

Closing the Gap in Energy Efficiency Programs for Affordable Multifamily Housing

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April 2019

Report U1903

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About the Authors

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Acknowledgments

This report is a collaboration between two multifamily energy efficiency initiatives: Energy Efficiency for All (EEFA) and ACEEE's Multifamily Energy Savings Project. EEFA is an initiative dedicated to linking the energy and housing sectors in order to tap the benefits of energy efficiency for millions of low-income families.¹ It is a partnership of the Energy Foundation, Elevate Energy, National Housing Trust, and Natural Resources Defense Council. EEFA works with electric and gas utilities and their regulators on innovative energy efficiency program designs. The organization also advises housing finance agencies on best practices in building owner engagement and finance products. To realize the opportunity of improved energy efficiency in affordable housing, EEFA's key objectives are to:

- Build an effective national network among energy efficiency and affordable housing professionals to help expand investments in efficiency upgrades.
- Support the work of state and local stakeholders in up to 12 states over the next two years to expand energy efficiency programs for the affordable multifamily sector.
- Expand and improve utility energy efficiency programs so they provide the necessary tools, financial incentives, administrative ease, and marketing to drive large-scale efficiency investments in affordable multifamily buildings.
- Support building owners and operators of affordable multifamily buildings looking for opportunities for energy efficiency upgrades or help in navigating the retrofit process.

In 2012 ACEEE launched the Multifamily Energy Savings Project, building on an earlier collaboration with the National Housing Trust and National Consumer Law Center to

¹ For more information on EEFA, see energyefficiencyforall.org/.

advance multifamily energy efficiency programs in selected states.² The project has three functions:

- Conducting research to track and analyze the status and performance of multifamily energy efficiency programs.
- Facilitating a working group of multifamily program managers from utilities and third-party administrators.
- Offering no-cost technical assistance to working group members, such as targeted research or technical guidance in developing or modifying programs.

To date we have published eight research reports on multifamily programs, and the working group has grown to more than 50 members.

This report was made possible through the generous support of Energy Efficiency for All. The authors gratefully acknowledge external reviewers, internal reviewers, colleagues, and sponsors who supported this report. External expert reviewers included Stephen Morgan, Clean Energy Solutions; Abby Corso, Elevate Energy; Michael Harris, Energy Outreach Colorado; Giuliana Kunkel, Benjamin Burdick, and Karen Blyton, DC Sustainable Energy Utility; Emma Ingebretsen, CenterPoint Energy; Yvonne Pfeifer, Xcel Energy; John Richards and Matthew Ray, National Grid; Julia Kalloz, Preston Thomas, and Scott Falvey, Maryland Department of Housing and Community Development; Jennifer Duvall, Southern Company; Todd Nedwick and Dana Bartolomei, National Housing Trust; Lindsay Robbins and Deron Lovaas, Natural Resources Defense Council; and Sarah Lerhaupt, California Public Utilities Commission. Internal reviewers included Lauren Ross, Ariel Drehobl, Martin Kushler, Neal Elliott, Maggie Molina, and Steven Nadel. The authors also gratefully acknowledge the assistance of Sarah Hill, Association for Energy Affordability, and Irma DePratti, San Diego Gas and Electric. External review and support do not imply affiliation or endorsement.

We thank Fred Grossberg for developmental editing, Elise Marton for managing the editing process and copy editing, Sean O'Brien and Roxanna Usher for copy editing, Eric Schwass for publication design, and Casey Skeens, Maxine Chikumbo, and Wendy Koch for their help in launching this report.

² For more information on the Multifamily Energy Savings Project, see aceee.org/multifamily-project.

Executive Summary

KEY TAKEAWAYS

- Affordable multifamily energy efficiency programs can achieve significant and cost-effective energy savings in both hot and cold climates.
- Effective program designs for affordable multifamily housing feature practices like financing and incentives, technical assistance, collaboration among partners and stakeholders, and effective outreach.
- The most important component of an effective affordable multifamily program is providing property owners and managers with technical assistance throughout the retrofit process.

BACKGROUND

Multifamily buildings, those with apartments or condominiums, have been historically underserved by energy efficiency programs, and this is especially true for multifamily properties that are home to low-income households. In part because they live in less efficient housing, these individuals and families experience higher energy cost burdens than other households. While energy efficiency programs have a long history of serving low-income single-family homes, few comparable multifamily programs existed until recently.

CHALLENGES AND OPPORTUNITIES

Multifamily energy efficiency programs serving affordable housing face many of the same challenges that other multifamily programs do, but these challenges are often magnified. Several programs are working to overcome these challenges and achieve both substantial energy savings and many nonenergy benefits for low-income customers.

RESEARCH OBJECTIVES AND METHODOLOGY

Our research highlights trends in the performance of affordable multifamily energy efficiency programs serving some of the largest multifamily markets in the United States. We examine programs in terms of their 2017 energy savings, spending, participation, and cost effectiveness. We also identify the effective policies and practices that support them.

NATIONAL TRENDS IN AFFORDABLE MULTIFAMILY PROGRAMS

The 32 affordable multifamily energy efficiency programs we analyze in this report spent at least \$102 million in 2017. These programs saved an average of 740 kWh electricity and 3.15 MMBtu natural gas per household in 2017 – the equivalent of saving more than a month and a half of energy use in an average apartment and at least \$103 per multifamily unit annually.

Energy savings and customer participation totals vary by program type. Some programs offer no-cost direct-install energy efficiency measures, while others provide incentives for a more extensive list of equipment upgrades or building system improvements. Both approaches can be effective in meeting different market needs. Programs offering direct-install measures tend to reach more multifamily homes but achieve lower savings per

dwelling unit; conversely, programs that offer an expanded list of incentivized measures reach fewer participants but attain higher savings per participant.

Data available for 14 affordable multifamily programs in our set show that most of them are cost effective. When evaluating programs, administrators in most of the states where these programs are located consider the nonenergy benefits of efficiency for low-income households, which can be large. They also may analyze energy efficiency benefits that are specific to low-income customers or assign greater value to low-income customer participation impacts.

COMMON FEATURES OF EFFECTIVE AFFORDABLE MULTIFAMILY PROGRAMS

Our research shows that there are cost-effective programs serving affordable multifamily housing in both hot and cold climates. Our interviews with program staff reveal several common features of effective affordable multifamily programs. These include:

- Technical assistance provided to analyze opportunities and recommend improvements
- Collaboration and strong relationships among key partners and stakeholders
- Effective outreach, communication, and education
- Access to financing and availability of incentives for energy efficiency measures and projects

Additional effective program features include:

- One-stop shop program design
- Whole-building approach to achieve deep savings
- Technical assistance for project finances
- Alignment of program incentives with other available incentives

An overarching finding from our research is that the most important feature of affordable multifamily programs is providing technical assistance throughout the retrofit process. This includes analyzing and recommending equipment and system improvements, supporting the contracting and implementation of measures, and helping owners obtain and assemble the financial packages needed to pay for projects. The need for assistance is generally higher in the affordable multifamily market as property owners commonly have fewer resources and less time available to devote to energy efficiency retrofits.

RECOMMENDATIONS

New and developing affordable multifamily programs can achieve significant and cost-effective energy savings for many low-income households by emulating strategies of existing effective programs. Affordable multifamily programs should support energy efficiency retrofit projects from planning to completion, enlisting the help of community partners. Programs also should provide incentives that improve the efficiency of building systems and envelopes to maximize energy savings. Program administrators should continue to expand programs and services for affordable multifamily programs to close gaps in addressing the needs of this underserved market.

Introduction

Energy efficiency programs offered to utility customers are common throughout the United States. In 2017 total annual spending on these programs was \$7.9 billion (Berg et al. 2018). A guiding principle followed by program administrators is equity in the availability of programs, services, and incentives across the full range of customer types.

The multifamily market, composed of apartment and condominium buildings, is one customer segment that has historically been underserved by utility and related energy efficiency programs. There are many reasons for this, but market barriers, such as split incentives, are often the cause (Johnson 2013). Split incentives arise from the fact that multifamily building residents are often responsible for paying their own energy bills and can benefit from energy efficiency improvements that reduce these costs, but building owners and managers must often approve and cover the cost of these installations, with little means of recouping their investment. Types of ownership and utility metering also can be barriers.³ However many utilities and related organizations are addressing these barriers and offering robust and effective programs to multifamily households and building owners (Samarripas, York, and Ross 2017).

The multifamily market is composed of many types of buildings, ownership structures, and residents.⁴ Low-income residents make up an important segment of this market and live in many types of multifamily buildings that collectively are often termed “affordable housing.”⁵

In this report we examine the performance of affordable multifamily programs, which are those programs targeted to low-income multifamily homes. This report builds on earlier ACEEE research analyzing multifamily programs serving the largest multifamily markets in the United States (Samarripas, York, and Ross 2017). Our research scope encompasses a representative set of energy efficiency programs for affordable multifamily housing in these urban areas.

Affordable Multifamily Housing: An Underserved Market for Energy Efficiency

THE PROBLEM OF HIGH ENERGY BURDENS

The problems faced by low-income households in affording utility costs are not new. Some of the earliest energy efficiency programs offered by utilities, local governments, state agencies, and the federal government targeted low-income utility customers living in single-family homes. These programs provided services to weatherize building envelopes and

³ For more on multifamily market barriers to energy efficiency, see the materials published as part of ACEEE’s [Multifamily Energy Savings Project](#).

⁴ Multifamily buildings vary by characteristics including height, age, number of units, and construction type.

⁵ *Affordable housing* is a blanket term that characterizes a variety of housing types and ownerships, all with the common objective of being low-cost to residents. Affordable housing includes subsidized housing – properties with below-market rents, or market-rate properties with residents who receive vouchers for rent payments. It also includes “naturally occurring affordable” housing – properties that are low-cost without any subsidies.

provide energy-efficient upgrades of mechanical systems, lighting, and appliances. Such programs have been successful in reducing energy costs for participating households and yielding additional health, safety, and comfort benefits as well (Tonn et al. 2014). However comparable programs targeting low-income households residing in multifamily housing have not been as common until more recently.

For middle-income and high-income households, the share of their earnings going to cover energy costs – their energy burden – is typically a relatively small percentage of their total income. Many low-income households living in multifamily buildings, especially renters, face high energy cost burdens. In a national analysis, Drehobl and Ross (2016) found that the median household energy burden for low-income households living in multifamily buildings is 5%, compared with a median of 3.5% across large US cities. Further, the study concluded that these households tend to live in less energy-efficient housing and pay a higher utility cost per square foot than the average household. Higher energy burdens also correlate with negative health impacts and increased stress, and they may force low-income households to make trade-offs between paying energy bills and meeting other essential needs. For these residents, the benefits of reduced energy costs resulting from improved efficiency can be large. For these reasons, addressing the energy burdens faced by low-income households is critical to achieving substantial energy savings and equitable outcomes in the multifamily market.

CHALLENGES AND OPPORTUNITIES FOR AFFORDABLE MULTIFAMILY ENERGY EFFICIENCY

Programs that serve affordable multifamily housing markets face all the same barriers as those programs serving other multifamily customers. Despite such barriers, there are numerous examples of successful programs that target affordable housing. The structure of programs serving the affordable multifamily housing market varies. In some cases, these are separate programs tailored to this market; in others, a single multifamily program may have different eligibility criteria for nonsubsidized and subsidized housing. Program success ultimately results from effective program designs and supportive policies, which we illustrate later in this report with selected program examples.

