conclusion

Policymakers at LADWP and the City of Los Angeles have an unprecedented opportunity to support smart energy-efficiency investments in the housing stock of their most vulnerable renters, and to realize broad environmental and economic benefits for all customers and residents in return. Not only does this report lay out the tangible environmental and economic benefits that accrue from this approach, but it also presents a detailed and feasible pathway to get there. Achieving the projected energy savings will greatly reduce the disproportionate energy cost burdens shouldered by lower-income multifamily renters while improving the health, comfort, and safety of their housing.

Appendix A

Energy Savings and Jobs Potential – Findings, Methods, and Assumptions



This appendix presents an overview of the methodology used by Optimal Energy to develop a cost-effective portfolio of energy-efficiency offerings for multifamily homes in LADWP's service territory. The appendix breaks out energy and cost savings data and explains how they were calculated starting from demographic information.

Develop Multifamily Population Overview: The analysis used 2015 American Community Survey data to determine the number of multifamily households in LADWP's service territory and classified housing units in buildings with five or more units as multifamily homes. Then, to determine how many of these multifamily homes in LADWP territory qualify as low-income housing, two definitions were applied. The first definition defines low-income as households with incomes up to 80% of the area median income (AMI); 409,278 homes in LADWP service territory qualify by this definition. The second definition defines households with income up to 200% of the federal poverty level (FPL) as low-income; 299,257 homes qualify using this criterion.[70] Energy consumption data for multifamily housing was obtained from UCLA's Energy Atlas to develop an estimate of average energy use per low-income multifamily home. This estimate of average energy use is a benchmark used to ensure that total measure-level energy savings potential is reasonable as a fraction of total energy use.

Measure List: Optimal Energy compiled a list of 203 energy-efficiency measures for each primary residential end use (e.g., space heating, cooling, and lighting); this list included energy-efficiency opportunities in both individual housing units and common areas.

Measure Characterization: Optimal Energy then developed parameters required to calculate the technical and economic potential of each measure. These parameters include the measures' annual energy savings, incremental costs, technology density (average prevalence of technology per home), and lifetime. Existing literature and publicly available analyses were reviewed to develop these parameters.[71]

Technical Potential: Technical potential is the total possible energy savings available. Optimal calculated the annual technical energy savings potential in low-income multifamily homes in LADWP's service territory. In doing so, adjustments were made for measure applicability and for the portion of the market that has already converted to efficient equipment and practices, or is projected to do so in the future absent any program intervention.[72]

Measure Screening: Optimal developed measure costs and savings and then screened each measure for cost-effectiveness through a modified total resource cost test (TRC); this test was modified to account for non-energy benefits, such as reduction in utility energy arrearages, water savings, and price of carbon. Optimal also included an estimate of the administrative cost to deliver these programs; this was assumed to be 15% of a measure's delivery cost. For this study, a measure passed the cost-effectiveness screen if it had a benefit-to-cost ratio greater than 0.3. A low individual benefit-to-cost ratio was selected because the study's objective was to evaluate the greatest level of energy savings available while applying cost-effectiveness constraints of close to 1.0 on the whole portfolio of measures for this housing segment as opposed to each individual measure.

Estimate Cost-Effective or Economic Potential: Total cost-effective or economic potential was calculated as the sum of the technical potential of individual measures that pass the TRC measure screening.

This analysis included several assessments of cost-effective energy-efficiency potential, and these assessments entailed 12 individual model runs. Two different definitions for "affordable" multifamily housing were used. In addition, three different packages of measures were assessed. The first package included only relatively simple, low-cost measures likely to be implemented through typical direct-install programs. The second package, in addition, included measures that could be incorporated in expanded direct-install programs, such as kitchen appliances, HVAC equipment, and common area lighting. The third package included all measures characterized through the measure characterization process. Cost-effectiveness was determined with the TRC with a few caveats discussed below. To assess the sensitivity of the model to additional program costs, a scenario was developed increasing the measure costs by 15% to account for non-incentive program administrative costs, such as marketing and administrative staff.[73]

The potential analysis involved several initial steps that were required regardless of the specific scenario assessed. These steps included the following:

- Estimating the number of affordable multifamily housing units by building size (i.e., buildings with 5– 49 units and buildings with 50 or more units), and subsidy type (i.e., lower-cost market rate, subsidized affordable, and public housing authority-owned)
- Estimating baseline energy consumption for affordable multifamily housing units
- Characterizing efficiency measures, including estimated costs, savings, and lifetimes
- Identifying location-dependent parameters for the LADWP service territory, including climate, lighting hours of use, measure costs, avoided energy supply costs, non-energy benefits, and cost of carbon
- Developing a comprehensive measure list representing all pertinent combinations of measures, market, building size, and all location-dependent parameters to make possible the analysis used to quantify the economic potential
- Measure costs and savings were calculated per housing unit and then screened for cost-effectiveness. The TRC test was used to estimate the costs of achieving efficiency savings and benefits that result from these measures.

Making appropriate adjustments for measure applicability and taking into consideration the portion of the market that has already converted to efficient equipment and practices, or is projected to in the future absent any program intervention, the total potential was estimated by applying the measure-level costs and savings to the population of affordable multifamily housing units both statewide and by electric utility service territory.

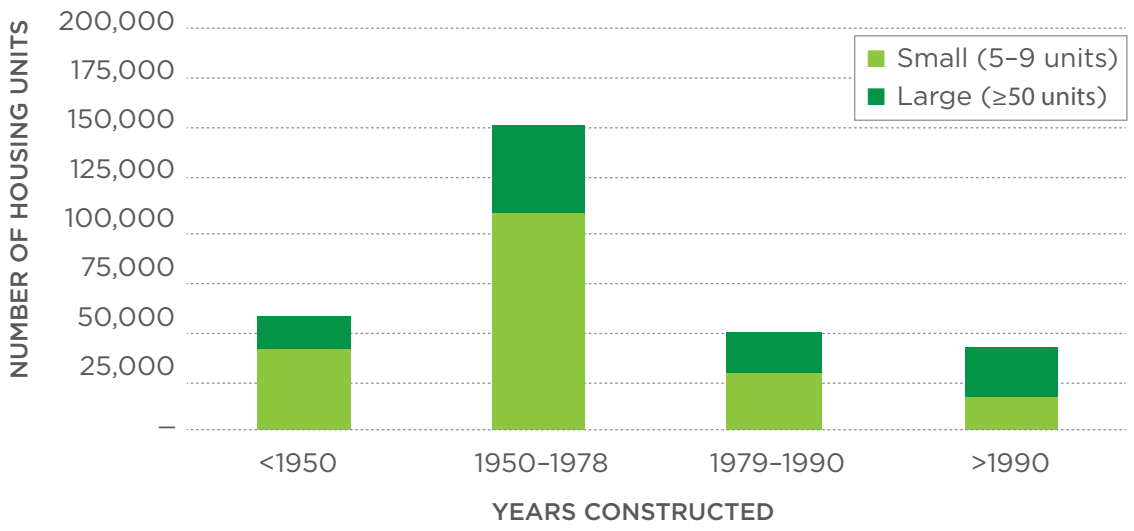
To estimate the economic potential, Optimal generally assumed that all cost-effective measures would be taken at the rate of turnover for market-driven measures, such as for major renovation and natural replacement (commonly referred to as "replace on burnout"). For time-discretionary retrofit measures, Optimal estimated the "overnight" economic potential by neglecting practical constraints and assuming all cost-effective retrofit measures were implemented immediately.

Unit Counts: Elevate Energy provided estimates of multifamily housing unit counts by building vintage, size, and subsidy type. The affordable housing market was subdivided in three ways: by year of construction or vintage (i.e., pre-1950, 1950–1978, 1979–1990, and post-1990), by the number of units in the building (i.e., 5–49 units and 50 or more units), and by affordability definition (i.e., 80% AMI or 200% FPL). The following table shows the 16 possible scenarios given these variables:

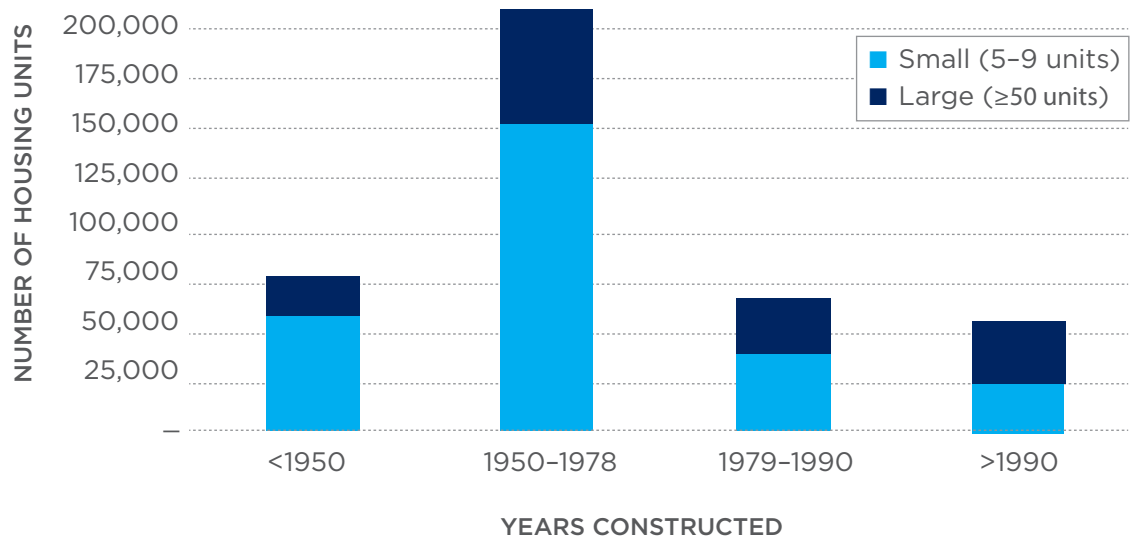
SUPPLEMENTARY TABLE 1: AFFORDABLE MULTIFAMILY HOUSING SEGMENTATION

Year Constructed	Affordable Housing Definition			
	80% Area Median Income		200% Federal Poverty Level	
	Building Size		Building Size	
	Small (5–49 Units)	Large (≥ 50 Units)	Small (5–49 Units)	Large (≥50 Units)
<1942	80% AMI, Small (5–49 Units), Pre-1942	80% AMI, Large (≥50 Units), Pre-1942	200% FPL, Small (5–49 Units), Pre-1942	200% FPL, Large (≥50 Units), Pre-1942
1942–1978	80% AMI, Small (5–49 Units), 1942-1978	80% AMI, Large (≥50 Units), 1942–1978	200% FPL, Small (5–49 Units), 1942–1978	200% FPL, Large (≥50 Units), 1942–1978
1979–2000	80% AMI, Small (5–49 Units), 1979-2000	80% AMI, Large (≥50 Units), 1979–2000	200% FPL, Small (5–49 Units), 1979–2000	200% FPL, Large (≥50 Units), 1979–2000
>2000	80% AMI, Small (5–49 Units), 2001–2016	80% AMI, Large (≥50 Units), 2001–2016	200% FPL, Small (5–49 Units), 2001–2016	200% FPL, Large (≥50 Units), 2001–2016

SUPPLEMENTARY FIGURE 1: AFFORDABLE MULTIFAMILY HOUSING UNIT COUNTS, 80% AMI



SUPPLEMENTARY FIGURE 2: AFFORDABLE MULTIFAMILY HOUSING UNIT COUNTS, 200% FPL



The affordable housing population includes both subsidized and market-rate units housing low-income residents. All information on subsidy type was obtained from the National Housing Preservation Database (NHPD) created by the Public and Affordable Housing Research Corporation and the National Low Income Housing Coalition. This database includes any property that has received at least one subsidy of any sort, including through any program of the U.S. Department of Housing and Urban Development and U.S. Department of Agriculture Rural Development. Unsubsidized affordable units are any units in low- and moderate-income census tracts that do not have subsidies. Tract housing populations are calculated based on a combination of American Community Survey

2012, five-year estimated total unit counts and the tract-level unit counts from NHPD. In some areas, the census estimates credited fewer total units in a tract than were represented by NHPD subsidized unit records. In these cases, geocoded NHPD counts were used as total counts, so final unit estimates were slightly higher in some areas than in the census data. After unit counts were determined at the census tract level, they were aggregated up to the LADWP territory using 2014 Platts geospatial data. The population of units at or below 80% AMI was assumed to be equal to the total population of subsidized and unsubsidized affordable units as described above. The population of units at or below the 200% FPL was estimated using the household median incomes by census tract. The resulting unit counts by affordable housing definition are presented in Figures 1 and 2 below.

Baseline Energy Consumption

For this study, Optimal Energy developed annual energy consumption estimates for typical affordable multifamily housing units for each energy type (i.e., electricity and natural gas). Energy consumption in affordable multifamily residences, in contrast to other subsectors, has not been well studied; a single comprehensive source for information about affordable multifamily energy consumption by building vintage, size, and end use in Los Angeles does not exist.

Optimal Energy attempted to address this issue by referencing two primary data sources: the Los Angeles Energy Atlas and the 2009 California Residential Appliance Saturation Study (RASS). First, estimates of energy use intensity (EUI) by building vintage and size from the LA Energy Atlas were used with the unit counts described above to estimate total electric and natural gas consumption for affordable multifamily households in the City of Los Angeles.[74] Median EUI estimates were calculated separately by building size and vintage category and applied to the appropriate unit counts.

Next, RASS 2009 data specific to LADWP's service area was used to develop end-use EUIs and equipment saturations. These could not be differentiated by building vintage and size because of sample size limitations. Interviews with Los Angeles Housing + Community Investment Department (HCIDLA) staff and professional judgment were used to reconcile the RASS data with the LA Energy Atlas data and develop a single dataset estimating end-use energy consumption and equipment saturation by building vintage and size.

While the baseline consumption estimates used are not specific to the affordable sector, they are reasonably consistent with affordable housing energy estimates presented in Fannie Mae's 2014 Transforming Multifamily Housing: Fannie Mae's Green Initiative and Energy Star for Multifamily. However, the need remains for a comprehensive baseline study of affordable multifamily homes.

One drawback of the RASS data is that it does not include common area consumption. Based on several other recent studies that specifically quantified common area characteristics, Optimal estimated that an additional 10% of space heating, cooling, and water heating end use energy is consumed in common areas. Also, because of the impact of the Energy Independence and Security Act of 2007 on lighting efficiency standards, the U.S. Energy Information Administration's Residential Energy Consumption Survey data do not adequately reflect current lighting energy consumption. To address this, Optimal estimated lighting consumption, both within housing units and common areas, by multiplying the type, number, and wattage of lighting fixtures per unit by the assumed hours of use.

The resulting baseline consumption estimates are used for both informing our measure characterizations and reporting the potential estimates as percentages of total load.

Measure Characterization

A key early step in the analysis was to generate the measure list and characterize measures in terms of costs, savings, useful lives, and baseline assumptions. Optimal collaborated with NRDC to develop a comprehensive list of measures representing all major efficiency opportunities in affordable multifamily housing. The analysis addresses all in-unit measures usually characterized in efficiency studies. But, because of budget constraints, the study's assessment of consumer electronics and other devices plugged directly into outlets (small-plug loads) was limited to advanced power strips and efficient set-top boxes. Also because of budget constraints, behavioral measures were assessed as a single package assuming residents receive periodic feedback on energy usage and advice for improving their energy performance.

All measures were characterized on a per-housing-unit basis. When made possible by the available

data, measure characterizations specific to each of the two building sizes (i.e., 5–49 units and 50 or more units) were developed. All in-unit measure characterizations (i.e., measures installed within individual housing units) are generally consistent across both building sizes and reflect the average number of those measures per apartment unit. To preserve the per-housing-unit approach, we allocated all central system efficiency measures to the individual units for each of the two building-size segments. For example, a large central heating plant would be screened based on the portion of a typical heating plant allocated to a single housing unit.

A total of 164 measures were characterized for up to two applicable markets (the natural replacement and renovation market and the retrofit market). This market differentiation is important because the costs and savings of a given measure can vary depending on how it is decided to implement the measure. For example, a retrofit or early retirement of operating but inefficient equipment entails covering the costs of entirely new equipment, the labor to install it, and disposal of the old equipment. For market-driven opportunities, installing new high-efficiency equipment may entail only the incremental cost of a high-efficiency piece of equipment relative to a standard efficiency one, as similar labor costs would be incurred in either case. Similarly, on the savings side, retrofit measures can initially save more when performance is compared with older existing equipment, while market-driven measure savings reflect only the incremental savings over current standard efficiency purchases. For early-retirement retrofit measures, Optimal model a "baseline efficiency shift" at the time when the equipment to be retrofitted would have needed to be replaced anyway.

In general, measure characterizations include defining the following for each combination of measures, market, and, if necessary, building size:

- Savings (relative to baseline equipment)
- Cost (incremental or fully installed, depending on market)
- Lifetime (both baseline and high-efficiency options, if different)
- Operation and maintenance (O&M) impacts (relative to baseline equipment)
- Water impacts (relative to baseline equipment)

For each technology, measure savings were primarily drawn from secondary sources, such as technical reference manuals (e.g., Savings Estimation Technical Reference Manual for the California Municipal Utilities Association), previous potential studies (e.g., 2014 LADWP Energy Efficiency Potential Study for the LADWP Territory from 2014-2033, and California investor-owned utilities (IOUs) measure workpapers. For more complex measures not addressed by these sources, engineering calculations were made based on the best available data about current baselines in LADWP territory and the performance impacts of high-efficiency equipment or practices. Measure costs were drawn from the sources mentioned above as well as from baseline studies, incremental cost studies (e.g., 2010–2012 Work Order 017 – the Ex Ante Measure Cost Study Final Report), and direct pricing research. Measure lifetimes, O&M impacts (e.g., reduced replacement lamp purchases for new high-efficiency fixtures), and water impacts were generally developed from Technical Resource Manuals and potential studies.

Cost-Effectiveness Analysis

Another key step in the process was to develop a list of all measure permutations necessary to screen measures for cost-effectiveness in each territory. Optimal analyzed each measure and market combination for each building size and utility service territory. This took into account differences in climate, measure costs, lighting hours of use, and avoided costs. In total, Optimal Energy modeled more than 10,000 distinct combinations of measures, markets, building sizes, and utility service territories for each year of the analysis.

Cost-Effectiveness Tests

The study used the TRC test to determine measure cost-effectiveness. The TRC test considers the costs and benefits of efficiency measures from the perspective of society as a whole. The principles of this cost test are described in the *California Standard Practice Manual*.[75] Efficiency-measure costs for market-driven measures represent the incremental cost between a standard baseline (inefficient) piece of equipment or practice and the high-efficiency measure. For retrofit markets, the full cost of equipment and labor was used because it is assumed that without efficiency program intervention, no action would be taken by the household or building owner. Measure benefits are primarily energy savings over the measure lifetime, but can also include other benefits, such as water and operation and

maintenance savings. In calculating energy impacts, multiple fuels, end uses, and secondary impacts may have to be taken into account. For example, efficient lighting reduces waste heat, which in turn reduces the cooling load, but increases the heating load. All of these impacts are accounted for in the estimation of a measure's costs and benefits over its lifetime. The threshold benefit-cost ratio (BCR) for the TRC test used in this analysis is 0.3 rather than the more typical 1.0. This threshold is consistent with LADWP historic low-income program requirements.[76] To assess the sensitivity of the model to additional program costs, in addition to screening measures using only the measure costs, a second scenario using a modified TRC test for which measure costs were increased by 15% to account for non-incentive program administrative costs.

The following table shows the costs and benefits considered in the TRC test.

SUPPLEMENTARY TABLE 2: OVERVIEW OF THE TOTAL RESOURCE COST TEST

Monetized Benefits / Costs	Total Resource Cost (TRC)
Measure cost (incremental over baseline)	Cost
Program administrator incentives	Excluded*
Program administrator nonincentive program costs	Cost**
Energy and electric demand savings	Benefit
Fossil fuel increased usage	Cost
Operations and maintenance savings	Benefit
Water savings	Benefit
Deferred replacement credit***	Benefit
Non-energy benefits	Benefit
Cost of carbon****	Benefit

*Program administrator incentives were not included because only the economic potential, which typically does not include the impacts of incentives, was assessed.

** Program administrator nonincentive program costs were included in only one of the sensitivity scenarios assessed.

*** The Deferred Replacement Credit is applied to early-retirement retrofit measures, measures that obviate or delay the need for the replacement of existing equipment.

**** This analysis used a modified TRC test that accounted for the cost of avoided carbon dioxide emissions. These benefits are not normally included in the TRC test.

Avoided Energy Supply Costs

Avoided energy supply cost (or simply, avoided cost) calculations are used to assess the value of energy savings (or increased usage). Detailed estimation of avoided costs was outside the scope of the project, so the avoided electric costs provided by LADWP, and used in its most recent potential study, were adopted for this analysis. There are two aspects of electric efficiency savings: annual energy demand and coincident peak demand. The former refers to the reductions in actual energy usage, which usually account for the greatest share of electric economic benefits. However, because it is difficult to store electricity, the total reduction in the system peak demand is also an important impact. Power producers need to ensure adequate capacity to meet system peak demand, even if that peak is only reached a few hours each year. As a result, substantial economic benefits can accrue from reducing the system peak demand, even if little energy is saved during other hours. The avoided costs, and therefore the electric benefits reported in this study, reflect the impacts of both electric energy savings (kWh) and peak demand reductions (kW).

To develop the gas avoided costs, Optimal started with SoCalGas avoided costs data from Energy and Environmental Economics' (E3) Energy Efficiency Calculator, a tool used by all California IOUs to compute the cost-effectiveness of their energy-efficiency programs. The gas avoided costs assume the sum of the commodity, transmission, and distribution cost components in the E3 Calculator.

Non-Energy Benefits and Cost of Carbon

The impacts of non-energy benefits and costs of avoided carbon dioxide emissions were included in all scenarios assessed in this analysis. Non-energy benefits (NEBs) were estimated for LADWP's territory based on values filed by Southern California Edison (for electric) and SoCalGas (for gas) in their 2015–2017 California Energy Savings Assistance program applications.[77] For each utility, the sum of the planned total resource benefits and NEBs were divided by the total resource benefits to develop a utility-specific avoided-cost multiplier. For example, SoCalGas reported a planned $59.1 million in gas resource benefits and $88.6 million in non-energy benefits for the Low Income Energy Savings Assistance Program in 2017. Dividing the sum of the resource benefits and NEBs by the resource benefits yields a value of 2.5 (i.e., [59.1+88.6]/59.1 = 2.5). The electric and gas avoided costs were then multiplied

by these factors, presented in Supplementary Table 3 below, to account for the impact of NEBs in the cost-effectiveness testing.

SUPPLEMENTARY TABLE 3: NEB MULTIPLIERS		
IOU	**Electricity**	**Gas**
SCE	1.21	-
SoCalGas	-	2.55

The cost-benefit analysis also includes the impacts of avoided carbon dioxide emissions. This study values avoided CO_2 emissions at a constant $70/ton over the analysis period.[78] Similar to the non-energy benefits, this value was added to the avoided energy costs for the purpose of conducting cost-benefit analyses. To do this, the cost of carbon was first converted to a cost per kWh saved and cost per MMBtu saved for electric and natural gas, respectively. Using California marginal resource emissions rates, this yielded carbon costs of $0.04/kWh for electric and $3.71/MMBtu for natural gas.

Economic Potential Analysis

Once all measure permutations were screened for cost-effectiveness, Optimal took into account the number of housing units and a number of other factors to derive the total economic potential for the LADWP service territory. In addition to unit counts, the analysis adjusted for applicability, space and water heating fuel shares, cooling equipment saturations, and not complete factors. All of these factors serve to reduce the total number of housing units in a given utility territory to only those units where the measure of interest could be applied. These factors are described in more detail below:

Applicability is the fraction of housing units for which a given measure represents a realistic option. For example, duct-sealing measures are only applicable to housing units with ducted HVAC systems.

Space Heating Fuel Shares are the percentages of housing units using electricity, natural gas, or fuel oil for space heating. For example, a Wi-Fi thermostat measure characterized to estimate gas savings should only be applied to the fraction of housing units using gas as their space heating fuel.

Water Heating Fuel Shares are the percentages of housing units using electricity, natural gas, or fuel oil for water heating. Both space and water heating fuel shares were provided by project partner Elevate Energy.

Cooling Equipment Saturations are the percentages of housing units using window or room air-conditioners (AC) versus central AC. Central AC tune-up measures, for example, should only be applied to housing units with central AC.

Not Complete is the percentage of housing units with equipment that already represents the high-efficiency option. This only applies to retrofit markets. For example, if 5% of sockets already have LED lamps, then the not complete factor for LEDs would be 5% (1.0–0.95), reflecting that only 95% of the total potential from LEDs remains.

The product of all these factors and the total housing units by service territory and energy saving potential is the total economic potential for each measure permutation. Total measure-level savings and costs are both derived using the same approach. However, the total economic potential is less than the sum of each separate measure potential. This is because of interactions between measures and competition between measures. Interactions result from the installation of multiple measures in the same facility. For example, if a building is insulated, the heating load is reduced. As a result, if a high efficiency furnace is then installed, savings from the furnace will be lower because the overall heating needs of the building have been lowered. As a result, interactions between measures should be taken into account to avoid overestimating savings potential. Because the economic potential assumes all possible measures are adopted, the accounting for interactions assumes every building does all applicable measures. Interactions are accounted for in this analysis by ranking each set of interacting measures by total savings, and assuming the greatest savings measure is installed first, and then the next highest savings measure. In some cases, measures with marginal savings may not pass the cost-effectiveness test after all interactions are accounted for.

To estimate the economic potential, Optimal generally assumed 100% installation of retrofit and market-driven (natural replacement or renovation) measures, but neglected practical constraints and assumed all retrofit measures can be installed immediately. For measures that are market-driven only, it is assumed that measures are implemented at the rate of turnover. Turnover is the percentage of existing equipment that will be naturally replaced each year because of failure, remodeling, or renovation. In general, turnover factors are assumed

to be one divided by the baseline equipment measure life. For example, Optimal assume that that 5% or 1/20th of existing equipment is replaced each year for a measure with a 20-year estimated life.

The estimated economic potential is not differentiated by subsidy type (i.e., unsubsidized affordable, subsidized affordable, and public housing authority-owned). Optimal believes this approach is appropriate because economic potential assumes 100% measure adoption and does not need to reflect differing program strategies that might be used, or penetration rates achieved. Assuming 100% adoption is a proxy that LADWP can assess to determine how much potential energy savings it is willing to achieve. While there may be some systematic differences in variables like housing unit size or number of occupants based on subsidy type, we do not expect these to be very large and available data, in any case, is not sufficient to quantify these distinctions.

Non-Incentive Program Budgets

As discussed previously, the sensitivity of the model to additional program costs was explored by increasing the measure costs by 15% to account for non-incentive program administrative costs.[79] For example, if total incentive budgets were estimated at $1 million, a non-incentive budget of $150,000 would be assumed. These additional program costs were assessed at the measure level and could affect measure cost-effectiveness, and therefore, inclusion in the economic potential. However, in practice, this cost increase did not cause many measures that had passed the 0.3 BCR requirement to fail.

Job-Years Study

Job estimates were calculated by BW Research Partnership.[80] Using a customized survey, BW Research estimated median labor hours for the 49 major energy-efficiency measures included in the potential analysis described above. It then estimated the total number of jobs that would be created if the full cost-effective energy savings potential was achieved.

The BW Research team created a comprehensive survey that was provided to energy-efficiency employers in California. The survey, sent via a web link, included questions related to revenue and workforce characteristics, such as survey participants' awareness of specific rebates or incentives, affiliation with unions, hiring difficulties, and education and experience requirements. Employers were asked to assign the number of labor hours to complete each measure in a typical energy-efficiency project. The hours per job estimate used to convert total job hours to total jobs was 1,875.

Energy-Efficiency Potential Results

Electric and Gas Savings

A breakdown of the total economic electric and gas savings potential in low-income multifamily units in 2018 if all cost-effective measures were adopted is presented in Supplementary Tables 4 and 5. For the first year of analysis, all possible retrofit measures (as opposed to replace on burnout measures) were included. Defining low-income households as those earning less than 80% of AMI, there are some 409,278 low-income multifamily homes in the LADWP service territory.

SUPPLEMENTARY TABLE 4: COST-EFFECTIVE ELECTRIC POTENTIAL SAVINGS

Construction Vintage	Savings Units	2018	2019	2020	2025	2030
Pre-1950	MWh	65,221	70,128	49,923	55,662	45,905
	% Total Sales	28	30	21	24	20
195–1978	MWh	204,448	217,731	163,233	174,161	144,197
	% Total Sales	29	31	23	25	20
1979–1990	MWh	77,154	82,262	65,653	71,970	62,128
	% Total Sales	31	33	26	29	25
Post-1990	MWh	66,186	70,577	56,828	62,522	54,270
	% Total Sales	31	33	26	29	25
Total	**MWh**	**413,009**	**440,698**	**335,637**	**364,314**	**306,500**
	% Total Sales	**29**	**31**	**24**	**26**	**22**

SUPPLEMENTARY TABLE 5: COST-EFFECTIVE GAS POTENTIAL SAVING[81]						
Construction Vintage	**Savings Units**	**2018**	**2019**	**2020**	**2025**	**2030**
Pre-1950	1000 therms	4,509	4,583	4,722	5,168	4,473
	% Total Sales	24	25	25	28	24
195–1978	1000 therms	12,261	12,460	12,834	14,099	12,306
	% Total Sales	25	25	26	28	25
1979–1990	1000 therms	3,356	3,403	3,506	3,803	3,354
	% Total Sales	26	26	27	29	26
Post-1990	1000 therms	2,701	2,738	2,821	3,053	2,696
	% Total Sales	27	27	28	30	27
Total	**1000 therms**	**22,826**	**23,184**	**23,882**	**26,123**	**22,829**
	% Total Sales	**25**	**25**	**26**	**28**	**25**

Another 299,257 households qualify as low income using the criteria that income is under 200% of the FPL.[82] These per-unit savings, presented in Supplementary Table 6, can be scaled according to other eligibility criteria to determine economic energy savings potential for that population.

Highest Cost-Effective Energy Savings Measures

The top electric savings measures, based on 2018 economic savings potential, account for 73% of the total electric energy savings potential for 2018. LADWP consistently offers about half of these measures, the other half are being considered for the future.

SUPPLEMENTARY TABLE 6: AVERAGE ANNUAL COST-EFFECTIVE POTENTIAL SAVINGS AVAILABLE PER APARTMENT UNIT					
	2018	**2019**	**2020**	**2025**	**2030**
Electric (kWh)	1,009	1,077	820	890	749
Gas (therms)	56	57	58	64	56

SUPPLEMENTARY TABLE 7: HIGHEST SAVING (2018) ELECTRIC MEASURES FROM THE COST-EFFECTIVE PORTFOLIO[83]			
Electric End Use	**Measure**	**Contribution to Cumulative 2018 Savings (%)**	**Measure Already Offered by LADWP?***
Lighting	Standard LED (In-unit)	29	Yes
Lighting	Specialty Lighting (In-unit)	8	No, in planning stages
Water Conservation Measures	Commercial Laundry (Washer and dryer, common area)	7	No, in planning stages
Other	Behavioral	6	Partially
Lighting	Standard LED (Common area)	6	Yes
Programmable Thermostats	Wi-Fi Thermostat	5	Partial (via the Energy Savings Assistance program and the solar team)
Appliances	Refrigerator (CEE Tier 3)	4	Yes
Power Strips	Advanced Power Strip	4	Yes
Building Design	Air Sealing	4	Yes

SUPPLEMENTARY TABLE 8: HIGHEST SAVING (2018) GAS MEASURES FROM THE COST-EFFECTIVE PORTFOLIO (WITHOUT INCORPORATING HEAT PUMP WATER HEATERS			
Gas End Use	**Measure**	**Percentage Contribution to Cumulative 2018 Savings**	**Measure Already Offered by LADWP?[84]**
Water Heating	Water Heater Pipe Wrap	20	No (Offered by SoCal Gas)
Water Heating	Demand Control for Domestic Hot Water Recirculation Pump	11	Partial
Whole Building Heating	Retrocommissioning, HVAC Controls	10	Partial
Water Heating	Low-Flow Showerhead	10	Yes
Whole Building Heating	Low-Flow Faucet Aerator	9	Yes
Space Heating	Efficient In-Unit Furnace	7	No (Offered by SoCalGas on limited basis)
Water Heating	Efficient Central Boiler	6	Limited (Some will be offered via ESA's Common Area Measure program)
Water Heating	Boiler Pipe Insulation	6	No (Offered by SoCal Gas)
Appliances	Commercial Laundry (Common area)	6	No (Offered by SoCal Gas)
Water Heating	Water Heater Tank Wrap	5	No (Offered by SoCal Gas)

Supplementary Table 8 presents natural gas measures and their average contribution to available economic potential in 2018. These ten measures account for 90% of available economic potential gas savings.

Heat pump water heaters (HPWHs) have intentionally been left out from Supplementary Table 8 HPWHs were modeled as upgrades from both electric water heaters and gas water heaters. Upgrading gas water heaters to HPWHs involves switching the water heating fuel from gas to electric. In this scenario, all of the annual water heater gas energy use is avoided but electric HPWH load is added. Estimating energy savings for this measure requires consideration of this cross-fuel impact.[85]

Savings by Measure-Delivery Mechanism

Each measure is classified as either replace-on-burnout (ROB) or retrofit. Retrofit measures are better suited to direct-install type programs and may require the expertise of program-approved contractors or implementers. ROB measures are acquired by customers through a market purchase and self-installed and are thus offered through market discounts, vouchers, and rebates.

SUPPLEMENTARY TABLE 9: ELECTRIC SAVINGS CONTRIBUTIONS BY MEASURE DELIVERY MECHANISM				
Measure Delivery Mechanism	**2018**	**2020**	**2025**	**2030**
Replace-on-Burnout	21%	45%	61%	68%
Retrofit	68%	41%	37%	27%
Both	11%	14%	2%	5%

SUPPLEMENTARY TABLE 10: GAS SAVINGS CONTRIBUTIONS BY MEASURE DELIVERY MECHANISM, COMPREHENSIVE SCENARIO				
Measure Delivery Mechanism	**2018**	**2020**	**2025**	**2030**
Replace-on-Burnout	63%	68%	76%	84%
Retrofit	34%	29%	22%	15%
Both	3%	3%	2%	1%

Supplementary Tables 9 and 10 present the percentage breakdown of total savings by measure install by measure delivery mechanism. Some measures qualify as both ROB and retrofit; these measures' savings contributions are labeled as "Both" in Supplementary Table 10. Over time, existing equipment fails and the opportunity to install ROB measures increases. This trend is reflected through the ROB measures' increasing economic potential over time relative to retrofit measures.

These findings imply that LADWP can achieve most of these savings through market intervention programs that incentivize owners or residents to undertake ROB measures. These types of programs are also easier to scale up once they are designed and implemented. Retrofit measures, as explained above, usually require greater resources.

Investment Opportunity: Economic and Financial Potential

Supplementary Table 11 shows the benefits and costs associated with capturing available economic potential through 2030. Capturing all economic potential would result in a benefit-cost ratio of 1.5 in 2018 and 2.1 through 2030. Benefit-cost ratios for both electric and gas energy savings potential are greater than one throughout the analysis time-period.