Multifamily property owners face many challenges. Key barriers are limited time and resources to pursue energy efficiency. Owners of affordable housing may lack dedicated operations and maintenance staff, or such staff may be stretched very thin. Property owners simply may lack the time and capacity to initiate, evaluate, select, and pursue new projects that would improve a building's energy efficiency. They also typically have competing, higher priorities such as fundamental maintenance and repairs. If building operators do not receive sufficient training when energy-efficient upgrades are made, they may not operate and maintain new building equipment, systems, and controls as intended to achieve energy savings. Affordable-property owners also are more likely than other property owners to lack sufficient up-front capital to invest in building upgrades.

Program administrators face their own set of challenges in serving affordable housing owners. Gaining program participation can be more expensive, requiring greater administrative and marketing costs for outreach to potential participants. Determining eligibility for low-income programs can be burdensome for program administrators in some

cases. And the incentive amounts needed for customers to implement measures may need to be higher.

Program administrators also may encounter properties that are not well maintained and require repairs to ensure the health and safety of residents. These take precedence over energy efficiency improvements and must be resolved before such improvements can be implemented. Further, their costs must be covered apart from energy efficiency program budgets. Some programs, such as California's Energy Savings Assistance Program, do allow for some minor home repairs.

These barriers and others can be overcome. Ultimately what is most important is to identify what is needed to improve performance and to determine how programs can work with building owners to meet challenges and implement improvements.

Leading programs recognize such barriers and are designed to address them. Affordable multifamily programs may be subject to less stringent cost-effectiveness criteria in recognition of the higher program costs, or these criteria may give added weight to the broader social benefits that energy efficiency can provide to low-income households. To address building needs apart from recommended energy efficiency measures, programs may leverage other funding sources or receive funding specifically to deal with such problems. Programs can also provide periodic resident education as well as training for building operators and managers to ensure that efficient equipment and appliances are being operated and maintained properly.

Countering the barriers faced in serving affordable housing markets are the many nonenergy benefits that can result from energy efficiency improvements. Such benefits include healthier indoor environments, improved indoor comfort, reduced utility bill arrearages, reduced resident turnover, increased property values, and preservation of affordable properties (Cluett and Amann 2015; Samarripas, Ross, and Bailey 2017; Samarripas and York 2018).

EXISTING RESEARCH ON MULTIFAMILY ENERGY EFFICIENCY PROGRAMS SERVING LOW-INCOME HOUSEHOLDS

ACEEE has undertaken some of the first national-scale research on the prevalence and performance of multifamily energy efficiency programs (Johnson and Mackres 2013; Samarripas, York, and Ross 2017). This has not been without its challenges. Program data are typically aggregated by broad categories such as commercial or residential energy efficiency, not by a subcategory such as multifamily buildings. This makes it difficult to collect and analyze multifamily program information.

Johnson and Mackres (2013) relied on publicly available data on housing and utility programs. Their research revealed that the multifamily market had been largely underserved by energy efficiency programs due to a number of barriers and difficulties specific to this market faced by program administrators. The study examined multifamily programs without distinguishing those programs targeting low-income households in particular.

In 2017 ACEEE completed a second national-level review of multifamily energy efficiency programs (Samarripas, York, and Ross 2017). In this update, ACEEE collected information on income-eligible programs along with data similar to what was used in the 2013 study. Out of the 51 metro areas included in the 2017 research, ACEEE found that only 15 of them specifically offered some type of multifamily energy efficiency program serving income-eligible (low-income) households and property owners. This revealed a large gap in programs and services for this group of customers.

Research Objectives

The goal of this report is to highlight energy efficiency programs that are effectively serving affordable multifamily housing residents and building owners. The programs included here are among those serving the largest multifamily markets identified in the earlier ACEEE report by Samarripas, York, and Ross (2017). We examine trends in these programs' annual energy savings, spending, participation totals, and cost-effectiveness evaluations. We also closely examine several of the programs that are performing well in terms of one or several of these indicators. For each highlighted program, we examine the strategies and practices that support their performance.

Our research on these programs has been guided by several key questions:

- What types of services and energy efficiency improvements are provided?
- What impacts are the programs having?
- Are the programs cost effective?
- What lessons can we learn from the most successful programs?

Methodology

This research focuses exclusively on energy efficiency programs that are funded by utility customer surcharges or greenhouse gas (GHG) emissions auction proceeds and that provide energy-efficient equipment upgrades and other building improvements to the low-income residents and owners of affordable multifamily buildings. We discuss private sector energy efficiency investments in these buildings only to the extent that they are relevant to the work of these energy efficiency programs.

We employed a two-step process to collect program information. This involved both surveying and interviewing program administrators. We first contacted 35 program administrators and requested that they complete an online survey, whose questions can be found in Appendix B. In doing so, we made our best effort to include programs serving the largest multifamily markets identified in Samarripas, York, and Ross (2017). To supplement information obtained from survey responses, we used data obtained from public program reports filed with local and state utility regulators, such as evaluations and annual reports, whenever possible. We also used data from these sources to compensate for information missing from surveys. However data obtained from these sources did not always take the same form as those from our survey. We were therefore limited in our ability to compare all programs with one another. Ultimately, we were able to analyze information from 26 of the 35 program administrators initially contacted for this report. Together these 26 administrators manage a total of 32 affordable multifamily programs.

We used quantitative data from the surveys and public reporting to compare programs in terms of their energy savings, spending, participation, and cost effectiveness. We also used qualitative data collected from our survey and several follow-up interviews with program managers to identify the program practices that are leading to higher levels of cost-effective energy savings and more customers served. Questions used in our follow-up interviews are included in Appendix C. While the body of this report includes several tables highlighting programs' performance and practices, Appendix A includes all collected data in detailed and comprehensive tabular form.

Findings

NATIONAL-LEVEL DATA ON AFFORDABLE MULTIFAMILY PROGRAMS

The 32 programs highlighted in this report spent at least \$102 million to deliver energy efficiency upgrades and improvements in 2017.⁶ In 2017, affordable multifamily programs achieved an average of 740 kWh of electricity savings and 3.15 MMBtu of natural gas savings in income-eligible multifamily homes.⁷ This is equivalent to saving roughly a month and a half of electricity and natural gas use in the average US apartment. The programs also produced an annual cost savings of at least \$103 per unit (EIA 2018, 2019a, 2019b).⁸ Ultimately, customer savings such as these can vary substantially by program type. We explore differences in these and other program indicators below.

Energy Savings, Spending, and Participation

We divided programs into groups to better compare energy savings and participation data. We categorized programs both by the fuel type they target (electricity or natural gas) and by program type, either "direct install" (offering installation of a limited number of no-cost energy efficiency measures) or "comprehensive" (providing incentives for a more extensive

⁶ Our estimate of 2017 program spending is based on available spending or budget reporting. Using all available data, we estimate that programs spent a total of \$102,122,951 in 2017. While most programs reported at least partial spending or budget data, three programs (Kansas City Power and Light, Philadelphia Gas Works, and PPL Electric Utilities) did not report any. Detailed spending data are presented for each program in Appendix A. Because California's Department of Community Services and Development reported spending totals for a period of two and half years, we adjusted these by a factor of 40% to approximate one year of spending.

⁷ We calculated average savings per household by dividing the sum of all energy savings across programs that reported participation totals by the sum of all the dwelling units they served.

⁸ We used data from EIA's 2015 Residential Energy Consumption Survey (RECS) to obtain average monthly electricity and natural gas use for a household living in a building with at least five dwelling units. In 2015, occupied apartments used an average of 503.11 kWh electricity and 1.9 MMBtu natural gas each month. We then used EIA's electricity data browser and natural gas price data viewer to calculate average 2017 electricity and natural gas rates. We used commercial electricity and natural gas prices to conservatively estimate cost savings because multifamily program data in our report include both commercial and residential energy savings, and commercial rates are lower than residential rates. Commercial energy savings may result from installing efficiency measures in master-metered buildings or common area spaces. We used average 2017 commercial prices (10.66¢ per kWh and \$7.60 per MMBtu) to estimate a minimum program cost savings per dwelling unit. Using this approach, we estimated per unit cost savings of \$78.88 in electricity bills and \$23.94 in natural gas expenses.

list of equipment upgrades and building improvements).⁹ While these program types differ in their approach, both can meet important energy efficiency needs of affordable multifamily properties. Tables 1, 2, 3, and 4 present relevant savings, participation, and spending data for each of these groups.¹⁰

Table 1. Direct install electricity program annual performance for 2017

Administrator	State	Program	Total annual savings (kWh)	Total annual spending	Total annual dwelling units served	Savings per unit (kWh)
Pacific Gas and Electric ¹	CA	Energy Savings Assistance	5,959,000	\$9,635,802	13,859	430
San Diego Gas and Electric ²	CA	Energy Savings Assistance	1,146,000	\$3,462,732	9,236	124
Southern California Edison ³	CA	Energy Savings Assistance	5,856,531	\$9,552,666	20,645	284
DCSEU ⁴	DC	Income Qualified Efficiency Fund	2,244,380	\$402,224	5,382	417
Xcel Energy	MN	Multi-Family Energy Savings	972,901	\$1,391,040	N/A	N/A
PECO Energy	PA	Low-Income Energy Efficiency	1,901,000	\$2,300,000	2,227	854
Dominion Energy ⁵	VA	Income and Age-Qualifying Home Improvement	1,786,400	N/A	5,552	322

¹ Values reflect only residential measures. While commercial measures for common spaces were approved in 2016, these were not available to customers until 2018. Spending and participation totals include some data on customers receiving natural gas measures. *Source:* PG&E 2018. ² Values reflect only residential measures. While commercial measures for common spaces were approved in 2016, these were not available to customers until 2018. Spending and participation totals include some data on customers receiving natural gas measures. *Source:* SDGE 2018. ³ Values reflect only residential measures. While commercial measures for common spaces were approved in 2016, these were not available to customers until 2018. We have reported the company's MWh savings as kWh savings without conversion. We found it likely that the original reporting was made in error. *Source:* SCE 2018. ⁴ DCSEU is the District of Columbia Sustainable Energy Utility. Participation totals include some customers receiving natural gas measures. ⁵ While the program's participation total includes both multifamily and single-family customers, available information indicates that most units were multifamily.

⁹ For purposes of this report, we consider programs that provide prescriptive, custom, or performance-based incentives as comprehensive. Maryland's Department of Housing and Community Development (DHCD) provides participants with grant or loan funding, and we have categorized this as a custom program.

¹⁰ Because energy savings are a critical indicator of program performance, we include in tables 1, 2, 3, and 4 only those programs that reported 2017 multifamily customer energy savings. We provide available data for programs that did not report energy savings in Appendix A.