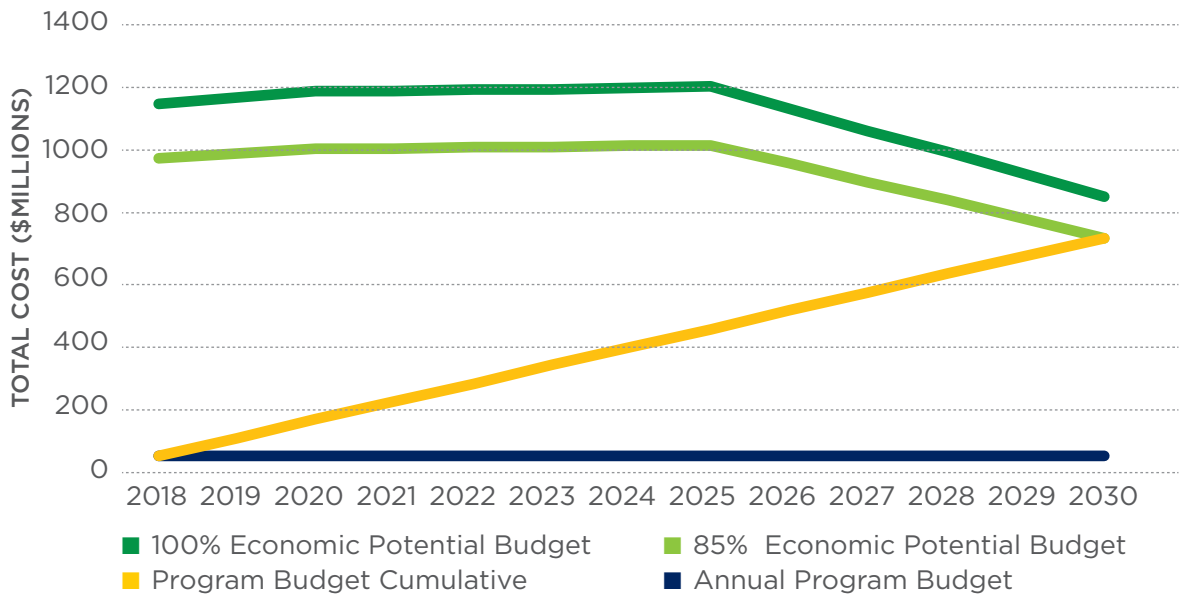
An annual combined (gas and electric) program budget of $75 million would be required to capture 85% of available economic potential energy savings through 2030, according to NRDC's analysis of these program costs and benefit. This analysis is presented in Supplementary Figure 3.

The assumption that LADWP would be able to capture at most 85% of the available economic potential is based on practical constraints that LADWP may face, such as the possibility that a subset of multifamily customers would be hard to reach or would not want to participate in LADWP's programs.

Administrative (including marketing) costs of running a program, which NRDC assumed are 15% of the total measure incremental costs, are included in the costs presented in Table 6. NRDC further assumed that LADWP, for low-income housing programs, would subsidize an average of 90% of measures' incremental costs.

SUPPLEMENTARY TABLE 11: BENEFITS AND COSTS ($MILLIONS) OF ANNUAL AVAILABLE ECONOMIC POTENTIAL IN LADWP SERVICE TERRITORY BY YEAR												
	2018			**2020**			**2025**			**2030**		
	Costs	**Benefits**	**BCR**	**Costs**	**Benefits**	**BCR**	**Costs**	**Benefits**	**BCR**	**Costs**	**Benefits**	**BCR**
Electric	$ 508	$658	1.3	$510	$665	1.3	$470	$669	1.4	$269	$484	1.8
Gas	$1,045	$1,706	1.6	$1,123	$1,905	1.7	$1,294	$2,375	1.8	$989	$2,156	2.2
Total	$1,553	$2,366	1.5	$1,633	$2,569	1.6	$1,764	$3,044	1.7	$1,258	$2,640	2.1

SUPPLEMENTARY FIGURE 3: TOTAL PROGRAM SPENDING REQUIRED TO CAPTURE 85% OR 100% OF ECONOMIC POTENTIAL THROUGH 2030



Bill Savings

Economic Impact on Customers

If all economic potential energy savings are attained, annual potential bill savings for customers would be about $85 million in 2018 and decrease to $68 million in 2030. These potential bill savings decrease over time for the same reason that total economic potential decreases; upcoming code and standard improvements reduce future energy savings potential from the measures considered in this study from the perspective of the investing utility. Supplementary Table 12 presents a breakdown of savings by year and fuel type.

Decarbonization Potential

Switching appliances from conventional natural gas to electricity can also contribute to reducing GHG emissions. However, these measures in most instances cause customer utility bills to increase because of the higher cost of electricity than gas.[87]

This analysis is timely given the City of Los Angeles' recent commitment to reducing GHG emissions from residential buildings through transitioning appliances from conventional natural gas to electricity.[88] Supplementary Table 15 presents the energy usage impact and cost impact of switching from gas to electric for various appliances. Program administrators can avoid possible customer bill

SUPPLEMENTARY TABLE 12: ANNUAL CUSTOMER ENERGY BILL SAVINGS POTENTIAL ($MILLIONS) (80% AMI POPULATION SCREENING AND COMPREHENSIVE MEASURE LIST SCENARIO[86]

	2018	2019	2020	2025	2030
Electricity	$66	$71	$ 54	$ 58	$49
Gas	$19	$ 19	$20	$22	$19
Total	$85	$90	$74	$80	$68

increases from electrification by packaging these electrification measures with other standard energy-efficiency measures (like LED lighting) in the same measure-package as HPWH.

Job Benefits

In addition to the energy savings and economic benefits of designing programs to capture all cost-effective savings, more than 34,000 new job-years, or approximately 3,000 permanent jobs, would be created over the study's timeframe of 2018 to 2030, according to a BW Research.[89]

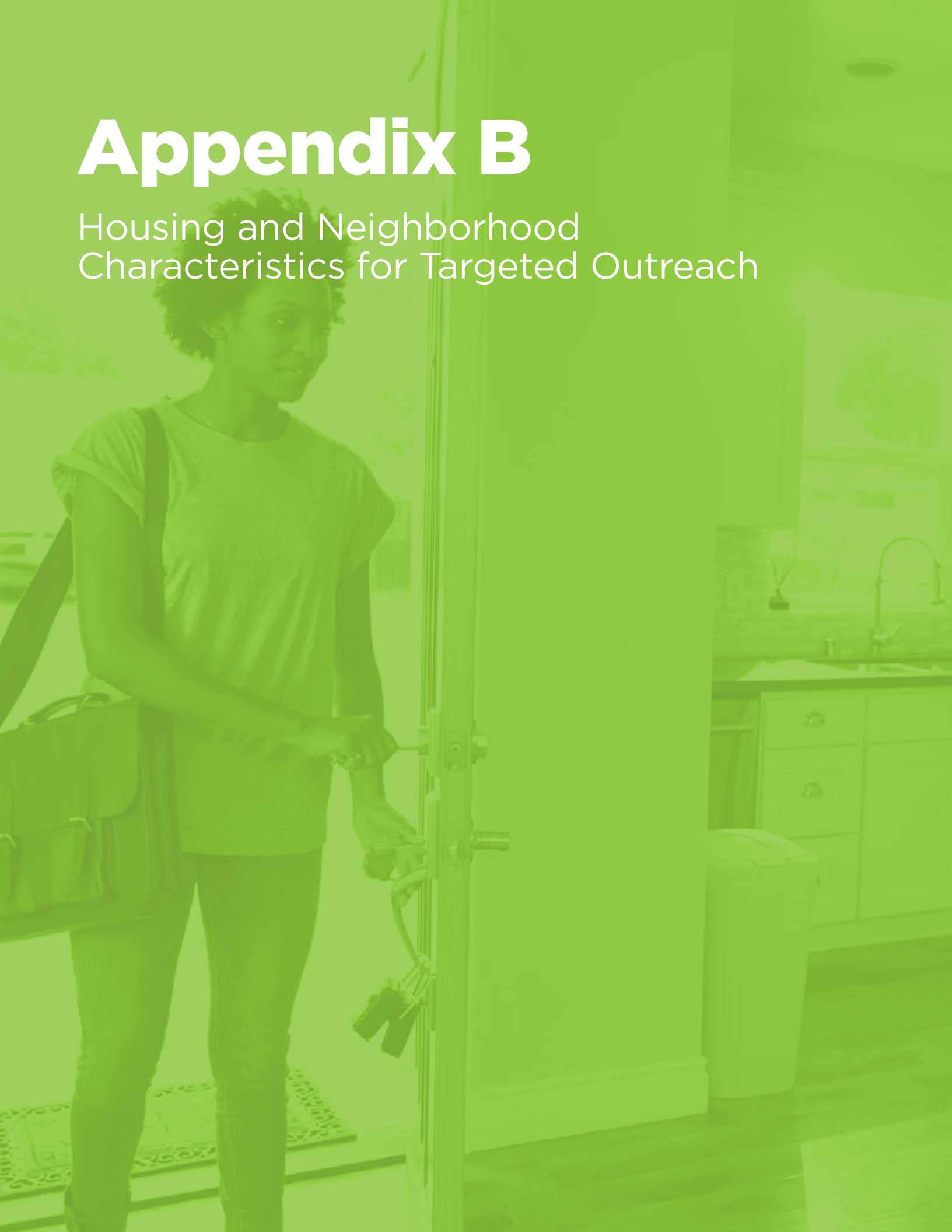
As a point of comparison, for every $1 million of direct investment in energy-efficiency programs, LADWP and UCLA anticipate the creation of 16 job-years, greater than the average 10.7 job-years for equivalent investment in residential construction.

SUPPLEMENTARY TABLE 13: PER-UNIT IMPACT OF FUEL SWITCHING MEASURES ON CUSTOMER CONSUMPTION AND ANNUAL ENERGY BILLS

Measure	Additional Electric Usage (kWh)	Gas Savings (therms)	Electric Bill Increase	Gas Bill Reduction	Net Bill Impact	Total Resource Cost Test Score
Heat pump water heat-er – In-unit, Gas storage baseline	1,309	188	$209	$156	+ $53	1.7
Heat pump water heat-er – Central, Gas stor-age baseline	1,309	182	$209	$151	+ $59	2.1
Efficient In-Unit HP (Air-Source), AC w/ furnace baseline (ROB)	376	45	$60	$37	+ $23	N/A
Efficient In-Unit HP (Air-Source), AC w/ furnace baseline (Retrofit)	198	50	$32	$42	- $10	4.2

Appendix B

Housing and Neighborhood Characteristics for Targeted Outreach



High Opportunity Areas – Market Characterization

To characterize the property traits, size, age, and affordability of Los Angeles' affordable multifamily sector, ten private and publicly available datasets were aggregated and analyzed. Findings from this analysis can help programs do outreach in a targeted, strategic manner, and can also inform program design overall. The table below provides a list and description of each dataset analyzed.

Data, when possible, was analyzed in census tracts and then aggregated to communities with defined boundaries. Data from both the American Community Survey (ACS) and the Housing + Community Investment Department of Los Angeles (HCIDLA) were used to determine the number of units and properties in Los Angeles. There is a difference between the number of units in the datasets due to different collection methods.

Based on an analysis of these data sets, this report presents the following findings:

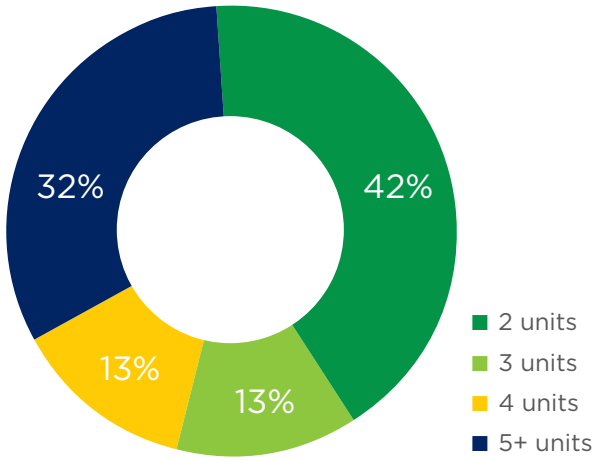
1. The majority of multifamily properties in Los Angeles (68%) are less than five units, lower-cost than average market rate, and unsubsidized.
2. The vast majority of deed-restricted units (84%) are located in large properties, i.e., with more than 20 units.[91]
3. The vast majority (82%) of multifamily buildings in Los Angeles were built before 1978 and account for more than half (55%) of all multifamily energy use in the city.
4. Most low-income households are located in Los Angeles neighborhoods with the highest energy-intensity—those that use the most energy per square foot of property—with concentrations in the San Fernando Valley and South Los Angeles.

The following sections provide more details on each of these key observations.

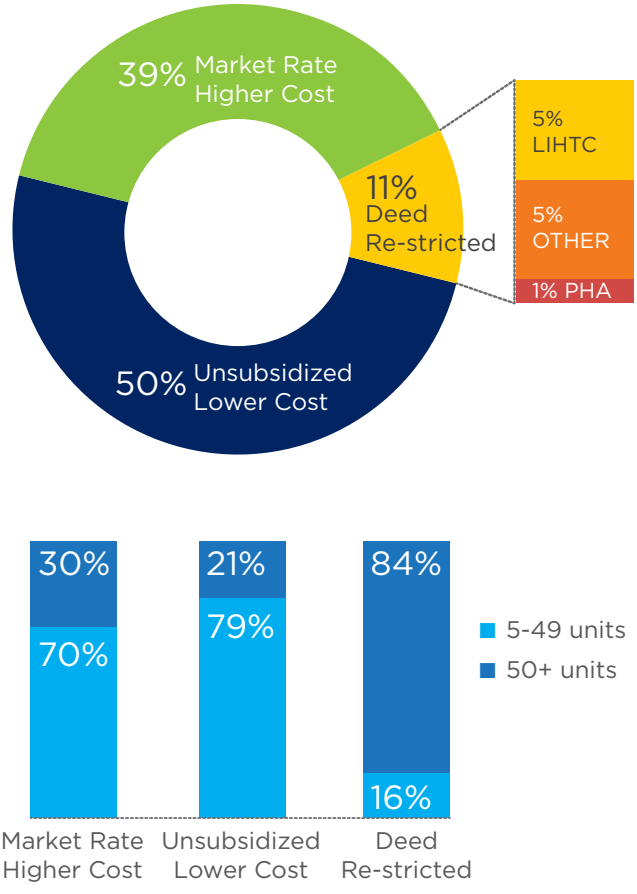
Low-Cost, Small Multifamily Properties

The City of Los Angeles has an estimated 110,040 low-income (defined as households with 80% or less of the area median income (AMI)) rental housing properties with more than two units).[92] The majority, roughly 68%, have fewer than five units. See Supplementary Figure 4. That means that there are about 28,000 buildings with between 5 and 20 units,

SUPPLEMENTARY FIGURE 4: MULTIFAMILY PROPERTIES IN THE CITY OF LOS ANGELES, N=110,040 (HCIDLA 2014–2017)



SUPPLEMENTARY FIGURE 5: MULTIFAMILY UNITS IN CITY OF LOS ANGELES, N=668,000 (5+ UNIT PROPERTIES, 80% AMI) (ACS 2014)



SUPPLEMENTARY TABLE 14: MULTIFAMILY HOUSING STOCK DATASETS ANALYZED

Dataset	Description	Number of Buildings	Number of Units	Unit of Analysis	Data Available (not inclusive)
Los Angeles County Assessor (2014)	A comprehensive listing of buildings in the City of Los Angeles	34,800	569,247	Parcel	Units, Square Footage, Address
UCLA Energy Atlas (2016)	An interactive website of building energy-use data that is based on the Los Angeles County Assessor's data	10,4000 parcels	N/A	Parcel	Energy-Use Intensity, Units, Stories
CoStar (2015)	A commercial real estate database with a multifamily module	22,035	308,705	Property	Owner Contacts, Rent Estimates, Units, Address
American Community Survey (2014–2015)	A U.S. Census Bureau survey of demographic data	-	~650,000	Household, Building Units	Units, Income, Fuel Type, Year Built
Southern California Association of Nonprofit Housing (SCANPH) (2015)	A comprehensive listing of completed affordable housing developments in Los Angeles County (incudes NHPD and HCIDLA datasets)	1,308	-	Property	Subsidies, Address
National Housing Preservation Database (NHPD) (2014)	A U.S. Department of Housing and Urban Development (HUD) database of federally subsidized properties (a data source within the SCANPH dataset)	868	64,209	Property	Type of Subsidies, Subsidy Expiration Dates
Los Angeles Housing + Community Investment Department **Code Compliance Rent Information System (CCRIS) housing inspection database (2014–2017)**	HCIDLA's CCRIS database includes rental properties of two units or more subject to HCIDLA's Systematic Code Enforcement Program. A subset of data for properties inspected between 2014 and 2017 was provided as well as summary Gateway-to-Green survey data, a subset of CCRIS.	34,002	566,855	Building	Address, Units, Year Built
American Housing Survey (AHS) (2011)	A U.S. HUD and Census Bureau biennial survey that provides descriptions of HVAC systems in renter-occupied homes	-	~280,000	Housing Unit, Census Tract (Metropolitan Statistical Area-MSA)	Air Conditioning, Cooling Fuel, Year Built, Stories
Seismic Data (2016)	Descriptive list of various types of soft-story buildings[90] in Los Angeles built before 1976 at risk of seismic damage	13,500	-	Property	Address, Stories, Year Built, Square Footage

SUPPLEMENTARY TABLE 15: PROGRAM OUTREACH METRICS FROM THE CALIFORNIA HOUSING PARTNERSHIP CORPORATION'S AND COSTAR DATABASES AND TRADE ASSOCIATIONS		
Low-Income Eligibility Designation	**No. of Multifamily Units**	**Program Eligibility Considerations**
80% Area Median Income	409,278	80% AMI is the standard for qualifying for affordable housing used by HUD. 110,000 of these units don't qualify for the California Energy Savings Assistance Program (ESA), for which LADWP is a partner.
200% Federal Poverty Level	299,257	The ESA program unit count is estimated based on findings in the Cadmus Multifamily Study.[94]
Disadvantaged Community	274,200	These units are eligible for Greenhouse Gas Reduction Fund(ed) programs, including LIWP-MF.

as almost 80% of multifamily properties with 5 or more units contain fewer than 20 units, according to CoStar data.