Table 2. Comprehensive electricity program annual performance for 2017

Administrator	State	Program	Total annual savings (kWh)	Total annual spending	Total annual dwelling units served	Savings per unit (kWh)
California CSD ¹	CA	Low-Income Weatherization Program for Multifamily Properties	11,242,406	\$24,000,000	4,895	2,297
Xcel Energy ²	CO	Affordable Housing Rebate	1,983,546	\$1,062,473	3,748	529
Eversource	CT	Multifamily Initiative—Income Eligible	6,644,718	N/A	8,560	776
DCSEU ³	DC	Low-Income Multifamily Custom	2,045,652	\$1,244,778	1,770	1,156
Georgia Power ⁴	GA	Home Energy Improvement	2,187,780	N/A	1,135	1,928
National Grid	MA	Low-Income Multi-Family	12,556,000	\$2,858,600	6,141	2,045
MD DHCD ⁵	MD	Multifamily Energy Efficiency and Housing Affordability	1,507,000	\$5,708,329	919	1,640
Consumers Energy ⁶	MI	Residential Multifamily Income Qualified	2,147,145	\$857,844	N/A	N/A
Xcel Energy	MN	Multi-Family Building Efficiency	2,179,169	\$515,419	N/A	N/A
Ameren ⁷	MO	CommunitySavers	7,334,784	\$2,124,240	4,486	1,635
Kansas City Power and Light ⁸	MO	Income-Eligible Multi-Family	4,183,846	N/A	N/A	N/A
NYSERDA ⁹	NY	Multifamily Performance Program Version 8	8,119,286	\$4,818,272	3,517	2,309
Duquesne Light ¹⁰	PA	Multifamily Housing Retrofit	41,000	\$310,000	N/A	N/A
National Grid	RI	Income-Eligible Multifamily	3,970,000	\$2,858,600	5,162	769

¹ CSD is the California Department of Community Services and Development. Data shown here span January 1, 2016, to June 1, 2018. While 2017-specific totals would be lower than those presented here, we assume that per-unit savings are roughly accurate. We have adjusted savings, spending, and participation totals by a factor of 40% in calculating averages presented throughout this report. ² The Affordable Housing Rebate Program coordinates delivery of energy efficiency measures to customers of multiple Colorado utilities, but available information indicates that most are Xcel Energy customers. Data presented here reflect performance for the entire program and not just Xcel Energy customers. ³ Separate participation data for those receiving electric and gas measures were not available. ⁴ Reporting does not distinguish income-eligible units from those that are not income-eligible. Data only reflect participants in the whole-home program option. *Source:* Burns et al. 2018. ⁵ MD DHCD is the Maryland Department of Housing and Community Development. ⁶ *Source:* Consumers Energy 2018. ⁷ *Source:* Ameren Missouri 2018. ⁸ *Source:* Kansas City Power & Light Company 2018. ⁹ Participation totals include customers receiving natural gas measures. ¹⁰ Duquesne Light Company 2017.

Data presented in tables 1 and 2 reinforce findings from previous research that programs targeting low-income customers often face a trade-off between serving more customers and achieving high energy savings (Gilleo, Nowak, and Drehobl 2017). Five out of the six direct-install programs that reported participation data served at least 5,000 income-eligible

multifamily units.¹¹ This was true for only 3 out of 10 comprehensive programs. However comprehensive programs achieved higher energy savings than those with only direct-install offers. Comprehensive programs saved an average of 1,360 kWh per multifamily unit and ranged from 529 kWh to 2,309 kWh saved per unit. Direct-install programs saved an average of 332 kWh per multifamily unit and ranged from 124 kWh to 854 kWh saved per unit.

We used survey data from Fannie Mae (2015) to compare these savings with the average whole-building electricity and natural gas use in multifamily buildings. The average electricity savings for direct-install programs (332 kWh) are 2% of the national average electricity consumption for multifamily units (14,176 kWh). The average savings for comprehensive programs (1,360 kWh) are 10% of this national average.

Table 3. Direct-install natural gas program annual performance for 2017

Administrator	State	Program	Total annual savings (MMBtu)	Total annual spending	Total annual dwelling units served	Savings per unit (MMBtu)
Pacific Gas and Electric ¹	CA	Energy Savings Assistance	16,596	\$8,480,764	12,168	1.36
San Diego Gas and Electric ²	CA	Energy Savings Assistance	3,489	\$3,415,072	9,173	0.38
Southern California Gas ³	CA	Energy Savings Assistance	17,396	\$10,797,032	26,412	0.66
DCSEU ⁴	DC	Income Qualified Efficiency Fund	4,003	\$402,224	5,382	0.74

¹ PGE 2018. Values reflect only residential measures. While commercial measures for common spaces were approved in 2016, these were not available to customers until 2018. Spending and participation totals include some data on customers receiving electric measures. ² SDGE 2018. Values reflect only residential measures. While commercial measures for common spaces were approved in 2016, these were not available to customers until 2018. Spending and participation totals include some data on customers receiving electric measures. ³ Values reflect only residential measures. While energy savings differ from annual reporting, these are consistent with the response to our survey. While commercial measures for common spaces were approved in 2016, these were not available to customers until 2018. *Source:* Southern California Gas Company 2018. ⁴ Participation totals include some customers receiving electric measures.

¹¹ We use 5,000 participants as a rough threshold for describing programs with elevated participation based on the distribution of our available data. Electricity efficiency programs had a median 2017 participation of 5,029 dwelling units, and natural gas programs had a median 2017 participation of 4,346 dwelling units. A generally better metric for looking at participation is the annual or cumulative participation rate, i.e., the number of participants divided by the number who are eligible or targeted. Unlike raw participation numbers, a participation rate helps adjust for the size of a service area in terms of the number of eligible customers. Unfortunately, very few programs compile or report the number of potential participants, so we could not analyze their participation rates. In keeping with Ross, Jarrett, and York (2016), we recommend that program administrators and their governing authorities make data available regarding a program's eligible population to better guide program planning and progress toward meeting the needs of a high proportion of the income-eligible multifamily sector.

Table 4. Comprehensive natural gas program annual performance for 2017

Administrator	State	Program	Total annual savings (MMBtu)	Total annual spending	Total annual dwelling units served	Savings per unit (MMBtu)
California CSD	CA	Low-Income Weatherization Program for Multifamily Properties	29,076	N/A	N/A	N/A
Xcel Energy ¹	CO	Affordable Housing Rebate Program	14,063	\$1,098,228	3,748	3.75
Eversource	CT	Multifamily Initiative—Income Eligible	21,089	N/A	2,430	8.68
DCSEU ²	DC	Low-Income Multifamily Custom	2,336	\$1,485,666	1,770	1.32
National Grid	MA	Low-Income Multi-Family	89,338	\$17,511,092	5,325	16.78
MD DHCD	MD	Multifamily Energy Efficiency and Housing Affordability	3,041	N/A	N/A	N/A
Consumers Energy ³	MI	Residential Multifamily Income Qualified	32,564	\$1,460,013	N/A	N/A
CenterPoint Energy	MN	Low Income Rental Efficiency (LIRE)	1,115	\$252,202	N/A	N/A
CenterPoint Energy ⁴	MN	Low-Income Multi-Family Housing Rebates (LIMF)	9,407	\$136,155	4,851	1.94
CenterPoint Energy	MN	Multi-Family Building Efficiency (MFBE)	1,351	\$140,128	640	2.11
Xcel Energy	MN	Multi-Family Building Efficiency	7,421	\$288,513	N/A	N/A
NYSERDA ⁵	NY	Multifamily Performance Program Version 8	53,264	N/A	3,517	15.14
National Grid	RI	Income-Eligible Multifamily	17,601	\$1,916,100	3,840	4.58

¹The Affordable Housing Rebate Program coordinates delivery of energy efficiency measures to customers of multiple Colorado utilities, but available information indicates that most are Xcel Energy customers. Data presented here reflect performance for the entire program and not just Xcel Energy customers. ² Separate participation data for those receiving electric and gas measures were not available. ³ Source: Consumers Energy 2018. ⁴ CenterPoint's LIMF program provides only efficiency measures that reduce commercially metered energy use. ⁵ Participation totals include data on customers receiving electric measures.

As tables 3 and 4 show, natural gas programs exhibit many of the same patterns as electric programs. All direct-install programs that reported participation data reached more than 5,000 units in 2017. Only one comprehensive program reached 5,000 units, but these programs are achieving more savings per multifamily unit than their direct-install counterparts. Comprehensive natural gas programs achieved 7.98 MMBtu of savings per multifamily unit and ranged from 1.32 MMBtu to 16.78 MMBtu saved per unit. Direct-install programs achieved 0.78 MMBtu of savings per unit and ranged from 0.38 to 1.36 MMBtu saved per unit.

To put these savings into perspective, we used the average regional natural gas use per multifamily unit from Fannie Mae (2015) to estimate percentage savings for selected regions. We had enough data to make such estimates for only one region for each type of natural gas program. For direct-install natural gas programs in the West, the average savings (0.8 MMBtu) are 7% of average natural gas use per unit (11.8 MMBtu). For comprehensive programs in the Northeast, the average program savings (12 MMBtu) are 39% of average natural gas use per unit (30.7 MMBtu). Despite their limitations, these data illustrate the magnitudes of savings possible from the two major types of programs. Greater savings are possible only with the installation of comprehensive sets of measures to address the major energy uses within buildings. The savings for comprehensive programs show a wide range since they are largely a function of the number of measures packaged together for a retrofit project.

Cost Effectiveness

Several states require that utility customer-funded affordable multifamily programs assess their cost effectiveness as part of an evaluation, measurement, and verification (EM&V) process. EM&V “provides accurate, transparent, and consistent metrics – based on good data – that assess the performance and implementation of energy efficiency projects, programs, and portfolios of programs” (ACEEE 2018). As part of this process, cost-effectiveness screening weighs programs’ benefits against their costs. States typically use at least one of the five cost-effectiveness tests laid out in the *California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects* to evaluate programs (CPUC 2001). These include:

- Total Resource Cost (TRC) Test
- Societal Cost Test (SCT)
- Participant Cost Test (PCT)
- Utility/Program Administrator Cost Test (UCT)
- Ratepayer Impact Measure (RIM) Test

While states’ overall approaches to conducting these tests are similar, exact methodologies vary by state, as do the benefits and costs that are included in calculating benefit-cost ratios (Kushler, Nowak, and Witte 2012).

We collected benefit-cost ratios for 14 programs and found that affordable multifamily programs are often cost effective under state-mandated tests. Benefit-cost ratios were available for only 14 programs because others included in our study had not yet been evaluated for cost effectiveness, were not specifically evaluated for their impact on multifamily homes, or did not operate in states that require programs to undergo cost-effectiveness screening.¹²

Twelve of the 14 programs we collected data for had at least one benefit-cost ratio greater than 1. While the threshold of what constitutes a cost-effective program can vary by state,

¹² Some states may still require that programs undergo cost-effectiveness screening even though they are exempt from meeting a minimum threshold. We have included these programs’ values.

programs with a benefit–cost ratio greater than 1 are achieving net benefits under their state’s cost-effectiveness criteria. For the purposes of this report, we consider programs with a ratio greater than 1 to be cost effective. In table 5, we show all available program benefit–cost ratios that correspond to the five standard cost-effectiveness tests identified in the *California Standard Practice Manual*, and we have highlighted those that are greater than 1.

Table 5. 2017 benefit–cost ratios for low-income multifamily programs

Administrator	State	Program	TRC electric	TRC natural gas	SCT electric	SCT natural gas	PCT electric	PCT natural gas	UCT electric	UCT natural gas	RIM electric	RIM natural gas
Xcel Energy ¹	CO	Affordable Housing Rebate Program	0.88	0.74	N/A	N/A	2.41	1.79	0.77	0.43	0.28	0.24
Eversource	CT	Multifamily Initiative—Income Eligible	N/A	N/A	N/A	N/A	N/A	N/A	1.00	1.17	N/A	N/A
DCSEU ²	DC	Low-Income Multifamily Custom	N/A	N/A	3.35	3.35	N/A	N/A	N/A	N/A	N/A	N/A
National Grid	MA	Low-Income Multi-Family	1.35	1.85	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Consumers Energy ³	MI	Residential Multifamily Income Qualified	1.48	0.89	N/A	N/A	N/A	N/A	1.48	0.89	0.32	0.35
CenterPoint Energy	MN	Low-Income Multi-Family Housing Rebates	N/A	N/A	N/A	2.29	N/A	2.65	N/A	6.15	N/A	0.69
CenterPoint Energy ⁴	MN	Multi-Family Building Efficiency	N/A	N/A	N/A	0.79	N/A	2.02	N/A	0.91	N/A	0.44
CenterPoint Energy	MN	Low Income Rental Efficiency	N/A	N/A	N/A	0.44	N/A	1.97	N/A	0.40	N/A	0.27
Xcel Energy	MN	Multi-Family Building Efficiency	1.33	N/A	1.61	1.79	8.63	3.07	N/A	N/A	0.31	0.55
Xcel Energy	MN	Multi-Family Energy Savings	0.15	N/A	0.18	N/A	0.82	N/A	N/A	N/A	0.16	N/A
Ameren ⁵	MO	CommunitySavers	3.66	N/A	4.66	N/A	41.30	N/A	2.09	N/A	0.48	N/A
KCPL ⁶	MO	Income-Eligible Multi-Family	1.29	N/A	1.41	N/A	N/A	N/A	1.29	N/A	0.40	N/A
Duquesne Light ⁷	PA	Multifamily Housing Retrofit Program	0.10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
National Grid ⁸	RI	Income-Eligible Multifamily	2.34	3.62	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Many programs have N/A values because state requirements for cost-effectiveness testing vary across the country. Programs are not always required to perform each test. While benefit–cost ratios are available for the California investor-owned utilities' Energy Savings Assistance Programs, we have not included these here because they are not multifamily specific. ¹ While other Affordable Housing Rebate Program data included in this report are inclusive of participants from other utilities that take part in the coordinated program, these benefit–cost ratios reflect only the benefits and costs associated with Xcel Energy customers. *Source:* Xcel Energy 2018. ² Electricity and natural gas benefits and costs were combined when evaluating DCSEU's Low-Income Multifamily Custom Program. Thus, the program does not report ratios by fuel type. *Source:* NMR Group et al. 2018. ³ *Source:* Consumers Energy 2018. ⁴ Benefit–cost ratios reflect program benefits and costs of serving both income-eligible and non-income-eligible customers. ⁵ ADM Associates calculated Ameren's PCT ratio by dividing total program incentives and customer bill savings (\$8,328,811) by total participant costs (\$201,644). *Source:* Ameren Missouri 2018. ⁶ Kansas City Power & Light Company 2018. ⁷ Duquesne Lighting Company 2017. ⁸ Rhode Island has replaced its TRC test with a state-specific test.

Gilleo, Nowak, and Drehobl (2017) observed that low-income programs can find it challenging both to achieve high energy savings and to be cost effective strictly on the basis of energy savings per dollar spent. Programs must often cover the full cost of energy efficiency improvements because low-income customers have little or no discretionary money. Low-income homes may also need health, safety, and structural repairs that incur costs but do not lead directly to energy savings. Our research indicates that it is possible for low-income multifamily programs to achieve high energy savings and be cost effective under state tests. National Grid Massachusetts is administering a cost-effective electric and natural gas efficiency program that is achieving electricity and natural gas savings higher than the average for all programs in our survey.¹³ Similarly, DCSEU's Low-Income Multifamily Custom, Ameren Missouri's CommunitySavers, and National Grid Rhode Island's Income-Eligible Multifamily programs are realizing cost-effective and higher-than-average electricity savings. Xcel Energy in Colorado and Eversource Connecticut are achieving cost-effective and higher-than-average natural gas savings through their affordable multifamily programs. These programs may test as cost effective because they operate in states that do not evaluate programs solely in terms of energy savings per dollar spent.

Cluett, Amann, and Ou (2016) found that low-income energy efficiency programs' "value to customers, the utility, and society at large can best be understood when both energy savings benefits and nonenergy benefits are considered." Some energy and nonenergy benefits of low-income energy efficiency programs can be greater in magnitude than those of other programs because the low-income customers they serve stand to gain more from participation than do those with higher incomes. Compared with more affluent households, those with low incomes often live in less energy-efficient housing, bear greater rent and energy cost burdens, have poorer health, are exposed to more air pollution from power plants, and experience a lower sense of well-being (Davis 2010; Ludwig et al. 2012; Penny and Kloer 2015; Woolf et al. 2015; Drehobl and Ross 2016; Massetti et al. 2017; Aurand et al. 2018; Mikati et al. 2018; NCHS 2018). Addressing these disparities provides benefits to not only low-income households, but utilities and society at large. Table 6 lists low-income efficiency program benefits that can be greater in magnitude than those of other programs.

¹³ These programs have achieved energy savings greater than the average savings of our program sample: 752 kWh and 2.97 MMBtu per multifamily unit.

Table 6. Energy efficiency program benefits for low-income households, utilities, and communities

Benefit recipient	Energy efficiency outcome	Resulting benefit
Low-income program participants	Lower monthly utility bills	Lower household energy burden and greater disposable income
		Reduced stress and fewer trade-offs between energy and other necessities
		Reduced exposure to risk from utility rate increases
		Lower risk of delinquency and disconnection due to nonpayment
	Improvements in the efficiency of the housing stock	Improved health and safety and greater household comfort
		Increased property value, more reliable equipment, and lower maintenance costs
		Preservation of affordable housing
		Greater satisfaction with the building/unit and improved household and neighborhood stability
Utilities	Demand-side management (both gas and electric)	Contribution toward compliance with energy efficiency portfolio standards and other environmental legislation
	Cost savings to utilities and ratepayers	Reduced arrearages and cost of shutoffs, which lowers utility operating costs
		Reduced maintenance costs due to less stress on the system
		Improved customer service and satisfaction
Society	Lower electricity and gas demand	Reduced environmental pollutants and improved public health
	Lower monthly utility bills due to avoided utility costs	More money spent in the local economy due to greater household disposable income, with higher local multiplier effect
		Poverty alleviation and improved standard of living
	Improvements in efficiency	Local job creation through weatherization programs and among energy efficiency providers and trade allies
		Improved quality of life
		Increased property values and preservation of housing stock

Source: Adapted from Ross, Dreihobl, and Stickle 2018

Data from ACEEE's 2018 *State Energy Efficiency Scorecard* and the National Efficiency Screening Project's (NESP) Database of State Efficiency Screening Practices reveal that states are taking several approaches to recognize these potential benefits when evaluating cost effectiveness (Berg et al. 2018; NESP 2019). These include:

- Including participant, utility, and societal nonenergy benefits and costs
- Increasing the value of low-income program benefits relative to other programs
- Considering benefits that are specific to low-income customers

Of the eight states that had cost-effective affordable multifamily programs, five adopted more than one of these strategies. These approaches may contribute to increasing the cost effectiveness of each state's affordable multifamily programs. Table 7 shows the states in our

report with cost-effective programs and the strategies they use to account for low-income benefits and costs.

Table 7. Benefits and costs included in states' 2017 cost-effectiveness screening

State	Low income-specific benefits	Added value for low-income benefits	Participant nonenergy impacts ¹	Societal or public nonenergy impacts ²	Avoided utility environmental compliance, credit, and collection costs
Colorado	No	Yes	Yes	Yes	Yes
Connecticut	No	No	No	No	No
District of Columbia	No	No	Yes	Yes	Yes
Massachusetts	Yes	No	Yes	Yes	Yes
Michigan	No	No	No	No	No
Minnesota	Yes	No	Yes	Yes	No
Missouri	No	No	No	No	No
Rhode Island	Yes	No	Yes	Yes	Yes

¹ Using NESP's *National Standard Practice Manual* categorizations, participant nonenergy impacts we include are changes in asset value, productivity, economic well-being, comfort, health and safety, satisfaction/pride, other fuel costs and benefits, and water resource cost benefits (Woolf et al. 2017). ² Based on NESP's *National Standard Practice Manual* categories, societal or public nonenergy impacts we include are changes in the environment, public health, economic development and jobs, energy security, and low-income impacts on society that go beyond those realized by program participants (Woolf et al. 2017). *Source:* Ameren Missouri 2018; Navigant 2018; Berg et al. 2018; NESP 2019.

Low-income multifamily programs operating in states not using any of the above strategies may still achieve cost effectiveness by establishing partnerships with other organizations that increase participation and reduce costs (ACEEE 2017). For example, our survey revealed that Eversource Connecticut partners with the Connecticut Green Bank, the Connecticut Department of Housing, and the Connecticut Housing Finance Authority to increase participation and provide participants with project financing options. Eversource also partners with Connecticut Natural Gas, the Southern Natural Gas Company, and the United Illuminating Company. While partnerships may save costs, there is no guarantee that this will always be the case. Programs operating in expensive housing markets may still have challenges in keeping costs low. We further discuss cost-saving partnerships in our next section, which highlights the features of effective programs.

While some states do require that low-income programs achieve certain minimum benefit-cost ratios, others adopt specific energy savings, participation, or spending targets for these programs in lieu of cost-effectiveness mandates. These goals are set to ensure that programs are achieving a minimum level of performance while acknowledging that costs may ultimately outweigh a state's recognized energy efficiency benefits. Using data collected for ACEEE's *2018 State Energy Efficiency Scorecard*, we found 13 states that exempt low-income programs from cost-effectiveness requirements (Berg et al. 2018). Several of these states have programs included in this study, including Connecticut, Illinois, Michigan, Minnesota, New York, and Virginia.

Another useful metric for assessing cost effectiveness is the cost of saved energy (CSE). CSE values are calculated by amortizing the annual costs of energy efficiency programs by an assumed discount rate over the expected useful lives of energy efficiency measures (Molina 2014).¹⁴ This metric gives a sense of a program's cost relative to energy savings achieved beyond just the first year in which measures are in place. The median value for our set of programs for which applicable data were available is \$0.16/kWh. This is comparable to the average value of \$0.142/kWh reported by Hoffman et al. (2015) in a large-scale national study. The natural gas median value for our data set is \$1.15/therm. We found no comparable national study of low-income natural gas programs.

EXAMPLES OF SUCCESSFUL AFFORDABLE MULTIFAMILY PROGRAMS

The data gathered in our survey of programs show that programs serving the affordable multifamily market are saving energy and reducing utility costs for residents. Program results demonstrate clearly that these objectives can be met cost effectively. Behind the data are program designs that provide valued services and assistance to building owners and residents. The types and forms of services may vary among programs, but a common thread is an overall structure that makes it easy for building owners to participate and facilitates the complex process of improving the energy efficiency of multifamily buildings.