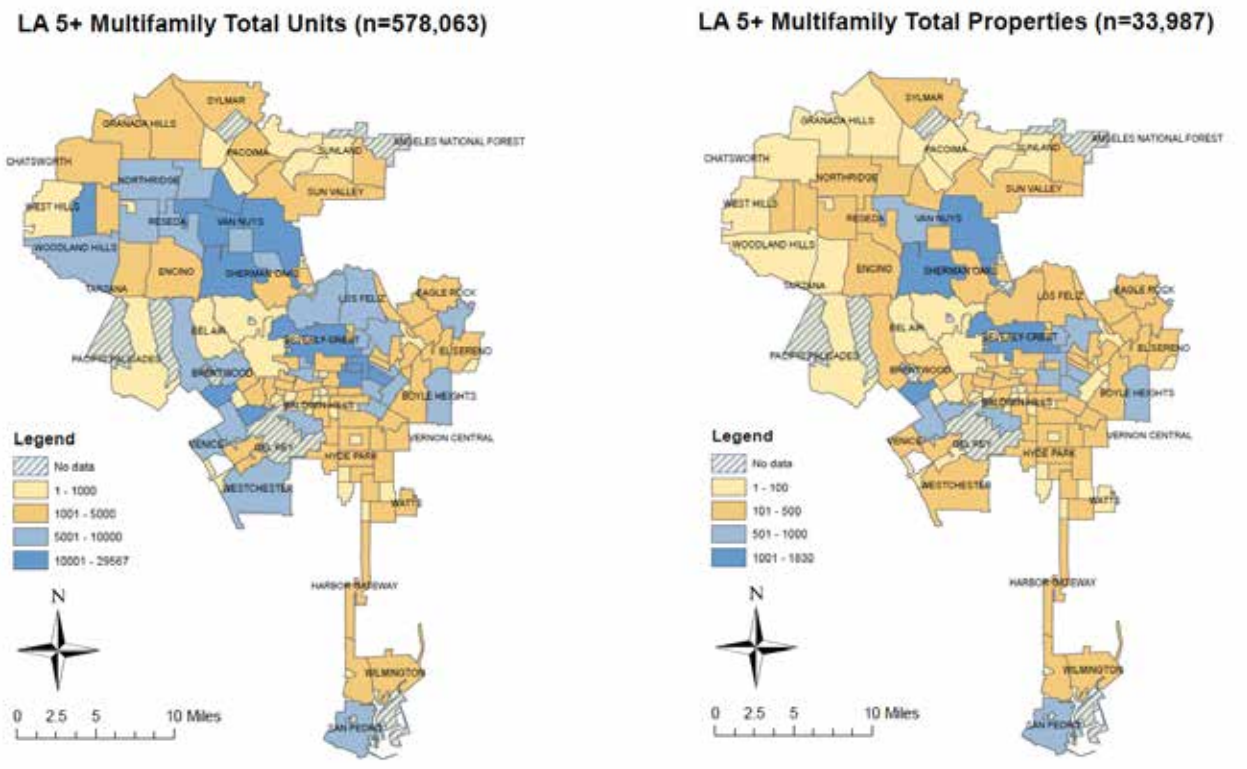
There are an estimated 668,000 units in all multifamily buildings with five or more units. Of these multifamily units, 41%, or 274,200 units, are located in high-risk Disadvantaged Communities (DAC), or areas most burdened by environmental and socioeconomic issues, and the majority of these are unsubsidized lower-cost units.[93]

Large Deed-Restricted Affordable Housing Properties

The majority of deed-restricted units (84%) are located in large properties with 50 or more units.[95] Although only 11% of multifamily units in the City of Los Angeles are deed-restricted, 84% of them are in these large properties.[96]

Supplementary Figure 6 illustrates the geographic distribution of multifamily properties and units within the boundaries of City of Los Angeles neighborhoods. By comparing the two maps,

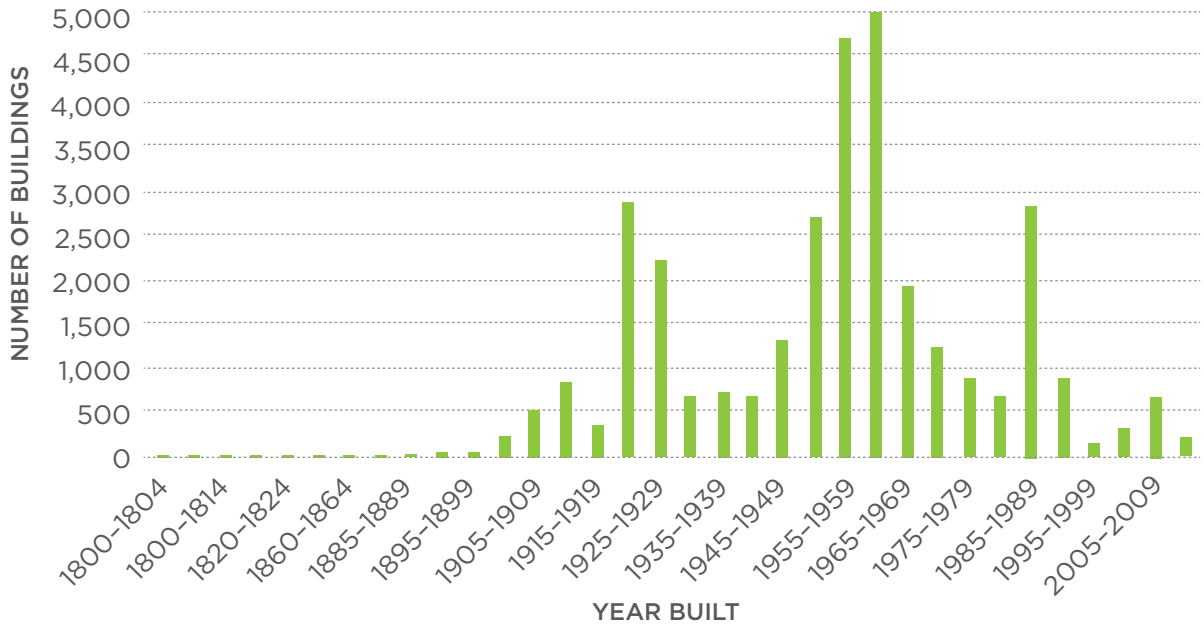
SUPPLEMENTARY FIGURE 6: MULTIFAMILY TOTAL PROPERTIES WITH FIVE OR MORE UNITS (LEFT) AND TOTAL UNITS (RIGHT) (LOS ANGELES COUNTY ASSESSOR, 2014)



SUPPLEMENTARY TABLE 16: HOUSING TYPES, UNIT COUNTS, AND PROGRAM DESIGN CONSIDERATIONS		
Housing Type	**# Units**	**Program Design Considerations: Finance and Retrofit Timing**
Unsubsidized Affordable Units	335,682	About 85% of buildings built pre-1978 and subject to LA's Rent Stabilization Ordinance are in this category.
Deed-Restricted Affordable Housing Units	73,616	See the three rows below for breakdown of these units.
Units Supported With Low-Income Housing Tax Credits	31,659	• Energy-efficiency programs for these units must be targeted during resyndication or rehabilitation. • The California Tax Credit Allocation Committee requires rehabilitation units to reduce energy usage by at least 10%. • Rents are restricted for up to 55 years. • Most bill savings from common-area upgrades are included in calculations for residual receipts payments[97] and returned to project public lenders (e.g., HCIDLA or HUD); they don't stay with the property or owner.
Public Housing	7,099	• Utility bills are not paid by residents. • Large-scale retrofits have been completed by the ESA program for many of these units, that are owned by the Housing Authority of the City of Los Angeles.
Units Supported With Other Subsidies	34,858	Specific subsidies will dictate the appropriate timing for efficiency investments.

observations can be made about specific neighborhoods. For example, Woodland Hills, a northeastern Los Angeles neighborhood, does not have a high concentration of properties but has a significant number of units. As a result, it can be concluded that Woodland Hills consists primarily of large multifamily buildings. Conversely, a darker shade in the map showing total properties and a lighter shade on the map showing total units suggest that such a neighborhood has a high concentration of small multifamily buildings. Supplementary Table 15 reflects the same property and unit information

SUPPLEMENTARY FIGURE 7: NUMBER OF MULTIFAMILY BUILDINGS BUILT IN LOS ANGELES OVER THE PAST TWO CENTURIES (LOS ANGELES COUNTY ASSESSOR, 2014)



for the top 20 neighborhoods ranked by number of units, where a value of one indicates the highest number of units or properties.

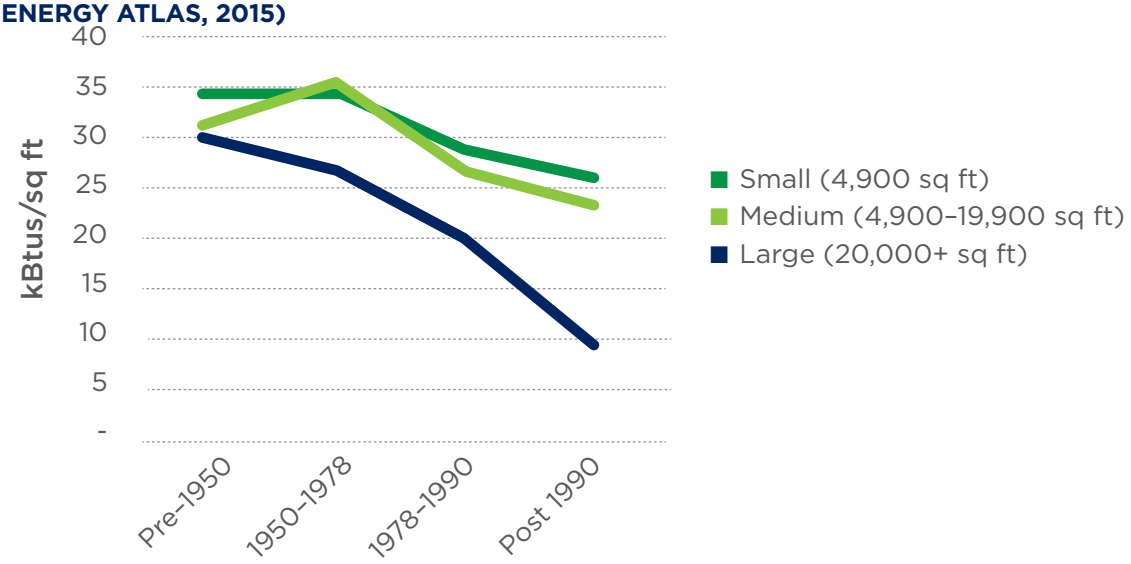
Older Properties Built Before Energy Codes Existed

The vast majority of multifamily buildings in Los Angeles (82%) were built before 1978 and account for more than half (55%) of all multifamily energy use in the city. See Supplementary Figure 7.[98]

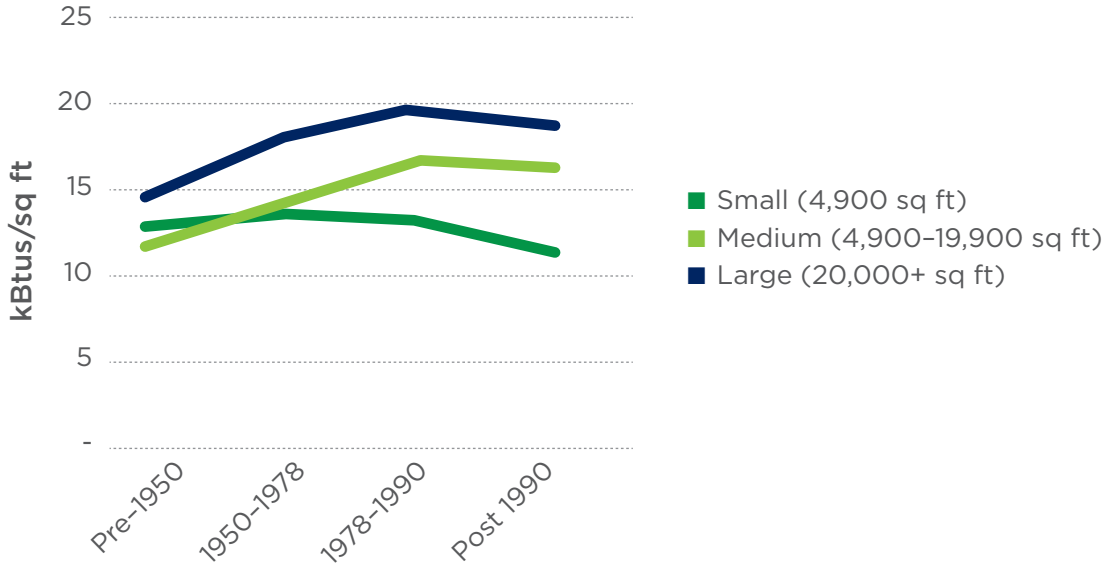
In general, there is a decrease in energy intensity in newer and larger properties as a result of the adoption of more stringent energy codes. However, electricity use appears to increase in newer and larger properties, perhaps because those properties are more likely to have air-conditioning. See Supplementary Figure 9.

The Los Angeles Energy Atlas also revealed that half of the most energy-intensive neighborhoods in the city are located in the San Fernando Valley,

SUPPLEMENTARY FIGURE 8: MEDIAN ANNUAL GAS USE INTENSITY IN 2015 (LA ENERGY ATLAS, 2015)



SUPPLEMENTARY FIGURE 9: MEDIAN ANNUAL ELECTRIC USE INTENSITY IN 2015 (LA ENERGY ATLAS, 2015)



SUPPLEMENTARY TABLE 17: THE TOP 25% OF ENERGY INTENSIVE NEIGHBORHOODS IN LOS ANGELES (LA ENERGY ATLAS, 2015)

Neighborhood	Median Energy Use Intensity (kBtus/sq ft)	Geographic Area
Manchester Square	58	South Los Angeles
Sunland	58	San Fernando Valley
Sunland-Tujunga	57	San Fernando Valley
Harvard Park	56	South Los Angeles
Florence-Firestone	55	South Los Angeles
Hyde Park	55	South Los Angeles
Vermont Knolls	54	South Los Angeles
Pacoima	53	San Fernando Valley
Playa Vista	53	N/A
Vermont-Slauson	52	South Los Angeles
Broadway-Manchester	52	South Los Angeles
Valley Glen	52	San Fernando Valley
Florence	52	South Los Angeles
Reseda	51	San Fernando Valley
Westchester	51	N/A
Leimert Park	51	South Los Angeles
Canoga Park	51	San Fernando Valley
Van Nuys	51	San Fernando Valley
Panorama City	51	San Fernando Valley
Vermont Vista	51	South Los Angeles
Woodland Hills	50	San Fernando Valley
Chatsworth	50	San Fernando Valley
North Hills	50	San Fernando Valley
Sylmar	50	San Fernando Valley
Gramercy Park	50	South Los Angeles
North Hollywood	50	San Fernando Valley
Atwater Village	50	N/A
Valley Village	50	San Fernando Valley

while 40% are located in South Los Angeles. See Supplementary Table 18.

Supplementary Table 17 illustrates the equipment types commonly found in multifamily properties based on specific characteristics, including age and size.[99] The table supports the conclusion that older properties are the most energy intensive, specifically because of the preponderance of large and old equipment in them.

The majority (63%) of renter-occupied units are gas heated, according to the 2011 American Housing Survey. Also according to the survey, 45% of renters use forced-air furnaces and 33% have floor, wall, or other built-in, hot-air units without ducts as their main heating equipment.[100]

Neighborhoods With the Highest Energy Usage per Household

The majority of low-income households are located in the most energy-intensive neighborhoods in Los Angeles, with concentrations in the San Fernando Valley and South Los Angeles. Supplementary Table 17 shows Los Angeles neighborhoods ranked by energy intensity as well as the neighborhoods' ranking for number of units and number of properties. A value of 1 indicates the highest number of units and properties.

Table 18 lists all of Los Angeles' neighborhoods ranked by number of units, number of properties, and median EUI. A value of 1 indicates the highest number of units, properties, or EUI. Some neighborhoods listed do not have an EUI rank because they are considered a part of a larger neighborhood by the data source, the LA Energy Atlas. Understanding the distribution of units versus properties and EUI can be helpful for targeted outreach strategies.

SUPPLEMENTARY TABLE 18: EQUIPMENT TYPES FOUND IN MULTIFAMILY PROPERTIES IN LOS ANGELES BASED ON AGE AND SIZE

	Age		Size		Location	Typical Energy Source
Equipment Type	**Pre-1978**	**Post-1978**	**Large MF (25+ units)**	**Small MF (<25 units)**		
Space Cooling	Wall/window AC	In-unit central system	Unavailable	Unavailable	Inland/Not along the coast or south LA	Electric
Space Heating	In-unit wall furnaces	In-unit wall furnaces	Central heating (for very large old properties)	Unavailable	All units are required to possess a furnace or other heater	Gas
Domestic Hot Water Heater (DHW)	Central boilers[101]	Large tank water heater	Central boilers	Small water heater or tankless (rare)	Unavailable	Gas
Common Lighting	Incandescent/ CFL	CFL/LED[102]	CFL/LED	Incandescent/ CFL	Unavailable	Electric
Envelope	No insulation[103]	Insulated	Unavailable	Unavailable	Unavailable	Unavailable

Note: "Unavailable" indicates that general conclusions could not be reached.