In this section we highlight a set of programs we selected from the full set included in our survey. We chose this set to illustrate successful programs in a range of climate zones. We define successful programs as those that:

- Are cost effective or otherwise meet or exceed other types of program goals
- Reach and serve relatively high numbers of affordable housing properties and households
- Achieve high savings
- Incorporate leading program designs and practices

These programs may match one or several of these criteria, but together they illustrate the range of programs successfully serving affordable housing property owners and households. The programs vary in their designs, services provided, and energy efficiency measures eligible for incentives and services.

Low-Income Weatherization Program for Multifamily Properties, California Department of Community Services and Development

California's Low-Income Weatherization Program (LIWP-MF) provides comprehensive energy efficiency retrofits and rooftop solar photovoltaic systems for low-income

¹⁴ We calculated CSE values for each program using the formula $(C) \times \{[A \times (1 + A)^B] / [(1+A)^B - 1]\} / (D)$, where A is the discount rate (5%), B is the estimated weighted average measure life in years, C is the total annual program cost in 2017 dollars, and D is the annual energy saved (kWh or therms) by energy efficiency programs. Our calculations use a discount rate of 5% in keeping with Molina (2014). We obtained or calculated estimated weighted average measure lives in years for programs that reported both annual spending and energy savings using data obtained from available annual program filings or program evaluations. We converted MMBtu savings values to therms by multiplying them by 10.0023877.

multifamily homes to save energy and reduce greenhouse gas emissions. A unique feature of the program is that it specifically targets and is funded to serve disadvantaged communities, which the state defines as those communities that are in the highest quartile of census tracts scored on poor air quality, number of low-income households, and other factors that affect the quality of life.¹⁵ Determining eligibility by location based on such multifactor assessment facilitates program participation and reduces a common barrier faced by program administrators: screening properties and households solely by income. The California Department of Community Services and Development administers the program. The most recent annual budget (2017–2018 program year) was \$38 million. Funding comes from California’s cap-and-trade greenhouse gas reduction program. This amount has more than doubled from its initial 2014–2015 program year appropriation of \$17.9 million.

LIWP-MF began in 2014, and in its short history it has achieved large impacts. Through 2017 the program served 43 properties and 4,549 units, achieving utility bill savings of \$37 million. An especially notable achievement is that the properties participating in LIWP-MF have reduced total purchased energy by an average of 44% (38% savings from energy efficiency, 6% from solar PV generation). The program is fully subscribed with close to 200 properties on the program waiting list. The program benefits a diverse range of building types and sizes, property owners, low-income households, and geographic regions.

The program’s primary objective of reducing GHG emissions enables it to target and achieve deep energy savings in addition to installing solar energy systems. According to program staff interviewed, this objective justifies the large initial investments typically needed to achieve deep energy savings, investments that may be out of reach for utility programs with more limiting cost-effectiveness criteria. Another key to the program’s success is flexibility. There is no standard set of qualified measures. Rather, any measure or bundle of measures that can reduce GHG emissions within certain cost guidelines is eligible. Owners can use their own contractors and choose their own equipment. They also can leverage incentives and services available from utility and other programs, which LIWP-MF staff help coordinate. The program provides technical assistance from highly skilled experts at all stages of a project, from initial analysis of opportunities through post-installation commissioning.

Key features of LIWP-MF include:

- One-stop shop providing a single point of contact for comprehensive technical assistance, program incentives, and a full range of services
- Higher incentives for tenant-meter savings to encourage energy bill savings for renters and to counter the split-incentive problem facing building owners and tenants
- Integrated, whole-building approach to energy efficiency and solar energy systems

¹⁵ *Disadvantaged communities* as designated by the California Environmental Protection Agency for the purposes of SB 535 are those areas that represent the 25% highest-scoring census tracts in CalEnviroScreen 3.0 (a scoring tool), along with other areas with high amounts of pollution and low-income populations.

- Program structure that aligns well with other available incentive programs to leverage funding and expand the scope of retrofits
- Portfolio approach to identify and reach out to eligible properties

Affordable Housing Rebate Program, Xcel Energy–Colorado

Xcel Energy’s Affordable Housing Rebate Program in Colorado is administered by Energy Outreach Colorado (EOC), a nonprofit organization focused on reducing low-income household energy burdens. EOC has been able to offer a low-cost one-stop shop to support affordable multifamily property owners going through the process of approving and implementing an energy efficiency project. Program staff support projects with services such as doing an initial walk-through to assess a property’s energy efficiency potential, conducting an audit, connecting owners with high-quality contractors, and discussing incentive and financing options. The program models energy savings in existing buildings using an assumed building energy code, which may or may not have been followed. With every step of a project, EOC works to minimize the financial strain faced by property owners and managers. For example, if helpful, it will set up a multiparty contract with program participants so that EOC can pay contractors directly. This is especially helpful for properties with limited staff hours available to manage an energy-saving project.

EOC has been able to offer one-stop shop services at a lower cost to customers than other programs because of its partnerships, which supplement utility funding. In addition to the Xcel Energy rebates, EOC has leveraged more than \$5 million in federal, state, and local government funding along with grants and donations from philanthropic sources to further offset participant costs.

Key features of the Affordable Housing Rebate Program include:

- One-stop shop with a single point of contact for comprehensive technical assistance, program incentives, and full range of services
- A full range of incentives and financing available to support a project
- Contractor ally network
- Leveraging of external funding sources

Low-Income Multifamily Custom Program, District of Columbia Sustainable Energy Utility

DCSEU’s Low-Income Custom Program works with affordable housing in the District of Columbia to provide rebates for projects that lead to energy savings. Projects can be as complex as a total building gut renovation or a new construction project, or they can be as simple as a lighting retrofit. Rebates for these projects are based on total energy savings. Measures eligible for rebate consideration must have either electric or gas savings and can include items such as HVAC replacement, LED lighting, lighting sensors, building controls, appliances, hot-water heaters, low-flow water fixtures, windows, insulation, and in some cases solar PV.

For new construction and gut rehab projects, DCSEU’s engineers will review and analyze possible energy efficiency measures that could be implemented. The analysis also will determine applicable rebates. DCSEU likes to be involved early in a large project to help its customers consider energy efficiency for these projects and to show where rebates may be

able to cover the incremental cost of a piece of more efficient equipment. The baseline for determining savings is the local DC green building code.

The Low-Income Multifamily Custom Program began in October 2017. The annual budget in its first year was \$3.5 million, including incentives and administrative costs. In its first year, program energy savings were 2,046 MWh (electricity) and 2,336 MMBtu (natural gas). The program provided electricity efficiency improvements to 20 properties comprising 1,770 housing units. The program has been very cost effective, with a 2017 benefit-cost ratio of 3.35 based on scenarios run by DCSEU's evaluator.

Strong relationships among key multifamily stakeholders are important to the program's success, according to program staff. DCSEU has worked to recruit and train certified business enterprise contractors, who are involved in both the direct-install program and DCSEU's custom program. DCSEU also has developed strong relationships with area developers to increase awareness of available rebates and program services. Contractors and developers have become knowledgeable about the program, including the optimal times to become involved. Early engagement in the design and development phase of projects is important both for funding and for energy savings impacts. DCSEU also cites strong support from the DC Department of Energy and Environment in publicizing the program and connecting low-income developers to DCSEU.

Key features of the Low-Income Multifamily Custom Program include:

- Technical assistance to identify, analyze, and recommend energy efficiency measures
- Rebates available for qualified measures to cover the incremental cost of more efficient equipment
- Rebates that are based on total project energy savings
- Projects ranging from simple equipment upgrades to total building gut renovation or new construction
- Wide range of technologies that are eligible for rebates, including HVAC replacements, lighting controls, LED lighting, building controls, appliances, water heaters, low-flow water fixtures, windows, insulation, and solar photovoltaic systems
- Technical assistance on financing, helping to identify funding sources and put together packages that enable building owners to move ahead and implement projects

Home Energy Improvement Program, Georgia Power

Georgia Power's Home Energy Improvement Program (HEIP) targets both single-family and multifamily customers. It provides incentives to owners of multifamily properties, including those serving low-income households, for a range of energy efficiency improvements. The Georgia Public Service Commission has carved out \$500,000 per year of the total HEIP budget to serve affordable multifamily properties. Energy efficiency measures eligible for program rebates include high-efficiency central air-conditioning equipment, attic insulation, air and duct sealing, water heating, and Wi-Fi-enabled thermostats. Incentive amounts are 50% of measure costs up to caps specified for each type of measure. Georgia Power also provides an incentive for home energy assessments. The

program served 1,135 units in 2017. Average electricity savings per household were 1,928 kWh.

Program longevity and awareness contribute greatly to the success of Georgia Power's Home Energy Improvement Program. Originating in 2011, the program is one of the company's oldest residential energy efficiency programs. This gives it great momentum and widespread awareness among customers and contractors. The contractor network is an aggressive channel of information and education and brings participants into the program. Georgia Power has cultivated relationships with contractors across the state, and as a result, the program has become an integral part of business models for some of them.

Another feature contributing to the program's success is that it offers two paths for participation, either whole-house or individual improvements. This provides customers flexibility to choose options based on their priorities and budgets. There is one slight downside to the program model. Those contractors who rely on the program as their core source of business may be adversely affected by decreased program funding, which can happen from one funding cycle to the next.

The Home Energy Improvement program is an example of how a utility expanded an existing residential program that serves single-family homes to provide similar services to the affordable multifamily market. While this is a positive step, the funding amount for affordable multifamily housing established by the Georgia Public Service Commission is small. Advocates would like to see this funding increased to serve more low-income households.

Key features of the Home Energy Improvement Program include:

- Large, well-established network of contractors engaged with the program
- Large, comprehensive set of eligible improvements for rebates
- Two paths for participation, whole-building or individual improvements
- Flexibility in meeting customer priorities and budgets

Multifamily Energy Efficiency and Housing Affordability Program, Maryland Department of Housing and Community Development

The Multifamily Energy Efficiency and Housing Affordability (MEEHA) program, administered by Maryland's Department of Housing and Community Development (DHCD), achieved the third-highest electricity savings among the programs we analyzed, based on reported 2017 data. The program covers all costs of energy efficiency upgrades to affordable multifamily buildings that are recommended by a DHCD-approved energy auditor and authorized by program staff. Program administrators have consistently achieved high electricity savings – in excess of 1,000 kWh per multifamily unit. One key to success is providing incentives for whole-building upgrades that affect both individual units and common spaces. Projects come to DHCD for financing of new construction, rehabilitation, and acquisition rehabilitation projects, and DHCD wraps MEEHA incentives into the financial package to enable projects to be implemented. Incentives are available as either grants or zero-interest deferred loans to meet project financing requirements. Having DHCD administer the program facilitates the financing process and enables program staff to

seamlessly integrate utility incentives into projects (Samarripas, Ross, and Bailey 2017). Incentives are also available for stand-alone retrofit projects.

The program has been able to attract participants and achieve high savings, although there has been some inconsistency in the numbers of completed projects from year to year. One problem was the timing of incentive payments. As the program was first structured, participants had to cover the up-front costs of project planning and the installation of energy efficiency measures because incentives were not available until project completion. Another earlier challenge was that many participants had difficulty in securing the necessary approvals from other project investors (Samarripas, Ross, and Bailey 2017). In response to these challenges, the program has changed the way it provides incentives, and it now offers some funding to cover the cost of an initial audit. Program staff can provide on-site training for project subcontractors to ensure that program requirements are met during a project's implementation. A challenge moving forward is to make incentives for gas efficiency measures more available than they have been. To date most of the incentives and associated projects have applied to electricity measures.

One of the keys to MEEHA's success is its flexibility to structure project funding as loans or grants. Many participants must receive the funding as a loan or as a grant based on their tax liability (nonprofit versus for-profit) or existing outstanding project debt.¹⁶ Without this flexibility in financing structure, many properties would not be able to participate in the program. This flexibility opens doors to more properties in general and allows the inclusion of MEEHA funding into more complex financing structures, as typically seen in Low-Income Housing Tax Credit (LIHTC) projects that DHCD finances.¹⁷

Key features of MEEHA include:

- Integrated, whole-building approach to energy efficiency for electricity measures
- Alignment with the state's affordable housing incentive programs
- Provision of funding to cover project energy audits at grant or loan closing
- Flexibility to structure funding as loans or grants
- Contractor training opportunities

Multifamily Building Efficiency, CenterPoint Energy–Minnesota with Xcel Energy–Minnesota

CenterPoint Energy partners with Xcel Energy to administer the Multifamily Building Efficiency (MFBE) program to multifamily customers who receive electricity from Xcel

¹⁶ Unlike loans, grants are taxable income for for-profit businesses and in some cases may also be taxable for nonprofit organizations. Some housing providers may not be able to pay these taxes. Affordable housing project investors may also not agree to accept a loan to finance energy efficiency improvements.

¹⁷ The LIHTC program gives affordable housing providers an indirect subsidy to fund the construction and rehabilitation of affordable rental housing for low-income households. According to Novogradac (2019), "LIHTC gives investors a dollar-for-dollar reduction in their federal tax liability in exchange for providing financing to develop affordable rental housing. Investors' equity contribution subsidizes low-income housing development, thus allowing some units to rent at below-market rates. In return, investors receive tax credits paid in annual allotments, generally over 10 years."

Energy and natural gas from CenterPoint or Xcel Energy. The program provides direct-install and tiered incentives.¹⁸ These are available to all multifamily customers, but properties that are home to mostly or all low-income residents are eligible to receive higher incentives. The program was launched in late 2015. Program staff worked with housing sector allies to identify and recruit program participants. The program provides participants a one-stop shop for assistance with the project application and implementation process. These services include a preliminary whole-building energy use assessment, comprehensive energy audit, no-cost direct installation of several energy efficiency measures, an analysis of a more comprehensive retrofit project's scope, contractor bid reviews, and brochures for residents with energy-saving tips at project installation. To encourage deeper savings, the incentives are structured in tiers so that they pay higher percentages of costs (up to 80%) for reaching higher levels of savings (above 15%, which is the minimum threshold).

The program experienced some start-up problems, such as process issues that delayed the determination of eligibility of proposed projects for rebates. Some proposed projects also have not met the minimum 15% savings threshold. Despite some of these early challenges, the program is achieving 1.94 MMBtu of natural gas savings per multifamily unit. The initial program budgets and associated targets were modest as this was a new type of program for CenterPoint Energy. The company sought to gain experience and test its model before making a larger commitment. Some stakeholders have advocated for a much larger program capable of serving many more customers and thereby achieving a much greater share of the energy efficiency potential for affordable multifamily housing.

Key features of MFBE include:

- One-stop shop with a single point of contact for comprehensive technical assistance, program incentives, and full range of services
- Energy audit and direct-install measures offered up front at no cost
- Assistance with reviewing contractor bids
- Tiered incentive structure that encourages deeper savings

Income-Eligible Multifamily Program, National Grid–Rhode Island

In 2017 National Grid–Rhode Island undertook an extensive review of its multifamily programs serving both market-rate and income-eligible customers. As a result of this review, National Grid–RI redesigned its income-eligible program to incorporate new ideas, technologies, and approaches to improve its services. The goal was to offer a comprehensive program that is both cost effective and thorough in meeting the needs of this customer segment. The program continues to focus on heating system improvements, such as boiler replacements or installation of in-unit heat pumps where cost effective. Beyond this core emphasis, the redesigned program also focuses on technological innovations such as the

¹⁸ Tiered incentives pay a higher percentage of the costs for qualified measures or packages of measures for higher energy savings estimated for a given project. This structure rewards customers for implementing measures that achieve high savings.

inclusion of smart thermostats and ductless mini-split systems in electrically heated buildings.

National Grid’s program provides energy audits and incentives for energy efficiency measures affecting typical end uses for electricity and natural gas: lighting, hot water, space heating, and plug loads. There are no costs to eligible customers; the audit and measures are 100% covered. The total annual budget for 2017 was \$4.93 million. In 2017 the program served 5,162 housing units with electric efficiency measures and 3,840 units with natural gas measures. Using the Rhode Island test for cost effectiveness (a recent replacement for the Total Resource Cost Test), the benefit–cost ratio for the program is 2.34 for electric efficiency and 3.62 for natural gas.

The program’s success stems from several factors. One is having a highly experienced and well-established vendor provide program services. Another key to success is the strong relationships that have developed among stakeholders and program partners, facilitated by the small size of National Grid–RI’s service territory. Program staff also report that customers are very knowledgeable about what services and incentives are available. They know what they are looking for and speak with each other about opportunities and experiences with the program. The program also is well connected with key partners that serve the housing market, including state authorities, finance institutions, and community development organizations. There also are low-income and multifamily housing advocates who serve on Rhode Island’s Energy Efficiency Resources Management Council, a public board responsible for guiding and develop state energy policies.

Key features of the Income-Eligible Multifamily Program include:

- No-cost energy audit and 100% cost coverage for installed measures
- Experienced, well-established vendor providing program services
- Strong relationships among program partners and stakeholders, especially finance institutions, community development organizations, and state authorities

LESSONS LEARNED ON EFFECTIVE PROGRAM DESIGN AND IMPLEMENTATION

Our data reveal program designs and practices that are effective in reaching and serving affordable multifamily markets. Leading programs are meeting the many challenges faced in this market. We observe several common traits of successful programs, which we discuss below. Our findings largely reinforce earlier research by ACEEE (Johnson 2013) and others on best designs and practices for multifamily programs.¹⁹

Common features of our selected affordable multifamily program examples include:

¹⁹ Additional references and resources on effective multifamily program designs are available from ACEEE’s Multifamily Energy Savings Project, aceee.org/multifamily-project, and from Energy Efficiency for All, energyefficiencyforall.org/resources/one-stop-shops-multifamily-sector.

- Technical assistance provided to analyze opportunities and recommend improvements
- Collaboration and strong relationships among key partners and stakeholders
- Effective outreach, communication, and education
- Access to financing and availability of incentives for energy efficiency measures and projects

While these features apply to all types of multifamily programs, they may take on additional importance for programs serving affordable multifamily markets. Owners of these buildings generally have fewer resources available to devote to energy efficiency retrofits. Well-designed affordable multifamily programs must recognize and respond to the specific needs of this market. We note such needs throughout our discussion below.

Technical assistance to property owners is a key aspect of leading programs because multifamily projects typically are complex. They may involve technologies unfamiliar to building owners and managers, and the funding and financing may be difficult to identify and package. Providing technical assistance for building technologies and project financing addresses these information gaps and facilitates the development and implementation of successful projects. Such information gaps may be larger and more prevalent in affordable housing markets because owners may not have dedicated operations and engineering staff to address such technical issues.

Strong relationships among the many stakeholders involved in affordable multifamily markets and programs are important. Key affordable housing partners typically include housing authorities, community action agencies, and economic development organizations. Creating strong relationships among stakeholders builds common trust, awareness, and experience to help programs reach their target population and be successful. Contractors and building trades are important stakeholders as they ultimately deliver the technical services required for building retrofits. Training of contractors can foster such relationships. It also can increase awareness of programs and potential clients. Contractors can leverage available program resources and help recruit participants.

Effective outreach, communication, and tracking are elements that help programs succeed. It is especially important for outreach staff to understand the affordable housing market and have experience with effective communications to targeted building owners and residents. Dedicated outreach staff are important to promote programs and create relationships with key partners and stakeholders. Regular meetings between program administrators and implementers facilitate communication on program performance. Such regular check-in meetings can ensure that a program is working as intended and that program materials are accurate and up-to-date. This also can help to identify any problems early and address them quickly. Using some type of scorecard to track monthly and yearly objectives provides important data for program performance.

Access to capital and financing may be especially challenging in affordable multifamily markets. Building owners typically have limited capital available to invest in energy efficiency measures. Incentives paid to property owners can be critical in moving projects ahead.

Model Program Features for Affordable Multifamily Housing Programs

In our research and interviews we identified additional features of affordable multifamily housing programs that are important for program effectiveness. Table 8 summarizes this set of model features for our selected program examples.

Table 8. Selected program example features

Program/state	One-stop shop	Whole building	Financial technical assistance	Financial alignment
Low-Income Weatherization–MF California	X	X	X	X
Affordable Housing Rebate Colorado	X		X	X
Low-Income MF Custom District of Columbia		X	X	
Home Energy Improvement Georgia		X		
MF Energy Efficiency and Housing Affordability Maryland		X	X	X
Multifamily Building Efficiency Minnesota	X	X		X
Income-Eligible Multifamily Rhode Island			X	X

Programs based on a one-stop shop model are prevalent among leading programs. Having a single point of contact throughout the application and implementation processes is helpful to support projects that combine multiple rebates or take advantage of performance-based incentives. This reduces the complexity of energy efficiency retrofits, making program participation easy for property owners and building managers. In affordable housing markets this is especially important as building owners may not have staff available to take on such additional projects. The one-stop shop model also provides consistency and effective management of projects from start to finish, and it can be administered at relatively low cost. One approach to saving on the cost of these services is for program administrators to partner with other utilities or organizations and share costs, as CenterPoint Energy and Xcel Energy are doing in Minnesota in offering a joint program. One-stop shops still can provide flexibility for participants, which is important in adjusting to the needs and preferences of participants. For example, Energy Outreach of Colorado is prepared to recommend contractors for participants' projects, but only if requested to do so.

Achieving high program impacts in terms of energy and cost savings requires a comprehensive, whole-building approach for implementing energy efficiency improvements. The greatest savings in most cases are realized through upgrades to the equipment and systems that serve entire buildings, typically HVAC and hot water. Improvements to building envelopes by increased insulation and other weatherization measures also can often achieve large reductions in heating and cooling energy use and costs.

Assembling financial packages to make proposed improvement projects viable can be challenging for property owners. The complexity of such packages and the time required to put them together may prevent projects from moving ahead. Property owners and building managers may not have the ability to construct such deals on their own. Programs that provide financial technical assistance and work with property owners to assemble financial packages can overcome this barrier.

A related program featured cited as being very beneficial for property owners is structuring incentives to align well with incentives available from other sources. Such alignment can simplify and streamline required applications and paperwork. It also may mean coordinating scheduling to ensure that necessary capital is available at required times.

While not common among our examples, a tiered incentive structure is an attractive feature to encourage customers to achieve deeper savings. This requires creating and bundling comprehensive packages of measures.

Conclusions and Recommendations

Affordable multifamily energy efficiency programs can achieve substantial and cost-effective energy savings in affordable multifamily buildings across the United States. Programs such as these can reduce energy burdens for low-income multifamily households, but the benefits of energy efficiency are not limited to just cost savings or building residents. These programs can create healthier indoor environments, improve indoor comfort, reduce utility bill arrearages, increase property values, and preserve unit affordability.