SUPPLEMENTARY TABLE 19: THE TOP 20 NEIGHBORHOODS RANKED BY ENERGY USE INTENSITY, WITH RANKING OF NUMBER OF UNITS AND PROPERTIES

Neighborhood	EUI Rank	Unit Rank	Property Rank
Manchester Square	1	112	101
Sunland	2	99	109
Tujunga	3	64	67
Harvard Park	4	86	77
Florence-Firestone	5	90	68
Hyde Park	6	49	36
Vermont Knolls	7	89	74
Pacoima	8	63	90
Playa Vista	9	85	117
Valley Glen	10	39	33

Neighborhood	EUI Rank	Unit Rank	Property Rank
Reseda Ranch	11	132	133
Reseda	12	23	49
Westchester	13	30	26
Leimert Park	14	81	63
Canoga Park	15	10	23
Van Nuys	16	5	7
Panorama City	17	13	28
Vermont Vista	18	53	34
Woodland Hills	19	20	93
Chatsworth	20	65	106

SUPPLEMENTARY TABLE 21: ENERGY USE INTENSITY OF LOS ANGELES NEIGHBORHOODS, ORDERED BY NUMBER OF UNITS

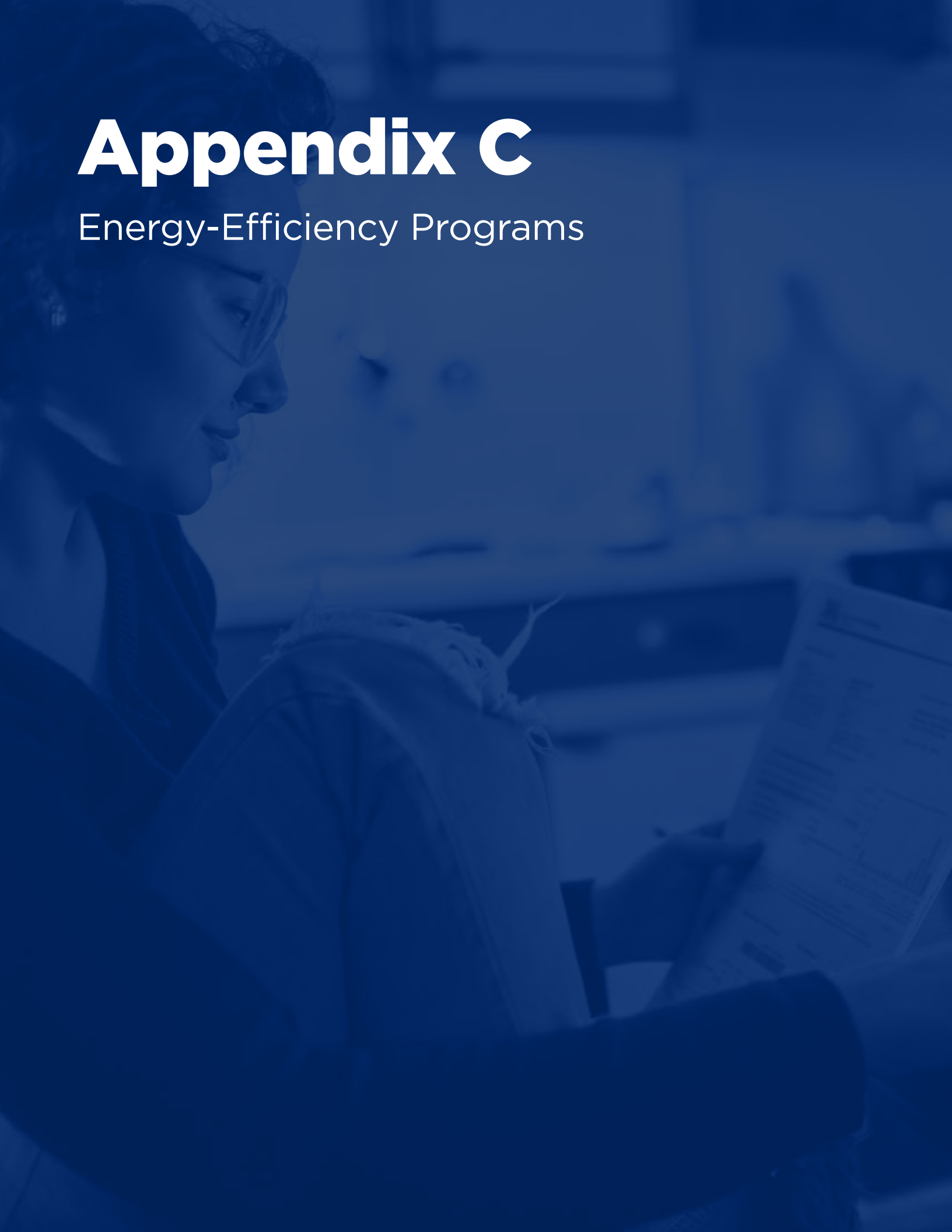
Neighborhood	Unit Rank	Property Rank	EUI Rank
North Hollywood	1	1	24
Melrose	2	3	N/A
Hollywood	3	2	63
Sherman Oaks	4	4	56
West Los Angeles	5	11	92
Palms	6	8	75
Van Nuys	7	5	16
Koreatown	8	9	85
Wilshire Center	9	7	N/A
Mar Vista	10	21	50
Silverlake	11	27	62
Pico-Union	12	15	80
San Pedro	13	28	65
Boyle Heights	14	32	60
Baldwin Hills	15	18	39
East Hollywood	16	24	59
Westlake	17	6	79
Temple-Beaudry	18	17	98
Westwood	19	14	94
Venice	20	31	37
Los Feliz	21	34	57
Valley Village	22	26	26
Canoga Park	23	10	15
Highland Park	24	38	43
Brentwood	25	36	91
Westchester	26	30	13
Harbor Gateway	27	42	66
Panorama City	28	13	17
West Adams	29	40	54
University Park	30	25	93
Miracle Mile	31	33	N/A
Wilmington	32	48	51
Valley Glen	33	39	10
Vermont Vista	34	53	18
Hollywood Hills	35	29	71
Hyde Park	36	49	6
Exposition Park	37	50	46
Little Bangladesh	38	12	N/A
Carthay	39	43	83
South Carthay	40	62	N/A
West Vernon	41	54	N/A
Lake Balboa	42	37	41
Northridge	43	16	61
Del Rey	44	44	34
Mid-City	45	75	64
Crestview	46	76	N/A
Harvard Heights	47	59	87
Lincoln Heights	48	60	74
Reseda	49	23	12
Central	50	79	55
Thai Town	51	45	N/A
Studio City	52	47	48
Echo Park	53	77	72
South Park	54	73	36
North Hills	55	35	21
Eagle Rock	56	67	30
Glassell Park	57	56	52
Historic Filipinotown	58	69	N/A
Beverlywood	59	74	95
El Sereno	60	71	42
Vernon Central	61	82	N/A
Cadillac-Corning	62	80	N/A
Leimert Park	63	81	14
Cloverdale/Cochran	64	88	N/A
Country Club Park	65	70	N/A
Harbor City	66	61	81
Tujunga	67	64	3
Florence-Firestone	68	90	5
Little Armenia	69	72	N/A
Hancock Park	70	68	88
Century Palms/Cove	71	84	N/A
Wholesale District	72	58	N/A
Century City	73	83	73
Vermont Knolls	74	89	7

SUPPLEMENTARY TABLE 21: ENERGY USE INTENSITY OF LOS ANGELES NEIGHBORHOODS, ORDERED BY NUMBER OF UNITS

Neighborhood	Unit Rank	Property Rank	EUI Rank
Toluca Lake	75	78	69
Mt. Washington	76	87	90
Harvard Park	77	86	4
Winnetka	78	46	32
Sun Valley	79	55	31
Victoria Park	80	96	N/A
Crenshaw District	81	93	N/A
Elysian Park	82	95	78
Encino	83	41	82
Sylmar	84	52	22
Alsace	85	100	N/A
Atwater Village	86	91	25
Adams-Normandie	87	98	86
Tarzana	88	51	76
Chinatown	89	57	77
Pacoima	90	63	8
Lafayette Square	91	105	N/A
St, Elmo Village	92	108	N/A
Woodland Hills	93	20	19
Granada Hills	94	66	29
Reynier Village	95	103	N/A
Wellington Square	96	102	N/A
Downtown	97	19	96
Figueroa Park Square	98	107	N/A
Watts	99	94	35
Green Meadows	100	109	47
Manchester Square	101	112	1
Pacific Palisades	102	104	40
Park La Brea	103	22	N/A
Angelino Heights	104	111	N/A
Cheviot Hills	105	97	58
Chatsworth	106	65	20
Rancho Park	107	101	67
Marina Peninsula	108	117	99
Sunland	109	99	2
Elysian Valley	110	125	44
Longwood	111	123	N/A
Regent Square	112	121	N/A
Faircrest Heights	113	124	N/A
Little Ethiopia	114	119	N/A
Mission Hills	115	106	27
Gramercy Place	116	113	23
Playa Vista	117	85	9
Playa Del Rey	118	118	89
Vermont Square	119	122	49
Toluca Terrace	120	128	N/A
Bel Air	121	126	70
Sycamore Square	122	127	N/A
Jefferson Park	123	130	53
Porter Ranch	124	92	100
University Hills	125	114	N/A
Arleta	126	110	68
Toluca Woods	127	129	N/A
Exposition	128	131	45
West Hills	129	120	97
Lakeview Terrace	130	116	28
Harbor Pines	131	133	N/A
Little Tokyo	132	115	N/A
Reseda Ranch	133	132	11
Beverly Crest	134	135	38
Brookside	135	134	N/A
Shadow Hills	136	136	33
Angeles National Forest	137	137	N/A
Arroyo View Estates	138	138	N/A
Mandeville Canyon	139	139	N/A
Palisades Highlands	140	140	N/A
San Fernando	141	141	84
Terminal Island	142	142	N/A
Universal City	143	143	N/A

Appendix C

Energy-Efficiency Programs



There are 40 ongoing efficiency, renewables, and health and safety programs and policies that affect the multifamily sector in Los Angeles.[104] That includes 27 utility incentive programs and 13 programs and policies administered by federal, state, and city agencies. In addition to incentive and rebate programs, there are three partial financing options.

Utility Programs

The majority of the 27 utility programs available to multifamily properties target commercial or residential customers, therefore multifamily building owners and tenants are eligible based on their status as commercial or residential account holders. More than two-thirds of the programs are funded by the Los Angeles Department of Water and Power (LADWP). The remaining are funded and administered by the Southern California Gas Company (SoCalGas) or are partner programs between LADWP and SoCalGas and the Metropolitan Water District (MWD).

Prescriptive Rebate Utility Programs

Seventeen of the programs are rebate programs, under which the retrofits conducted are based on a set of pre-approved equipment and products. Supplementary Table 21 outlines the prescriptive rebate utility programs available at the time of this analysis:

SUPPLEMENTARY TABLE 22: UTILITY PROGRAMS OFFERED IN LADWP TERRITORY AND FACTORS AFFECTING PARTICIPATION BY MULTIFAMILY PROPERTIES

Program	Program Agency	Specific Program for Multifamily Properties	Targets Multifamily Dwelling Units	Targets Multifamily Common Areas	Income Requirement
LADWP Residential Water Conservation Rebate Program	LADWP	X	X	X	
Commercial Lighting Incentive Program	LADWP			X	
Solar Incentive Program and Feed-in Tariff	LADWP		X	X	X
Consumer Rebate Program (Residential Rebate Program)	LADWP		X		
Certified Pool Pump Replacement Program	LADWP			X	
REfrigerator Turn-In and REcycle Program	LADWP		X		
Electric Vehicle Charger Rebate Program – Charge Up L.A.! (Residential and commercial)	LADWP		X	X	
Efficient Product Marketplace	LADWP		X		
Turf Removal Program/California Friendly Landscape Incentive Program	LADWP/MWD (Metropolitan Water District)			X	
LADWP/MWD Commercial Water Conservation Rebate Program	LADWP/MWD			X	
SoCal WaterSMART Residential Rebates	LADWP/MWD		X		
SoCal WaterSMART Commercial Rebates	LADWP/MWD				
SoCalGas Rebates for Property Owners and Managers (Multifamily)	SoCalGas	X	X	X	
SoCalGas Rebates for Residential Customers	SoCalGas		X		
California Solar Initiative Solar Thermal	SoCalGas		X	X	X

Through LADWP's AC Optimization program, customers may obtain air-conditioning maintenance services (e.g., air filter replacements, outdoor coil cleaning, and system diagnostic tests) that reduce their air-conditioning units' energy consumption at no charge.[105] LADWP contracts with certified heating, ventilation, and air-conditioning (HVAC) technicians to provide the services for this program.

LADWP rebates have also been used to accelerate market changes in appliances and electrical and water fixtures.

BARRIERS: The rebates are often small relative to the cost of the appliances and, consequently, have not been widely or equitably taken advantage of. According to LADWP's Equity Metrics Data Initiative, the majority of rebates wind up being used by more affluent single-family ratepayers, who may be able to afford the upgrades without the rebates.[106] Specific barriers facing low-income renters' use of rebates include: renters not owning their own units, rebates requiring upfront capital, and some rebates, such as the HVAC System rebate, requiring approved building and safety permits. Applications for permits must be filled out by building owners or landlords. Building owners are not incentivized to invest in their buildings (except for their buildings' common areas) and to apply for rebates unless they are responsible for their tenants' utility bills. Rebates are also problematic because the programs lack quality standards for contractors and work performed.

RECOMMENDATIONS: Direct-install programs must be more comprehensive, and the levels of rebates and incentives should be raised. They should also offer more attractive incentives upfront within their rebate programs. Perhaps this could include a voucher or coupon to pay for an energy-efficient product upfront at a retail store or for a contractor's labor costs.

Direct-Install Utility Programs

Seven of the utility programs potentially available to multifamily properties are direct-install programs, under which measures are installed at no cost to owners. In direct-install programs, less efficient equipment is replaced with energy saving technologies. Installations are conducted by technical assistance providers on the same day that a unit is assessed. The typical direct-install program includes the installation of LED light bulbs, high-efficiency faucet aerators and showerheads, water heater blankets and pipe insulation, weather-stripping, air sealing, and attic insulation. Supplementary Table 22 outlines the direct-install utility programs available at the time of this analysis:

SUPPLEMENTARY TABLE 23: DIRECT-INSTALL PROGRAMS IN LADWP TERRITORY AND FACTORS AFFECTING PARTICIPATION IN MULTIFAMILY PROPERTIES

Program	Program Agency	Specific Program for Multifamily Properties	Targets Multifamily Dwelling Units	Targets Multifamily Common Areas	Income Requirement
Home Energy Improvement Program (HEIP)	LADWP		X		X
Refrigerator Exchange Program	LADWP		X		X
FREE Water Conservation Items	LADWP		X	X	
City Plants (FREE Tree Programs)	LADWP			X	
SoCal Energy Smart – Multifamily Direct Installation Program	SoCalGas	X	X		
Energy Savings Assistance Program (ESAP) (for low-income customers)	SoCalGas	X	X	X	X
Energy Upgrade California Middle Income Direct Install Program	SoCalGas		X	X	X

Refrigerator Exchange and Recycling Programs

LADWP's direct-install programs include the Refrigerator Exchange and the Refrigerator Recycling programs, which replace inefficient, older model refrigerators with Energy Star®-rated refrigerators and recycle the older models. Appliance Recycling Centers of America, an LADWP contractor, is responsible for administering the program.[107]

"Energy efficient refrigerators use half as much electricity as older models" and help "tenants and our customers save up to $60 each year on refrigerator operating costs, while helping reduce greenhouse gas emissions," according to Nancy Sutley, LADWP's chief economic development and sustainability officer.[108] Optimal Energy found that energy-efficient refrigerators, through direct installation, can save an average of 7.2 % of household energy usage, as described in Appendix A. To date, LADWP has replaced more than 2,150 aging refrigerators, producing an estimated $150,000 per year in energy savings. [109]

SUPPLEMENTARY TABLE 24: HEIP OVERVIEW[110]

Number of Households	GWh Savings FY 16–17	Job Years Created	Projected Program Budget* (in $1,000s) FY 16–17
200 per month (a total of 6,000 between July 2015 and December 2017)	18.4	9.5 (total)	26,816

The Home Energy Improvement Program

The Home Energy Improvement Program (HEIP) is an LADWP program aimed at reducing customer energy and water usage. HEIP does an assessment of a home or residential building, identifies potential improvements, and of those, it will make the following: for building envelopes – weather strip and insulate attics; replace air conditioning; install LED lighting; replace toilet, showerhead, and sink aerators; install carbon monoxide detector; and test for gas leaks. Customers are often referred to other LADWP direct installation programs, such as the AC Optimization and Refrigerator Exchange Programs to maximize energy savings. Direct installations are offered at no cost to customers. LADWP targets but does not limit HEIP participation to low-, moderate-, and fixed-income households. Single-family households comprise the majority of households served.

BARRIERS: Technically, multifamily residents are eligible to receive HEIP installations, but there are challenges to their participation in HEIP. The HEIP application requires a minimum participation of 50% of the renters within a multifamily building, and all renters are required to submit their own print applications. This creates a burden for individual renters to coordinate to reach the threshold, and to obtain their landlords' approval.

RECOMMENDATION: Programs should work directly with owners and ease participation requirements for multifamily housing residents.

HEIP's UPCT Program Feature

One benefit of HEIP is that rather than using private contractors with unclear standards for performance or job quality, LADWP directly runs the program and uses its own trained Utility Pre-Craft trainees (UPCT) to complete the energy-efficiency installations.

Formed in 2011 as a collaboration between International Brotherhood of Electrical Workers (IBEW) Local 18 and LADWP, the UPCT program is an apprenticeship program that gives individuals the opportunity to learn various craft and construction trades necessary to be competitive for permanent jobs at LADWP.[111] This program was formed in response to large waves of retirements of long-time craft workers at LADWP.

Trainees rotate through project areas in order to gain exposure to different power and water construction work. According to the UC Berkeley Labor Center's 2016 report, Training for the Future II, which analyzed the UPCT program, "Trainees receive $16 per hour plus health and retirement benefits, considerably better compensation than most entry-level workers earn for weatherization work."[112] The program participants receive union representation and benefits through IBEW Local 18. Since the program's inception, in April 2018, a total of 175 UPCTs have been hired. Out of those hired, 88% are still working as either UPCTs or as LADWP or City of Los Angeles permanent employees.

The program is especially successful in opening doors for people of color, women, and low-income and formerly incarcerated individuals who face employment barriers at LADWP. Half (50.3%) of the trainees are Latinx. In comparison, 28.5% of construction workers nationwide are LatinX. More than one in five UPCTs (22.1%) are African-American. Women comprise 12.7% of UPCTs, while nationwide, women represent 2.6% of the construction workforce. More than two-thirds of UPCTs came from zip codes in which more than half the population lived below the federal poverty level. Thus, the UPCT program, through its HEIP work, not only benefits the environment but also supports economic growth in underserved communities.[113]

BARRIERS: Because of budgeting constraints, there are only two UPCT classes per year that produce the trainees that service roughly 2,400 households with HEIP installations. The limited number of classes has led to a lengthy waitlist, averaging two to three years. The UPCT program currently lacks a business plan or permanent funding from LADWP. Lack of funding is a bigger, longer term issue for the program but one that could affect the timing and scale of HEIP expansion.