Affordable multifamily programs that are effective in reaching and serving their target market share several common strategies. On the basis of our research, we recommend that program administrators adopt the following practices:

- Create a one-stop shop, a program model that coordinates the provision of technical assistance through a single point of contact, to assist property owners with project planning and implementation.
- Help owners identify and combine all available funding and financing for retrofit projects. Also, work to align program incentives with those available from other sources.
- Coordinate and partner with affordable housing organizations and local contractors to both recruit participants and better support retrofit projects.
- Monitor and evaluate program outreach continuously. Effective strategies can include assigning dedicated administrator staff to work on outreach, meeting regularly with implementers, and creating a scorecard to monitor program progress toward goals.

While these practices are like many of those previously identified as beneficial for all multifamily energy efficiency programs, administrators of income-eligible programs must take care to adapt such practices and designs to meet the specific needs of the affordable multifamily market. Compared with the entire multifamily market, affordable multifamily property owners and managers are considerably more constrained in the time, funding, and

staff they can allocate to making energy efficiency improvements in buildings. Leading programs are stepping up to help fill these gaps and ensuring that all possible resources are made available to support these projects.

References

- ACEEE. 2017. *Recommendations for Scaling Up Modest Low-Income Multifamily Energy Efficiency Programs*. Washington, DC: ACEEE. aceee.org/sites/default/files/pdf/scaling-up-modest-lowincome.pdf.
- . 2018. “Evaluation, Measurement, & Verification.” Accessed February. aceee.org/sector/state-policy/toolkit/emv.
- Ameren Missouri. 2018. *CommunitySavers Program Evaluation Report, March 2017–February 2018*. Case No. EO-2015-0055, July 16. Prepared by ADM Associates. Jefferson City: Missouri PSC (Public Service Commission). efis.psc.mo.gov/mpsc/commoncomponents/view_itemno_details.asp?caseno=EO-2015-0055&attach_id=2019000680.
- Aurand, A., D. Emmanuel, D. Yentel, E. Errico, and M. Pang. 2018. *The Gap: A Shortage of Affordable Homes*. Washington, DC: NLIHC (National Low Income Housing Coalition). nlihc.org/gap.
- Berg, W., S. Nowak, G. Relf, S. Vaidyanathan, E. Junga, M. DiMascio, and E. Cooper. 2018. *The 2018 State Energy Efficiency Scorecard*. Washington, DC: ACEEE. aceee.org/research-report/u1808
- Burns, P., L. Roy, W. Hodgson, M. Johnson, E. Miller, A. Carollo, and J. Eckstein. 2018. *Evaluation of Georgia Power Company’s 2017 DSM Programs – Volume I*. Docket No. 40162, August 14. Prepared by Cadmus for Georgia Power Company. Atlanta: Georgia PSC (Public Service Commission). psc.state.ga.us/factsv2/Document.aspx?documentNumber=173712.
- Cluett, R., and J. Amann. 2015. *Multiple Benefits of Multifamily Energy Efficiency for Cost-Effectiveness Screening*. Washington, DC: ACEEE. aceee.org/multiple-benefits-multifamily-energy-efficiency.
- Cluett, R., J. Amann, and S. Ou. 2016. *Building Better Energy Efficiency Programs for Low-Income Households*. Washington, DC: ACEEE. aceee.org/research-report/a1601.
- Consumers Energy. 2018. *In the Matter of the Application of Consumers Energy Company for Authority to Reconcile Its 2017 Energy Waste Reduction Plan Costs Associated with the Plan Approved in Case No. U-17771*. Case No. U-20028, May 31. Lansing: Michigan PSC (Public Service Commission). psc.force.com/sfc/servlet.shepherd/version/download/068t00000022ofQAAQ.
- CPUC (California Public Utilities Commission). 2001. *California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects*. San Francisco: CPUC. cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy_-_Electricity_and_Natural_Gas/CPUC_STANDARD_PRACTICE_MANUAL.pdf.

- Davis, L. 2010. *The Effect of Power Plants on Local Housing Values and Rents*. Sacramento: California Energy Commission. energy.ca.gov/sitingcases/mariposa/documents/others/2010-10-12_Effect_of_Power_Plants_on_Local_Housing_Values_Rents_TN-58732.pdf.
- Drehobl, A., and L. Ross. 2016. *Lifting the High Energy Burden in America's Largest Cities: How Energy Efficiency Can Improve Low-Income and Underserved Communities*. Washington, DC: ACEEE. aceee.org/research-report/u1602.
- Duquesne Light Company. 2017. *Final Annual Report to the Pennsylvania Public Utility Commission: Phase III of Act 129, Program Year 8 (June 1, 2016–May 31, 2017) – Energy Efficiency and Conservation Plan*. Prepared by Navigant Consulting. Docket No. M-2015-2515375, November 15. Harrisburg: Pennsylvania PUC (Public Utility Commission). puc.state.pa.us/pcdocs/1543433.pdf.
- EIA (Energy Information Administration). 2018. “2015 Residential Energy Consumption Survey (RECS).” eia.gov/consumption/residential/data/2015/.
- . 2019a. “Electricity Data Browser.” Accessed February. eia.gov/electricity/data/browser/.
- . 2019b. “U.S. Natural Gas Prices.” Accessed February. eia.gov/dnav/ng/ng_pri_sum_dcunusa.htm.
- Fannie Mae. 2015. “Multifamily Energy and Water Market Research Survey.” fanniemae.com/multifamily/green-initiative-market-research-survey.
- Gilleo, A., S. Nowak, and A. Drehobl. 2017. *Making a Difference: Strategies for Successful Low-Income Energy Efficiency Programs*. Washington, DC: ACEEE. aceee.org/research-report/u1713.
- Hoffman, I., G. Rybka, G. Leventis, C. Goldman, L. Schwartz, M. Billingsley, and S. Schiller. 2015. *The Total Cost of Saving Electricity through Utility Customer–Funded Energy Efficiency Programs: Estimates at the National, State, Sector and Program Level*. Prepared by Berkeley Lab. Washington, DC: DOE. emp.lbl.gov/sites/all/files/total-cost-of-saved-energy.pdf.
- Johnson, K. 2013. *Apartment Hunters: Programs Searching for Energy Savings in Multifamily Buildings*. Washington, DC: ACEEE. aceee.org/research-report/e13n.
- Johnson, K., and E. Mackres. 2013. *Scaling Up Multifamily Energy Efficiency Programs: A Metropolitan Area Assessment*. Washington, DC: ACEEE. aceee.org/research-report/e135.
- Kansas City Power & Light Company. 2018. *KCP&L-MO Evaluation, Measurement, and Verification Report – FINAL, Program Year 2017*. Case No. EO-2015-0240, December 21. Prepared by Navigant. Jefferson: Missouri PSC (Public Service Commission). efis.psc.mo.gov/mpsc/commoncomponents/view_itemno_details.asp?caseno=EO-2015-0240&attach_id=2019009835.

- Kushler, M., S. Nowak, and P. Witte. 2012. *A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs*. Washington, DC: ACEEE. aceee.org/research-report/u122.
- Ludwig, J., G. Duncan, L. Gennetian, L. Katz, R. Kessler, J. Kling, and L. Sanbonmatsu. 2012. "Neighborhood Effects on the Long-Term Well-Being of Low-Income Adults." *Science* 337 (6101): 1505–10. ncbi.nlm.nih.gov/pubmed/22997331.
- Masseti, E., M. Brown, M. Lapsa, I. Sharma, J. Bradbury, C. Cunliff, and Y. Li. 2017. *Environmental Quality and the U.S. Power Sector: Air Quality, Water Quality, Land Use and Environmental Justice*. Prepared by Oak Ridge National Laboratory. Washington, DC: DOE. energy.gov/sites/prod/files/2017/01/f34/Environment%20Baseline%20Vol.%202--Environmental%20Quality%20and%20the%20U.S.%20Power%20Sector--Air%20Quality%2C%20Water%20Quality%2C%20Land%20Use%2C%20and%20Environmental%20Justice.pdf.
- Mikati, I., A. Benson, T. Luben, J. Sacks, and J. Richmond-Bryant. 2018. "Disparities in Distribution of Particulate Matter Emission Sources by Race and Poverty Status." *American Journal of Public Health* 108 (4): 480–5. ajph.aphapublications.org/doi/abs/10.2105/AJPH.2017.304297.
- Molina, M. 2014. *The Best Value for America's Energy Dollar: A National Review of the Cost of Utility Energy Efficiency Programs*. Washington, DC: ACEEE. aceee.org/research-report/u1402.
- NCHS (National Center for Health Statistics). 2018. *Health, United States, 2017: With Special Feature on Mortality*. Hyattsville, MD: NCHS. ncbi.nlm.nih.gov/books/NBK532685/.
- NESP (National Efficiency Screening Project). 2019. "Database of State Efficiency Screening Practices." nationalefficiencyscreening.org/state-database-dresp/.
- NMR Group, Ecometric Consulting, Demand Side Analytics, Blue Path Labs, and Setty and Associates. 2018. *Performance Benchmark Assessment of FY2017 DC Sustainable Energy Utility Programs*. Washington, DC: DCSEU (District of Columbia Department of Energy & Environment). doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/DCSEU%20FY2017%20Performance%20Benchmarks%20report%20-%20FINAL%20092818.pdf.
- Novogradac. 2019. "About the LIHTC." novoco.com/resource-centers/affordable-housing-tax-credits/lihtc-basics/about-lihtc.
- Penny, B., and P. Kloer. 2015. *Shelter Report 2015 – Less Is More: Transforming Low-Income Communities through Energy Efficiency*. Atlanta: Habitat for Humanity. habitat.org/sites/default/files/2015-habitat-for-humanity-shelter-report.pdf.

- PG&E (Pacific Gas and Electric Company). 2018. *Energy Savings Assistance Program and California Alternate Rates for Energy Program: 2017 Annual Report*. Sacramento: CPUC. cpuc.ca.gov/iqap/.
- Ross, L., A. Drehobl, and B. Stickles. 2018. *The High Cost of Energy in Rural America: Household Energy Burdens and Opportunities for Energy Efficiency*. Washington, DC: ACEEE. aceee.org/research-report/u1806.
- Ross, L., M. Jarrett, and D. York. 2016. *Reaching More Residents: Opportunities for Increasing Participation in Multifamily Energy Efficiency Programs*. Washington, DC: ACEEE. aceee.org/research-report/u1603.
- Samarripas, S., L. Ross, and T. Bailey. 2017. *Making Maryland Homes More Affordable through Energy Efficiency*. Washington, DC. aceee.org/research-report/u1711.
- Samarripas, S., and D. York. 2018. *Our Powers Combined: Energy Efficiency and Solar in Affordable Multifamily Buildings*. Washington, DC: ACEEE. aceee.org/research-report/u1804.
- Samarripas, S., D. York, and L. Ross. 2017. *More Savings for More Residents: Progress in Multifamily Housing Energy Efficiency*. Washington, DC: ACEEE. aceee.org/research-report/u1702.
- SCE (Southern California Edison). 2018. *Annual Report Activity on Low Income Assistance Programs: 2017 Results*. Sacramento: CPUC. cpuc.ca.gov/iqap/.
- SDGE (San Diego Gas & Electric Company). 2018. *Annual Report Activity on Low Income Assistance Programs: 2017 Results*. Sacramento: CPUC. cpuc.ca.gov/iqap/.
- Southern California Gas Company. 2018. *Energy Savings Assistance (ESA) Program and California Alternate Rates for Energy (CARE) Program Annual Report 2017 Results*. Sacramento: CPUC. cpuc.ca.gov/iqap/.
- Tonn, B., D. Carroll, S. Pigg, M. Blasnick, G. Dalhoff, J. Berger, E. Rose, B. Hawkins, J. Eisenberg, F. Ucar, I. Bensch, and C. Cowan. 2014. *Weatherization Works: Summary of Findings from the Retrospective Evaluation of the U.S. Department of Energy's Weatherization Assistance Program*. Prepared by Oak Ridge National Laboratory. Washington, DC: DOE. weatherization.ornl.gov/wp-content/uploads/pdf/WAPRetroEvalFinalReports/ORNL_TM-2014_338.pdf.
- Woolf, S., L. Aron, L. Dubay, S. Simon, E. Zimmerman, and K. Luk. 2015. *How Are Income and Wealth Linked to Health and Longevity?* Washington, DC: Urban Institute. urban.org/research/publication/how-are-income-and-wealth-linked-health-and-longevity.
- Woolf, T., C. Neme, M. Kushler, S. Schiller, T. Eckman, and J. Michals. 2017. *National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources*.