RECOMMENDATIONS: To expand the HEIP program over the next fiscal year, LADWP should, at a minimum, double the number of UPCT classes to four per year. The classes should consist of no more than 25 trainees each so as to maintain a solid trainee-trainer ratio. LADWP should also work with IBEW Local 18 to create a business plan, and the department should allocate permanent funding for the program to reduce the long waitlist for the UPCT program. A larger, more secure funding source for the UPCT program would allow HEIP to grow and adding more UPCT trainees, presumably, will help the utility with finding qualified workers in the future, as more baby boomers retire and their jobs will need to be filled.

The Energy Savings Assistance Program

The Energy Savings Assistance Program (ESAP) provides eligible, low-income multifamily residential customers in Los Angeles with energy-, gas-, and water-saving measures at no cost to customers. Eligible customers include renters in unsubsidized and subsidized housing. Measures consist of energy-efficient light bulbs, smart power strips, faucet aerators, and low-flow showerheads. However, water-heating and cooling measures are not included.

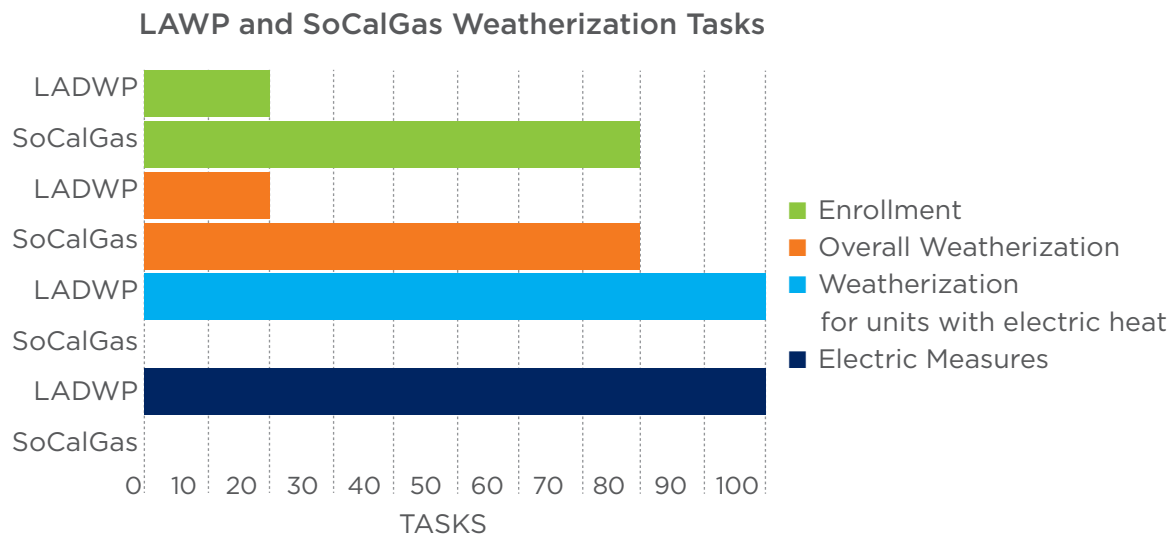
Between 2016 and 2017, ESAP installed energy-efficiency measures for 11,900 low-income, multifamily units in Los Angeles, according to LADWP. Approximately 3,500 of those units were Housing Authority of the City of Los Angeles (HACLA) public housing units. LADWP expected annual resource savings to include more than 93 million gallons of water and 4.6 megawatt hours of electricity, as well as 170,000 therms of natural gas.[114]

SUPPLEMENTARY TABLE 25: MULTIFAMILY UNITS IN LOS ANGELES SERVED THROUGH ESAP[115]

Number of MF Units in Los Angeles (estimated)	Number of ESAP-Eligible Units in Los Angeles (estimated)	Number of ESAP-Eligible Units Served by SoCalGas
880,000	350,000	84,000 *(24%)

LADWP contracts with both SoCalGas and its subcontractors, as well as the IBEW Local 11 members to do installations in different portions of multifamily buildings. IBEW Local 11 members, who also do work for LADWP's Commercial Direct Install program, install primarily LED lighting in multifamily building common areas (e.g., community rooms, hallways, and lobbies). LADWP contracts with SoCalGas to complete the other in-unit, utility-saving measures within the program, such as smart power strip and faucet aerator installations. The division between tasks for LADWP and SoCalGas is shown in the figure 10.

SUPPLEMENTARY FIGURE 10: LADWP AND SOCAL GAS WEATHERIZATION TASKS[116]



Thus, SoCalGas is responsible for the vast majority of energy-efficient measures through ESAP, but LADWP administers all of the electric and electric heater measures for residents. Subcontractors like The East Los Angeles Community Union, the Maravilla Foundation, and Reliable Energy complete energy-efficiency work installed in HACLA properties.

BARRIERS/LIMITATIONS: LADWP and SoCalGas don't ensure that ESAP helps enough market-rate, low-income housing residents receive holistic offerings. ESAP also does not place as much emphasis on reaching the tenants of market-rate multifamily housing as it has historically placed on public housing buildings that HACLA operates.

RECOMMENDATIONS: While ESAP does provide some environmental benefits, additional measures—like hot-water heaters and cooling measures—could produce deeper savings. LADWP and SoCalGas should also ensure that ESAP helps more market-rate, low-income housing residents receive financial benefits. ESAP needs to place as much emphasis on reaching the tenants of market-rate, multifamily housing as it has historically placed on public housing buildings that HACLA operates. The program could improve its reach and ensure that high-road job standards are being implemented by increasing its scale and setting workforce standards for its contractors.

Partnerships such as the one with HACLA create an excellent opportunity to serve thousands of residents, but there are also labor concerns.

BARRIERS/LIMITATIONS: Training does not seem to occur on an annual basis nor does the company have metrics in place to evaluate contractor performance. There is also no indication that SoCalGas and its contract workers are accountable for the work they do.

RECOMMENDATIONS: LADWP should urge contractors to have mandatory trainings so that it can continually evaluate certain workforce performance metrics. This is particularly important if LADWP begins to include additional measures for ESAP. Having performance metrics would push the program to have better trained employees and contractors, leading to improved energy savings because of higher job performance.

BARRIER: No data is available regarding the wages that SoCalGas' subcontractors pay their workers in comparison with how much Utility Workers Union of America Local 132 (SoCalGas' union) members are paid.

RECOMMENDATIONS: Clear labor standards, such as stipulations that workers be provided living wages, are needed for those who actually perform installations. Wages for contractors hired by Los Angeles amount to $17.26 per hour without health benefits.[117] Programs involving public funds (either at the department or at comparable utilities) should ensure transparency about job quality, including the number of quality jobs available, wages, and benefits. Currently, city government workers are paid the following salaries: UPCTs – $16 per hour with $7.74 per hour in medical benefits; exempt electrical mechanics and journeyman wiremen – $43.35 per hour with $12.59 per hour in medical benefits; and exempt electrical craft helpers – $32.51 per hour with $12.59 per hour in medical benefits.[118] Ideally, partners and their subcontractors would pay their workers similar, competitive wages.

Comprehensive Utility Programs

There are three programs with a comprehensive approach to energy efficiency offered through LADWP or the investor-owned utility, SoCalGas, in Los Angeles. One such program, a partnership between SoCalGas and LADWP, is the Energy Upgrade California (EUC) Multifamily Program, for both subsidized and unsubsidized buildings. The program, begun in 2015, is available to properties with three or more units. After a property owner enrolls in the program, an energy audit is conducted to evaluate the property. Owners may choose their own contractors to perform installations. Incentives are paid after projects are completed and all measures are verified. Incentive types include up to $5,000 for design and technical assistance, $5,000 to $10,000 for a whole building or $20 per unit to cover the cost of energy assessments, and $420 to $960 per unit to offset costs of improvements. The program, for which there are no income requirements, follows best practices by offering owners flexibility to include common areas and tenant units under a single application, set of rules, and point of contact.

SUPPLEMENTARY TABLE 26: UTILITY PROGRAMS AVAILABLE TO CUSTOMERS

Program	Program Agency	Specific Program for Multifamily Properties	Targets Multifamily Dwelling Units	Targets Multifamily Common Areas	Income Requirement
Custom Performance Program (Commercial rebate program)	LADWP			X	
Custom Water Conservation Projects (Technical Assistance Program)	LADWP		X	X	
Energy Upgrade California Multifamily Program	SCG/ LADWP	X	X	X	

BARRIERS/LIMITATIONS: The EUC Multifamily Program is the only utility-administered, performance-based retrofit program that targets deep energy savings through whole-building retrofits that was available to existing multifamily buildings in Los Angeles as of 2017. The 2013–2014 budget for the EUC Multifamily Program was $500,000. As of March 2017, it was not being marketed on utility websites and only two properties had participated**.** Whole-building programs are recommended by national experts as they result in a combination of measures that are likely to produce the greatest savings at a given project cost.[119,120]

The program's limited incentive amounts are hampering its impact on the affordable multifamily sector. Since incentives that range from $420 to $960 per unit are likely to be insufficient in view of the cost of recommended work, owners who do not have access to substantial financial resources are discouraged from participating in the program. Unlike LADWP's Custom Performance Program for commercial buildings, which covers 75% of improvement costs, the EUC Multifamily Program is not responsive to the financial need presented by the affordable multifamily sector and usually covers only 20–30% of costs.[121] The limited EUC Multifamily incentive amount is especially challenging for smaller buildings.

The timing of an incentive is a significant barrier to owner participation for affordable multifamily buildings. Affordable multifamily buildings served by LADWP, particularly smaller ones, often forego participation because they cannot receive financial incentives until after construction is completed. Having to bridge the contractor costs until post-construction is often prohibitive for affordable multifamily buildings because they generally do not have adequate cash reserves or access to financing.

RECOMMENDATIONS: LADWP should consider increasing its contribution to the EUC program incentive and providing some of the incentive upfront or midway through construction to address cash-flow issues for owners.

Other Utility Programs

The remaining programs include incentives for new construction, retrocommissioning, and a trainee program. They are outlined in the following table;

SUPPLEMENTARY TABLE 27: OTHER UTILITY PROGRAMS

Program	Program Agency	Specific Program for Multifamily Properties	Targets Multifamily Dwelling Units	Targets Multifamily Common Areas	Income Requirement
Repower LA's Utility Pre-Craft Trainee Program	LADWP				X
California Advanced Homes Program (For multifamily new construction projects)	SoCalGas/LADWP	X	X	X	
Retrocommissioning Program	SoCalGas/LADWP			X	

City Policies, Programs, and Initiatives

The Sustainable City Plan

The City's first-ever sustainability plan was established in 2015 with the goal of transforming Los Angeles into a global leader in the environment, economy, and equity. The plan sets time-bound goals for creating a clean and efficient energy grid that will support improved environmental health, economic opportunity, and equity for all residents of Los Angeles. The Mayor's plan sets these energy-efficiency targets:

- Reduce energy use per square foot below 2013 baseline—for all building types—by at least 14% by 2025 and 30% by 2035.
- Use energy efficiency to deliver 15% of all of Los Angeles' projected electricity needs by 2020. Use rebates, incentives, and education to achieve this goal.[122]

The plan outlines a roadmap for short- and long-term targets in 14 categories. Although all categories affect the multifamily market, the "Housing and Development" and "Energy-Efficient Buildings" categories have a particularly direct impact on the future of housing. To date, the city has begun to meet outcomes in those categories by enacting a local benchmarking ordinance to report and improve buildings' performance and by implementing Assembly Bill 2222 (A. Nazarian, 2014) to minimize the loss of affordable housing units.

Los Angeles has also created a Resilient Los Angeles plan, which identifies measurable initiatives to address the city's preparedness to deal with disasters, the economic security of all Angelenos, the threats of climate change, and aging infrastructure.[123] As part of the Resilient Los Angeles plan, the Mayor's office has committed to reduce water and energy use through LADWP to make homes and businesses more energy and water efficient.

The Los Angeles Existing Buildings Energy- and Water-Efficiency Ordinance

Effective in 2017, the city's new benchmarking ordinance requires privately owned commercial, industrial, and multifamily buildings in Los Angeles that are larger than 20,000 square feet and city-owned commercial, industrial, and multifamily buildings larger than 7,500 square feet to disclose their energy and water use.[124] Privately owned buildings that are 100,000 square feet or more will be the first to have to benchmark. All buildings will have to benchmark annually by 2019. Also beginning in 2019, privately owned buildings 20,000 square feet or more will be required, every five years, to either demonstrate energy- or water-use reductions or complete an energy and water audit and plan with retrocommissioning, if necessary, to improve performance.

The Los Angeles Better Buildings Challenge

The Los Angeles Better Buildings Challenge (LABBC) is an innovative utility-funded initiative to support property owners and managers in executing cost-effective building performance upgrades to achieve 20% energy and water savings by 2025. LABBC offers free, customized advisory services for effectively reducing operating costs and improving tenant comfort and the environment. LABBC is also a key partner in implementing Los Angeles' energy benchmarking ordinance.

The Housing + Community Investment Department of Los Angeles' (HCIDLA) Gateway-to-Green Survey

The Gateway-to-Green (G2G) survey, initiated in mid-2014, is a survey of Los Angeles' rental housing units. It is part of the routine inspection process by HCIDLA's Systematic Code Enforcement Program, which inspects over 720,000 rental housing units at approximately 110,000 different properties on a four-year cycle.[125] Apartment owners are given individualized reports identifying actions they can take to increase energy and water efficiency plus referrals to local incentive programs that can pay for some of the improvements. The program website provides information about sustainability, water conservation, and energy efficiency for people who might not be familiar with these concepts.

Between July 2014 and July 2018, free G2G energy-efficiency and water-conservation surveys were conducted by housing inspectors at more than 81,971 multifamily rental housing properties in the city; more than 68% of them showed the potential for water- or energy saving improvements. The next four-year round of property inspections starting in early 2019 will provide updates on each property's remaining energy- and water-saving opportunities.

The Housing + Community Investment Department of Los Angeles' Handyworker Program

The Handyworker Program has been addressing the housing needs of low-income seniors and people with disabilities in the City of Los Angeles since the 1970s. The Handyworker Program provides eligible homeowners free minor home repairs and improvements that address basic health, safety, security, and accessibility issues of owner-occupied, single-family homes, condominiums, and townhomes.[126] These repairs help preserve the city's aging housing stock, prevent accidents in homes, and extend the time seniors and people with disabilities can remain in their own homes.

Federal and State Programs

The Low Income Weatherization Program for Multifamily Properties

The Low Income Weatherization Program for Multifamily Properties (LIWP-MF) is an energy-efficiency, electrification, and solar program that helps homeowners and renters reduce utility bills. This is a state-level offering, administered by the California Department of Community Services and Development (CSD) and funded by California Climate Investments (Cap-and-Trade resources). Information is available at: https://camultifamilyenergyefficiency.org/.

The program has two overarching goals. First, LIWP is designed to maximize environmental benefits such as greenhouse gas (GHG) reductions. In so doing, the program incentivizes owners and renters to take energy-efficient installation measures and switch to renewables (e.g., solar photovoltaics) within multifamily buildings in disadvantaged communities. Any measure that reduces GHG emissions is eligible for installation under the program.[127] Second, LIWP aims to maximize economic benefits. The program fosters job creation and direct investment in disadvantaged areas and households. Direct investment includes "employment, job training, and supporting the ongoing presence of affordable housing stock in these communities."[128]

To be eligible for LIWP-MF, at least 66% of a building's households must be at or below 80% of the area median income and the properties must be in Disadvantaged Communities. Owners initiate the application process.[129]

For the LIWP-MF Statewide Program, CSD works with the Association for Energy Affordability, which is the technical service provider for this program, to determine how to best carry out program goals. Social service nonprofits and affordable housing nonprofits like the California Housing Partnership Corporation (CHPC) serve as local program outreach and intake representatives.

As of October 2018, LIWP-MF had served two Los Angeles properties and other projects were underway and projected.[130] Of the two completed projects, three buildings were served (117 households or about 187 people) and 754 MT CO_2 (metric tons of carbon dioxide equivalent) will be reduced over the lifecycle of the upgrades made.[131]

When the program launched in 2016, it quickly became popular. By December 2017, Los Angeles' affordable housing owners saw the value of the program's unique one-stop-shop approach and they applied for the screening of more than 6,020 households within the city. Lack of owner interest for LIWP investments is clearly not the cause of limited use of the program; there are still 1,225 households in the city on the waitlist for screening and there are many more affordable housing providers who may be interested.[132]

BARRIERS: The principal barriers to full use being made of this program include project to program timing issues (i.e., aligning a project's timing and financing with the timeline and deadlines of the program), lack of gap funding or viable financing options, and limited utility incentives to leverage with the program.[133]

RECOMMENDATIONS: LAWDP should tap into existing, successful program infrastructure and resources that are provided through LIWP-MF. That will enable it to serve a greater number of multifamily households. LADWP can also provide its own additional utility incentives.

BARRIERS: The LIWP-MF program does not define wage standards in its program guidelines. And, because the program allows owners to choose their own contractors, data on wages and job quality for the program is limited. The program has allowed this choice in response to owner feedback about its importance, in part for quality control.

RECOMMENDATIONS: LADWP could push the state to track this data, and if the data is obtained, LADWP could work to ensure that the program offers living wages and high-road jobs to its workers. In doing so, it will be important to balance the needs of time- and resource-constrained affordable housing developers with the opportunity to meet living wage standards. Any workforce policies that may result in higher retrofit costs should be accompanied by state and local strategies to close increased project funding gaps. Without this, the primary barrier preventing many affordable housing owners from doing LIWP-MF energy retrofits that directly benefit their residents will only be heightened.

U.S. Department of Energy Weatherization Assistance Program

The federally funded weatherization program administered by CSD is designed to increase the energy efficiency of homes owned or occupied by lower-income people, reduce their total residential expenditures, such as heating and cooling bills, and improve their health and safety.[135] Single-family dwellings, mobile homes, and small and large multifamily buildings are eligible for the program. This program also offers some health and safety weatherization measures, as well as education on basic energy-efficiency practices and the proper use and maintenance of measures installed. Weatherization measures may include weather stripping, insulation, caulking, water heater blanket installation, refrigerator replacement, electric water heater repair or replacement, heating and cooling system repair or replacement, compact fluorescent lamp installation, and thermostat repair or replacement.

SUPPLEMENTARY TABLE 28: INCENTIVE-ELIGIBLE MEASURES FOR THE LOW-INCOME WEATHERIZATION PROGRAM[134]

Measure Category	Measure	
Building Shell	Cool roof Roof insulation Attic insulation Wall insulation Floor insulation	Window or sliding door replacement Window coatings Window shading Air sealing
Heating and Cooling	Heating system replacement Cooling system replacement Fan replacement Pump replacement	Duct sealing HVAC system controls Energy management systems
Water Heating	Water heater or boiler replacement Variable speed pumps Recirculation controls	Pool and spa pumps and equipment Low-flow fixtures (kitchen and bath) Pipe insulation
Lighting and Appliances	Indoor, outdoor, parking lot, and garage lighting	Refrigerators Dishwashers Clothes washer and dryers (including common area coin-op)
Renewable Energy	Solar hot water systems (thermal)	Solar photovoltaic

Community Services and Development's Low Income Home Energy Assistance Program

The Low Income Home Energy Assistance Program (LIHEAP) is a federal block grant that provides assistance to eligible low-income households to manage and meet their immediate home heating and cooling needs. Assistance is provided through a weatherization program coordinated with the U.S. Department of Energy's WAP program, which helps make homes more energy efficient, or through the Energy Crisis Intervention Program, which provides payments for weather-related and energy-related emergencies. To qualify, household income must be below 60% of the state median income.

U.S. Department of Housing and Urban Development Lead-Based Paint Hazard Control Program

The primary objective of the Lead-Based Paint Hazard Control Program is the delivery of lead hazard control services to low-income households living in buildings constructed before 1978 to ensure lead-safe housing. The program targets households occupied by children under the age of six or by children with elevated lead blood levels. CSD, which also administers efficiency weatherization programs, contracts with five community-based and local government organizations to provide services in several cities, including Los Angeles.

Other Lead-Based Paint Remediation Resources

For more than 20 years, HCIDLA has operated a Lead Hazard Remediation Program, funded by HUD Lead Hazard Control and Lead Hazard Reduction Demonstration grants. Community Development Block Grant funds are currently used for this purpose. In 2017, the County of Los Angeles Department of Public Health received a Lead Hazard Reduction grant, which it is now using. In addition, a recent settlement of the City and County of Los Angeles with SoCalGas for the massive Aliso Canyon gas leak allocated $5.2 million to Los Angeles County to address lead hazards in many eastside neighborhoods (including parts of Boyle Heights in the city). These hazards were created by emissions from the Exide battery recycling plant.[136] And, final decisions are being made in the decades-long lawsuit brought by several California counties and cities against paint companies; more than $400 million will be available sometime in 2019 for lead-paint hazard remediation to be divided among the plaintiffs, which include Los Angeles County.[137] Pairing efficiency programs with lead remediation is key to reducing tenant disruption and providing holistic offerings.

Financing Programs

Even with the various utility rebates available, financing energy-efficiency work has long been a major challenge for multifamily owners, particularly for affordable and nonprofit properties. The following financing programs are available now. However the limited or lack of participation by multifamily owners demonstrates these products are not optimal in their current form.

SoCalGas' Zero Percent On-Bill Financing Program[138]

SoCalGas is currently offering no-interest unsecured loans to finance the purchase and installation of eligible energy-efficiency upgrades. Owners of multifamily properties who do not reside on the premises where at least 65% of tenants are income qualified are eligible. Owners must also have good credit and owners obtaining the loans must realize savings . Loans are available for up to $250,000 for each meter for project paybacks ranging from 5 to 10 years or the useful life of the equipment installed, whichever is shorter. Owners repay their loans through their monthly utility bills.

LADWP Infrastructure Loan Program[139]

LADWP offers its commerical and industrial customers loans to help implement long-term measures to improve energy and water efficiency. While multifamily customers are eligible, the loan program was not designed to meet the needs of the affordable housing sector. Current loan terms are 4.677% for 1–10 years, although the actual rate is determined at the time the loan is approved. Loans that are for more than $150,000 require LADWP Board approval. Funds can be used to purchase and install equipment required to receive electric and water service, water- and energy-efficient equipment that exceed Title 24 requirements, equipment that helps correct power losses and maintans a steady rate of power, and solar photovoltaic systems.

Los Angeles County Residential Property Assessed Clean Energy Program[140]

CaliforniaFirst and HERO administer a countywide program that enables homeowners to install permanent energy-efficiency, renewable energy, and water-saving improvements in their properties. The Property Assessed Clean Energy program enables the county to issue a bond to a lender, that secures funding for the construction of an energy upgrade. Property owners then repay the financing twice a year through an assessment on their property tax bill. This financing program is best suited to properties making significant improvements, including solar photovoltaic and thermal installations. Ideal properties include those with one to two liens, preferably HUD Federal Housing Administration loan products with or without tax credits.

Appendix D

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Endnotes

1 All data represents a total potential savings for low-income, multifamily housing.

2 NRDC, through its Energy Efficiency for All (EEFA) initiative, commissioned an analysis specifically of the energy-efficiency savings potential in lower-income multifamily housing in Los Angeles' Department of Water and Power's (LADWP) service territory to understand the benefits and costs of large-scale energy-efficiency investment in this sector. NRDC contracted with Optimal Energy to conduct the analysis, which involved generating a list of more than 200 energy-efficiency upgrades and determining the energy savings potential and associated economics for these measures using similar data inputs to those employed by LADWP in its energy-efficiency planning. The study results can be used to inform future energy-efficiency targets and budgets for LADWP as well as program design elements such as measure selection and program delivery. NRDC also contracted with BW Research Partnership to estimate the total number of jobs that would be created if the full cost-effective energy savings potential was achieved.

3 This number is calculated by dividing annual customer savings, from Supplementary Table 6, Appendix A, by total homes in the study, i.e., 409,278.]

4 NRDC's conclusions are explained in Supplementary Table 9 on Page 48 of Appendix A.

5 Conclusions from quantitative research, qualitative data from a focus group, interviews, and a survey of affordable multifamily housing owners and property managers

6 Conclusions based on analysis of multiple data sets. For NRDC's explanation and data, see Appendix B.

7 The analysis of potential savings from energy-efficiency investment commissioned for this report and outlined in Appendix B, found a minimum of 20% of savings per property were cost-effective to implement, and that the return on investment was greater than the initial investment.

8 TCC funds development and infrastructure projects that alleviate pollution burden and improve economic opportunity and health equity for California's Disadvantaged Communities. For more information see: http://sgc.ca.gov/programs/tcc/.

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14 In order for California to achieve the Paris climate goals of keeping warming to 2-degrees Celsius or less, California will need to reduce the energy consumption of every single building by 30% by 2030, NRDC concluded in a 2017 study, *America's Clean Energy Frontier: The Pathway to a Safer Climate Future*, https://www.nrdc.org/sites/default/files/americas-clean-energy-frontier-report.pdf. This commitment is part of the city's broader commitment to reduce greenhouse gas emissions by 45% below 1990 levels by 2025 and 60% by 2035. Mayor Eric Garcetti's Office, Sustainability Team, *pLAn: Transforming Los Angeles: Environment, Economy, Equity*, 2017, http://plan.lamayor.org/wp-content/uploads/2017/03/the-plan.pdf.

15 Diana Hernández, "Understanding 'Energy Insecurity' and Why It Matters to Health," *Social Science & Medicine* 167 (2016), p. 1–10. http://dx.doi.org/10.1016/j.socscimed.2016.08.029.

16 NRDC, through its Energy Efficiency for All (EEFA) initiative, commissioned an analysis of the energy-efficiency savings potential in lower-income multifamily housing in the Los Angeles Department of Water and Power's (LADWP) service territory to understand the benefits and costs of large-scale energy-efficiency investment in this sector. The analysis, "Energy Savings and Jobs Potential**"** is Appendix A of this report. NRDC contracted with Optimal Energy to conduct the analysis, which included generating a list of more than 200 energy-efficiency upgrades and determining the energy savings potential and associated economics for these measures using similar data inputs to those employed by LADWP in its energy-efficiency planning. The study results can be used to inform future energy-efficiency targets and budgets for LADWP as well as program design elements, such as measure selection and program delivery.

17 This number is calculated by dividing annual customer savings from Supplementary Tables 5 and 6, Appendix A, Appendix B, by total homes in the study – 409,278.

18 Fuel-switching measures were also considered in this study but are not included in the above listFuel-switching measures are those that replace fixtures, appliances, and HVAC systems that run on gas with those that use ultra-efficient electric. An example of a fuel switching measure is replacing gas water heaters with heat-pump water heaters. By replacing gas-fired water heaters with heat pumps, which have an efficiency greater than 200%, significant GHG savings can be achieved. See Supplementary Table 14, page 54, Appendix A for complete analysis.

19 Unless noted otherwise, any references to Los Angeles indicate the city limits within the county itself and not the county as a whole, which is not serviced by LADWP. While this study focuses on LADWP, because Southern California Gas (SoCal Gas) provides natural gas services to LADWP residents, the study incorporates the portion of SoCal Gas' service territory that overlaps with the City of Los Angeles.

20 Samantha Sharf, "Los Angeles Tops Our List of the Worst Cities for Renters In 2018," *Forbes,* (April 15, 2018), https://www.forbes.com/sites/samanthasharf/2018/04/13/los-angeles-tops-our-list-of-the-worst-cities-for-renters-in-2018/#2dd9f6ef5b6b.

21 Gale Holland, "L.A.'s Homelessness Surged 75% in Six Years. Here's Why the Crisis Has Been Decades in the Making," *Los Angeles Times*, 1 February 2018, http://www.latimes.com/local/lanow/la-me-homeless-how-we-got-here-20180201-story.html.

22 California Housing Partnership Corporation, *Los Angeles County Annual Affordable Housing Outcomes Report* (California Housing Partnership Corporation, 2018),

https://1p08d91kd0c03rlxhmhtydpr-wpengine.netdna-ssl.com/wp-content/uploads/2018/06/Full-LA-County-Outcomes-Report-with-Appendices.pdf.

23 Ariel Drehobl and Lauren Ross, *Lifting the High Energy Burden in America's Largest Cities: How Energy Efficiency Can Improve Low-Income and Underserved Communities* (American Council for an Energy-Efficient Economy, 2016), https://aceee.org/research-report/u1602.

24 Gabriela Sandoval and Mark Toney, *Living Without Power: Health Impacts of Utility Shutoffs in California* (TURN - The Utility Reform Network, 2018), http://www.turn.org/wp-content/uploads/2018/05/2018_TURN_Shut-Off-Report_FINAL.pdf.

25 Ibid.

26 Ibid.

27 The Los Angeles Energy Atlas, created by the California Center for Sustainable Communities at the University of California, Los Angeles, is a publicly available interactive website that illustrates address-level energy consumption and building characteristics for Los Angeles County. It shows neighborhood-level energy consumption by aggregating energy consumption at the address level from 2006 to 2010. Multifamily properties make up 16% of the city's total energy use. A portion of the multifamily properties (12 are small multifamily, while 4% are classified as large multifamily. This energy use data revealed that multifamily properties of all sizes built before 1978 are the most energy intensive (Figure 7), particularly as it relates to gas use, as shown further in Appendix C. This is particularly noteworthy because the largest number of buildings were built before 1978 and therefore may need energy-efficiency upgrades.

28 Ibid. See also: Los Angeles County Office of the Assessor, *Data*, 2014, https://assessor.lacounty.gov/.

29 United States Census Bureau, American Community Survey, *American Community Survey 2014 5-Year Estimates*, https://www.census.gov/programs-surveys/acs/technical-documentation/table-and-geography-changes/2014/5-year.html and https://www.census.gov/programs-surveys/acs.

30 U.S. Office of Energy Efficiency & Renewable Energy, "5 of the Fastest Growing Jobs in Clean Energy," 24 April 2017, https://www.energy.gov/eere/articles/5-fastest-growing-jobs-clean-energy.

31 "High road" refers to business practices that benefit companies, employees, customers, and ultimately, society.

32 Mayor Eric Garcetti's Office, Sustainability Team, *pLAn: Transforming Los Angeles: Environment, Economy, Equity*, (2017), http://plan.lamayor.org/wp-content/uploads/2017/03/the-plan.pdf.

33 Deborah Kahn, "California: LA and Natural Gas: It's Complicated," *E&E News*, 7 February 2018, https://www.eenews.net/stories/1060073115 and Los Angeles City Council, Motion, CTT 1 8-0002-S7; Item No. 28, February 6, 2018, http://clkrep.lacity.org/onlinedocs/2018/18-0002-S7_mot_2-6-18.pdf.

34 To supplement the quantitative research, the project team, led by Global Green USA, conducted a focus group, seven interviews, and a survey with key stakeholders working in affordable multifamily housing. The purpose of this strategy was to understand the challenges and opportunities for affordable multifamily owners to take advantage of energy-efficiency programs. The interviews focused on programs provided by LADWP, but some comments also addressed challenges with programs administered by SoCalGas and some water utilities through the SoCal WaterSmart programs. Specific interview and survey responses are available by request to the report authors.

35 For more on the PACE program and how it affects affordable multifamily housing, see, *Commercial PACE for Affordable Multifamily Housing*, http://energyefficiencyforall.org/resources/commercial-pace-affordable-multifamily-housing. This report examines whether there is an opportunity for C-PACE to fill a gap in financing energy efficiency in the affordable multifamily buildings sector. C-PACE is a financing structure that enables owners of commercial, industrial, and multifamily residential properties to obtain affordable, long-term funds for 100% of the cost of energy- and water-efficiency retrofits (as well as for distributed generation investments). C-PACE enables building owners to finance qualifying improvements by placing a voluntary assessment on their property tax bills, and then paying for these improvements over time through an additional charge on these bills. Almost always, this voluntary assessment is more than paid for by the energy savings produced by the retrofit.

36 In the 2012 HUD notice, H-2012-14, the National Low Income Housing Coalition defines residual receipts as "moneys that exceed amounts needed to operate a property on a monthly basis, maintain a reserve for replacement funds and make allowable payments to the property's owner... Residual receipts are generally placed in an interest-bearing account that may be used for project-related purposes." https://www.hud.gov/sites/documents/RESIDUAL_RECEIPTS_FAQS.PDF.

37 For a breakdown of these programs, see Appendix C.

38 NRDC, through its Energy Efficiency for All (EEFA) initiative, commissioned an analysis of the energy-efficiency savings potential in lower-income multifamily housing in LADWP's service territory to understand the benefits and costs of larger-scale, energy-efficiency investment in this sector. The analysis, *Energy Savings and Jobs Potential*, is Appendix A of this report.

39 The International Brotherhood of Electrical Workers is a labor union that represents workers and retirees in the electrical industry.

40 Megan Emiko Scott and Carol Zabin, *Training for the Future II Los Angeles's Utility Pre-Craft Trainee Program: Progress to Date* (UC Berkley Labor Center, 2016), http://laborcenter.berkeley.edu/pdf/2016/Training-for-the-Future-2.pdf.

41 Ibid.

42 Department of Community Services and Development, *Low Income Weatherization Program Guidelines: Multi-Family (MF) Energy Efficiency and Renewables,* November 10, 2015 (Updated September 23, 2016; November 30, 2017; and January 22, 2019), http://www.csd.ca.gov/Portals/0/Documents/Public%20Notices/LIWP%20MF%20Program%20Guidelines_Amended%202019.pdf.

43 Ibid.

44 Detailed information on investments is available at: https://webmaps.arb.ca.gov/ccimap/.

45 Written correspondence with program implementers, Blanca de la Cruz, CHPC, and Andrew Brooks, AEA, February 2019.

46 Ibid.

47 Ibid.

48 The MMMF OBR program, launched in the fall of 2016,

is the first statewide program in the country to offer a complete package of integrated utility on-bill financing tools tailored to the specific needs of low-income multifamily rental buildings for performance-based, whole building energy-efficiency retrofits.

49 Energy Efficiency for All, *One-Stop Shops for the Multifamily Sector* (2017), http://energyefficiencyforall.org/sites/default/files/EEFA%20OneStopShop%20Fact%20Sheet%20%282%29.pdf.

50 LADWP, *LADWP Resolution*, https://www.ladwp.com/cs/idcplg?IdcService=GET_FILE&dDocName=OPLADWPCCB657615&RevisionSelectionMethod=LatestReleased.

51 This conclusion is based on NRDC's analysis of the Optimal Energy potential study conducted for this report and outlined in Appendix A.

52 Optimal Energy calculated the benefits and costs using the Total Resource Cost test (TRC) framework.

53 The City of Los Angeles, Office of the Controller, *Popular Annual Financial Report* (2018), http://www.lacontroller.org/financial_reports.

54 "High Road" refers to business practices that benefit companies, employees, customers, and ultimately, society.

55 Los Angeles' RSO is intended to protect tenants from excessive rent increases and evictions while giving landlords a reasonable return on their investment. This law covers roughly 631,000 rental housing units in 118,000 properties, but only covers units built on or before October 1, 1978. The ordinance preserves the current affordability level of existing housing units as long as those units remain occupied by the same tenant. As of July 2017, the annual allowable rent increase for rental units subject to the RSO for the fiscal year from July 1, 2017 to June 30, 2018 was 3%. To ensure that existing tenants have stable housing, the RSO also prohibits evictions without specific good causes, even if the lease or rental agreement has expired. For units covered by the RSO, the risks of rent increases or displacement caused by energy improvements is therefore reduced. The RSO prohibits landlords from raising rents to cover the value of free improvements received though direct-install programs. However, for improvements paid for by the owner that exceed the annual general rent adjustment provided to all owners, the RSO potentially permits passing on those costs to tenants via rent increases under special rent adjustment procedures, either as increased operating costs beyond the annual adjustment, or as amortized capital improvements. For more detail, see Appendix C.

56 Lisa Sitkin and James Grow, *Survey of State Tenant Protection Policies for the Weatherization Assistance Program (WAP)* (National Housing Law Project, 2018), https://www.nhlp.org/wp-content/uploads/2019.02.14-WAP-Tenant-Protection-Memo-with-Appendices.pdf. Under WAP, even during the "reasonable time" period of any restriction, the federal mandate permits rent increases "demonstrably related to matters other than the weatherization work performed." States have interpreted this very differently, with some states prohibiting any rent increases, others including guidance on allowable justifications or standards, and others simply repeating the statutory language. See NHLP WAP memo, pp. 4-7.

57 New York State Homes & Community Renewal, WAP Form #8C, Multi-Family Building Owner Agreement, para. III C.

58 MassSave, Low-Income Multi-Family Retrofit Program, para, II A and B.

59 LIWP Affordability Covenant, sec. iii, available from LIWP Service Delivery Plan, sec. 7.10, https://camultifamilyenergyefficiencydotorg.files.wordpress.com/2018/02/aea_liwp-service-delivery-plan-v2_website.pdf. Note that the requirement that rents remain affordable only to tenants at 30% of 80% of AMI provides no effective protection at all to most low-income tenants who have incomes far below 80% of AMI, and rents set to be affordable for households at 80% of AMI exceed actual market rents in many areas.

60 See NHLP WAP Memo, at pp. 7-9.

61 For more details on this survey, see Appendix C.

62 Ibid.

63 The figure illustrates programs tracked by the National Housing Preservation Database, including HUD Section 8, rental assistance payments, the LIHTC program, public housing, and several others. The color of the dots corresponds to whether or not the property has an upcoming LIHTC expiration date; the size of the dot references the total number of units. Clicking on a dot provides more details for that property.

64 The potential savings analyzed in this study include approximately 66% electric (LADWP)- and approximately 33% gas (SoCalGas)- related bill savings.

65 Energy Savings Assistance for Common Area Measures offers common area measures to eligible low-income multifamily properties (deed-restricted and subsidized housing).

66 LADWP Resolution, https://www.ladwp.com/cs/idcplg?IdcService=GET_FILE&dDocName=OPLADWPCCB657615&RevisionSelectionMethod=LatestReleased.

67 For this study, a measure was evaluated if it passed the first cost-effectiveness screen with a benefit-to-cost ratio greater than 0.3. We recommend measures be provided by the utility if the overall measure package is greater than 1.0.

68 For more information on Connecticut Green Bank's Low Income Multifamily Energy loan, see: https://www.ctgreenbank.com/programs/multifamily/lime/.

69 Optimal Energy provides energy-efficiency consulting services to investor and municipally owned utilities, program administrators, state and federal energy offices, regulatory commissions, advisory councils, and advocacy groups.

70 The federal poverty level is a standard set every year by the U.S. Department of Health and Human Services. For more information, see: https://www.healthcare.gov/glossary/federal-poverty-level-fpl/.

71 Optimal has compiled these detailed measure-level inputs and their sources in a spreadsheet that is available on request.

72 Measure applicability accounts for the feasibility, or real-world constraints, of installing a measure. For example, when studying the potential for heat pump water heaters (HPWHs), the analysis accounted for the fraction of homes that have the infrastructure to install HPWHs because HPWHs occupy more space than the electric water heaters they would replace. They may also need an electric outlet with a larger capacity than exists. This analysis assumed that in-unit HPWHs have an applicability of 39%.

73 15% represents the overhead costs of running the program, which includes everything but the funds used for the incentive. The latter costs would include, for example, marketing and hiring an additional LADWP employee or a

consultant to manage the program.

74 This consumption data was not specific to affordable households.

75 *California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects* (Governor's Office of Planning and Research, State of California, 2002), http://www.calmac.org/events/SPM_9_20_02.pdf.

76 While total energy-efficiency portfolios in California are required to meet a minimum TRC BCR of 1.0, this is not required of each program or measure.

77 These were determined to be suitable proxies for non-energy benefits in LADWP's service territory based on discussion with LADWP staff.

78 The amount incorporated is based on the California Public Utility Commission's staff cost-effectiveness proposal.

79 David Jacot, director of efficiency solutions at Los Angeles Department of Water and Power, personal communication, September 1, 2017.

80 For more information about BW Research Partnership, see http://www.bwresearch.com/.

81 These economic potential savings decrease over time because of future expected code and standard improvements, especially for lighting, that reduce available energy savings.

82 Optimal Energy's results for this income group are not displayed here (for brevity), but are available upon request.

83 Some measures are offered only for subsets of the population or for small specific programs. This is why some measures are designated as "partial."

84 The potential savings analyzed by this study includes approximately 66% electric- (LADWP) and approximately 33% gas- (SoCalGas) related bill savings.

85 Replacing gas-fired water and space heaters with HPWH and air source heat pumps offers great GHG reduction potential. The GHG reduction potential is expected to increase in the future as the penetration of renewable energy in the electric grid increases. Care needs to be taken when determining how these fuel switching measures should be offered through low-income programs because of the possibility that these measures may increase customer utility bills if they aren't bundled with other cost-effective measures. See Supplementary Table 14 for more details.

86 Assumes an LADWP average residential rate of 16.4 cents/kWh as recommended by David Jacot, director efficiency solutions for LADWP and 83 cents/therm baseline charge for SoCalGas residential gas rate. https://www.socalgas.com/regulatory/tariffs/tm2/pdf/GM.pdf

87 Without electrifying buildings, the impact of a 100% renewable electric grid is limited because it does not cover natural gas use in buildings. Therefore, building decarbonization is a critical component of achieving the state's carbon goals and to ensure low-income renters do not bear the burden of accelerated electrification in other sectors which can have the adverse impact of lower-income residents bearing the cost of natural gas infrastructure (gas process reflect increase cost of infrastructure not gas as a commodity alone).

88 Merrian Borgeson and Maria Stamas," LA City Council Moves to Slash GHG Emissions from Buildings," *NRDC Expert Blog*, 8 February 8 2018, https://www.nrdc.org/experts/merrian-borgeson/city-council-moves-slash-ghg-emissions-buildings.

89 For more specifics on BW Research's methodology and analysis, please contact NRDC

90 A soft story building is a multi-story building in which one or more floors have windows, wide doors, large unobstructed commercial spaces, or other openings in places where a shear wall would normally be required for stability as a matter of earthquake engineering design.

91 Elevate Energy, from public and private data sources.

92 Housing + Community Investment Department of Los Angeles (HCIDLA), CCRIS (Code Compliance Rent Information System), 2014–2017.

93 Office of Environmental Health Hazard Assessment (OEHHA), *CalEnviroScreen*, https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30.

94 Cadmus Group, *ESA Program Multifamily Segment Study Volume 1: Report*, (2013), http://docketpublic.energy.ca.gov/PublicDocuments/16-OIR-02/TN211054_20160414T121838_ESA_Multifamily_Segment_Study_Volume_1_Report.pdf.

95 CoStar (2015).

96 Ibid.

97 For more information on residual receipts please see: https://hcidla.lacity.org/Services-for-residual-receipts

98 Los Angeles County Office of the Assessor, Data, 2014, https://assessor.lacounty.gov/. The Los Angeles Energy Atlas, created by the California Center for Sustainable Communities (CCSC) at the University of California, Los Angeles, is a publicly available interactive website that illustrates address-level energy consumption and building characteristics for Los Angeles County. It shows neighborhood-level energy consumption by aggregating energy consumption at the address level from 2006 to 2010. This energy-use data revealed that multifamily properties of all sizes built before 1978 are the most energy intensive (Figure 7), particularly with respect to gas use (Figure 8). This is particularly noteworthy, as the largest number of buildings were built before 1978 and therefore may be especially in need of energy-efficiency upgrades.

99 Table based on the Gateway-to–Green (G2G) Survey. To better understand the characteristics of Los Angeles' housing stock, Elevate Energy interviewed HCIDLA Systematic Code Enforcement Program housing inspectors who developed the G2G survey. The survey identified common equipment found in multifamily rental properties inspected since 2014.

100 U.S. Census Bureau, *American Housing Survey*, 2011, https://www.census.gov/programs-surveys/ahs.html.

101 For larger old properties.

102 CFL stands for compact fluorescent lamp. LED stands for light-emitting diode.

103 Except if affected by 1994 earthquake, thus requiring major repairs and upgrade to current code

104 The programs and policies outlined below may have changed since the writing of this section in 2017.

105 Los Angeles Department of Water and Power, AC Optimization Program, https://ladwpactuneup.com.

106 Los Angeles Department of Water and Power, Equity Metrics Data Initiative, https://ladwp.com/ladwp/faces/wcnav_externalId/au-fr-corporateperformance-emdi?_adf.ctrl-state=3p0i6f2di_4&WT.mc_id=pev_confpage&&_afrLoop=787156998160370.

107 Los Angeles Department of Water and Power, Refrigerator, Freezer and AC Recycling Program, https://www.arcaincutility.com/CA/Ladwp/account-lookup.cfm.

108 Fame Corporations, *Fame Corporations Installs Energy Efficient Refrigerators for Low Income Tenants Through LADWP Exchange Program, 2016, http://www.famecorporations.org/2016/01/12/fame-corporations-installs-energy-efficient-refrigerators-for-low-income-tenants-through-ladwp-exchange-program/.*

109 Ibid.

110 Data provided by LADWP's Director of Energy Efficiency and the California Department of Water Resources

111 The International Brotherhood of Electrical Workers is a labor union that represents workers and retirees in the electrical industry.

112 Megan Emiko Scott and Carol Zabin, *Training for the Future II Los Angeles's Utility Pre-Craft Trainee Program: Progress to Date* (UC Berkley Labor Center, 2016), http://laborcenter.berkeley.edu/pdf/2016/Training-for-the-Future-2.pdf.

113 Ibid.

114 Los Angeles Department of Water and Power, *LADWP Wins Energy Efficiency and Community Service Award for Program Benefiting Thousands of Low-Income Customers,* 2018, http://www.ladwpnews.com/ladwp-wins-energy-efficiency-and-community-service-award-for-program-benefiting-thousands-of-low-income-customers/.

115 Data provided by LADWP's Director of Energy Efficiency.

116 Ibid.

117 Personal correspondence with IBEW 18.

118 Ibid.

119 Energy Efficiency For All, *Program Design Guide: Energy Efficiency Programs in Multifamily Affordable Housing* (2015), http://www.energyefficiencyforall.org/program-design-guide.

120 Kate Johnson, *Apartment Hunters: Programs Searching for Energy Savings in Multifamily Buildings* ((American Council for an Energy-Efficient Economy, 2013), http://aceee.org/research-report/e13n.

121 Findings from owner interviews conducted by Elevate Energy and Global Green USA

122 Mayor Eric Garcetti's Office, Sustainability Team, *pLAn: Transforming Los Angeles: Environment, Economy, Equity* (2017), http://plan.lamayor.org/wp-content/uploads/2017/03/the-plan.pdf.

123 Mayor Eric Garcetti's Office, Resilience Team, *Resilient Los Angeles* (2018), https://www.lamayor.org/sites/g/files/wph446/f/page/file/Resilient%20Los%20Angeles.pdf.

124 The Existing Buildings Energy and Water Efficiency (EBEWE) Program was established by Los Angeles Municipal Code (LAMC) Division 97, Article 1, Chapter IX, Ordinance No. 184674 and amended by Ordinance Nos. 185198 and 185586. The EBEWE Program is commonly referred to in information provided by the Los Angeles Department of Building and Safety as the EBEWE Ordinance.

125 G2G, https://hcidla.lacity.org/Gateway-to-Green.

126 To be eligibility for the Handyworker Program, one must be a homeowner 62 years or older, a person with a permanent disability, or someone living with a disabled family member; a renter 62 years or older or with a permanent disability; or low income. Owner-occupied single-family, duplexes, condominiums, town homes, co-ops, and stationary mobile units (e.g., manufactured homes) are all eligible property types. Limited repairs are available for multifamily rental affordable multifamily homes. Information is available at: http://hcidla.lacity.org/low-income-sr.

127 Multifamily refers to apartment buildings with five or more residential units, whether or not they have central hot water, heating, and cooling systems, as well as multi-building complexes with at least five or more units on the property.

128 Department of Community Services and Development, *Low Income Weatherization Program Guidelines: Multi-Family (MF) Energy Efficiency and Renewables* (2015, updated 2016, 2017, and 2019), http://www.csd.ca.gov/Portals/0/Documents/Public%20Notices/LIWP%20MF%20Program%20Guidelines_Amended%202019.pdf.

129 Ibid.

130 Detailed information on investments available at: https://webmaps.arb.ca.gov/ccimap/.

131 Written correspondence with program implementers, Blanca de la Cruz, CHPC, and Andrew Brooks, Association of Energy Affordability, February 2019.

132 Ibid.

133 Ibid.

134 Nick Dirr, *Low Income Weatherization Program (LIWP)* (Association for Energy Affordability, 2017), https://www.enterprisecommunity.org/sites/default/files/media-library/where-we-work/southern-california/SCC/LIWP-LMF 031517-aea Nick Dirr.pdf.

135 For more information on the federally funded weatherization assistance program, see: https://www.energy.gov/eere/wipo/weatherization-assistance-program.

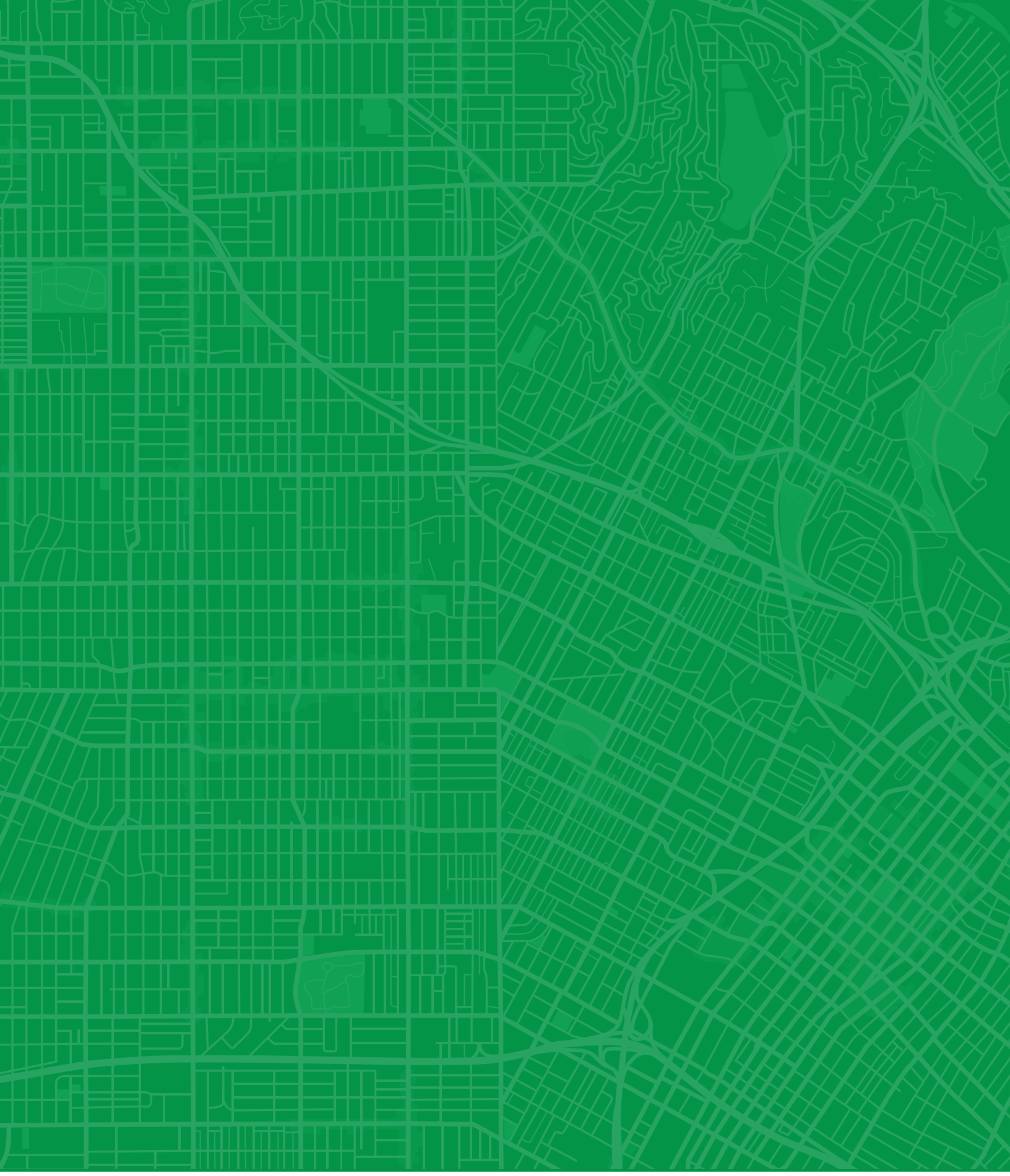
136 State of California v. SoCalGas, Consent Decree, Case Nos. BC602973 and BC628120 (February 25, 2019).

137 State of California v. SoCalGas, Third Amended Complaint for Civil Penalties, Judicial Council Coordination Proceeding No. 4861 (August 8, 2016).

138 SoCalGas, *Zero Percent On-Bill Financing*, https://www.socalgas.com/for-your-business/energy-savings/zero-%----percent-financing. https://www.socalgas.com/for-your-business/energy-savings/zero-percent-financing]

139 Los Angeles Department of Water and Power, Utility Infrastructure Loan Program, https://www.bomagla.org/sites/bomagla.org/files/Utility%20Infrastructure%20Loan%20Program%20COM.pdf https://business.lacity.org/content/utility-infrastructure-loan-program]

140 Los Angeles County Residential Property Assessed Clean Energy (PACE) Program, http://pace.lacounty.gov/residential/.



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