Framingham, MA: NESP. nationalefficiencyscreening.org/wp-content/uploads/2017/05/NSPM_May-2017_final.pdf.

Xcel Energy. 2018. *2017 Demand-Side Management Annual Status Report, Electric and Natural Gas Public Service Company of Colorado*. Proceeding No. 16A-0512EG, March 31. Denver: Colorado PUC (Public Utilities Commission). xcelenergy.com/staticfiles/xe-responsive/Company/Rates%20&%20Regulations/Regulatory%20Filings/2017-Colorado-DSM-Annual-Status-Report.pdf.

Appendix A. 2017 Program Data

Table A1. Summary of program eligibility requirements

Program administrator	State	Program name	Building units required	Residential and/or commercial eligibility	Master and/or individual meter required	Audit required	ASHRAE audit type	Audit assistance
Southern California Gas Company	CA	Energy Savings Assistance Program (ESAP)	5	Residential	Both	Yes	2	No cost
California CSD	CA	Low-Income Weatherization Program for Multifamily Properties (LIWP-MF)	5	Both	Both	Yes	1	No cost
San Diego Gas and Electric	CA	Energy Savings Assistance Program (ESAP)	1	Both	Both			
Southern California Edison	CA	Energy Savings Assistance Program (ESAP)	1	Both	Both	Yes		
Pacific Gas and Electric	CA	Energy Savings Assistance Program (ESAP)	1	Both	Both			
Xcel Energy	CO	Affordable Housing Rebate Program	2	Both	Both			
Eversource	CT	Multifamily Initiative—Income Eligible	5	Both	Both	No		
DCSEU	DC	Income Qualified Efficiency Fund	5	Both	Both	Yes	Less than 1	
DCSEU	DC	Low-Income Multifamily Custom	5	Both	Both	No		
Georgia Power	GA	Residential Energy Assessment and Solutions Program (EASP—formerly LIEE)	1	Residential	Both	Yes		
Georgia Power	GA	Home Energy Improvement Program (HEIP)	1	Residential	Both	No		No assistance
National Grid	MA	Low-Income Multi-Family (Income Eligible Coordinated Delivery)	5	Both	Both	Yes	Less than 1	No cost
MD DHCD	MD	Multifamily Energy Efficiency and Housing Affordability Program (MEEHA)	5	Both	Individually-metered	Yes	2	Some upfront funding

Program administrator	State	Program name	Building units required	Residential and/or commercial eligibility	Master and/or individual meter required	Audit required	ASHRAE audit type	Audit assistance
DTE Energy	MI	Multifamily Low Income Pilot	3	Both	Both	Yes	1	No cost
Consumers Energy	MI	Residential Multifamily Income Qualified	3	Both	Both	Yes	1	No cost
CenterPoint Energy	MN	Multi-Family Building Efficiency (MFBE)	N/A	Both	Both	Yes		No cost
CenterPoint Energy	MN	Low Income Rental Efficiency (LIRE)	1 to 4	Residential	Both	Yes		No cost
Xcel Energy	MN	Multi-Family Building Efficiency	5	Both	Both	Yes		No cost
Xcel Energy	MN	Multi-Family Energy Savings	5	Both	Both			
CenterPoint Energy	MN	Low-Income Multi-Family Housing Rebates (LIMF)	5	Commercial	Master-metered			
Ameren	MO	CommunitySavers	3	Both	Both	Yes	1	No cost
Kansas City Power and Light	MO	Income-Eligible Multi-Family	3	Both	Both	Yes	1	No cost
Spire	MO	CommunitySavers	3	Both	Both			
Spire	MO	Income Eligible MF Direct Install Program	3	Both	Both			
NYSERDA	NY	Multifamily Performance Program Version 8	5	Residential	Both	Yes	2	Some upfront funding
PGW	PA	Low Income Multifamily Efficiency (LIME)	2	Both	Both	Yes	1	No cost
Duquesne Light	PA	Multifamily Housing Retrofit Program (MFHR)		Both	Both	Yes		
PECO Energy	PA	Low-Income Energy Efficiency Program (LEEP)	N/A	Both	Both	Yes	1	No cost
West Penn Power	PA	WARM Multifamily	5	Both	Both	Yes		
National Grid	RI	Income-Eligible Multifamily	5	Both	Both	Yes		No cost

Program administrator	State	Program name	Building units required	Residential and/or commercial eligibility	Master and/or individual meter required	Audit required	ASHRAE audit type	Audit assistance
Dominion Energy	VA	Income and Age Qualifying Home Improvement Program	N/A	Residential	Individually-metered	Yes	2	No cost

Table A2. Summary of programs’ incentives and offers

Program administrator	State	Program name	Direct install	Prescriptive rebates	Custom rebates	Performance-based incentives
Southern California Gas Company	CA	Energy Savings Assistance Program (ESAP)	Yes			
California CSD	CA	Low-Income Weatherization Program for Multifamily Properties (LIWP-MF)				Yes
San Diego Gas and Electric	CA	Energy Savings Assistance Program (ESAP)	Yes			
Southern California Edison	CA	Energy Savings Assistance Program (ESAP)	Yes			
Pacific Gas and Electric	CA	Energy Savings Assistance Program (ESAP)	Yes			
Xcel Energy	CO	Affordable Housing Rebate Program	Yes	Yes	Yes	
Eversource	CT	Multifamily Initiative—Income Eligible	Yes		Yes	
DCSEU	DC	Income Qualified Efficiency Fund	Yes	Yes		
DCSEU	DC	Low-Income Multifamily Custom			Yes	
Georgia Power	GA	Residential Energy Assessment and Solutions Program (EASP—formerly LIEE)	Yes			Yes
Georgia Power	GA	Home Energy Improvement Program (HEIP)		Yes		Yes

Program administrator	State	Program name	Direct install	Prescriptive rebates	Custom rebates	Performance-based incentives
National Grid	MA	Low-Income Multi-Family (Income Eligible Coordinated Delivery)	Yes	Yes	Yes	
MD DHCD	MD	Multifamily Energy Efficiency and Housing Affordability Program (MEEHA)			Yes	
DTE Energy	MI	Multifamily Low Income Pilot	Yes	Yes	Yes	
Consumers Energy	MI	Residential Multifamily Income Qualified		Yes	Yes	
CenterPoint Energy	MN	Multi-Family Building Efficiency (MFBE)	Yes			Yes
CenterPoint Energy	MN	Low Income Rental Efficiency (LIRE)		Yes	Yes	
Xcel Energy	MN	Multi-Family Building Efficiency	Yes			Yes
Xcel Energy	MN	Multi-Family Energy Savings	Yes			
CenterPoint Energy	MN	Low-Income Multi-Family Housing Rebates (LIMF)		Yes		
Ameren	MO	CommunitySavers	Yes	Yes	Yes	
Kansas City Power and Light	MO	Income-Eligible Multi-Family	Yes		Yes	
Spire	MO	CommunitySavers	Yes	Yes		
Spire	MO	Income Eligible MF Direct Install Program	Yes	Yes	Yes	
NYSERDA	NY	Multifamily Performance Program Version 8				Yes
PGW	PA	Low Income Multifamily Efficiency (LIME)	Yes		Yes	
Duquesne Light	PA	Multifamily Housing Retrofit Program (MFHR)	Yes	Yes	Yes	

Program administrator	State	Program name	Direct install	Prescriptive rebates	Custom rebates	Performance-based incentives
PECO Energy	PA	Low-Income Energy Efficiency Program (LEEP)	Yes			
West Penn Power	PA	WARM Multifamily	Yes	Yes		
National Grid	RI	Income-Eligible Multifamily	Yes		Yes	
Dominion Energy	VA	Income and Age Qualifying Home Improvement Program	Yes			

Table A3. Participant technical assistance and support services offered by programs

Program administrator	State	Program name	Project planning assistance	Energy benchmarking	Contractor ally network	Contractor training or education	Health and safety funding	Financing options	Resident education materials	Staff education materials
Southern California Gas Company	CA	Energy Savings Assistance Program (ESAP)	Yes	Yes		Yes	Yes	Yes	Yes	Yes
California CSD	CA	Low-Income Weatherization Program for Multifamily Properties (LIWP-MF)	Yes	Yes	Yes	Yes			Yes	Yes
San Diego Gas and Electric	CA	Energy Savings Assistance Program (ESAP)				Yes	Yes		Yes	
Southern California Edison	CA	Energy Savings Assistance Program (ESAP)			Yes	Yes	Yes		Yes	
Pacific Gas and Electric	CA	Energy Savings Assistance Program (ESAP)				Yes	Yes		Yes	
Xcel Energy	CO	Affordable Housing Rebate Program	Yes		Yes					

Program administrator	State	Program name	Project planning assistance	Energy benchmarking	Contractor ally network	Contractor training or education	Health and safety funding	Financing options	Resident education materials	Staff education materials
Eversource	CT	Multifamily Initiative—Income Eligible	Yes		Yes	Yes	Yes	Yes		
DCSEU	DC	Income Qualified Efficiency Fund			Yes	Yes	Yes	Yes		
DCSEU	DC	Low-Income Multifamily Custom	Yes					Yes	Yes	Yes
Georgia Power	GA	Residential Energy Assessment and Solutions Program (EASP—formerly LIEE)			Yes	Yes	Yes		Yes	
Georgia Power	GA	Home Energy Improvement Program (HEIP)			Yes	Yes	Yes		Yes	
National Grid	MA	Low-Income Multi-Family (Income Eligible Coordinated Delivery)	Yes	Yes	Yes	Yes	Yes		Yes	
MD DHCD	MD	Multifamily Energy Efficiency and Housing Affordability Program (MEEHA)	Yes					Yes		
DTE Energy	MI	Multifamily Low Income Pilot		Yes	Yes			Yes	Yes	
Consumers Energy	MI	Residential Multifamily Income Qualified			Yes	Yes				
CenterPoint Energy	MN	Multi-Family Building Efficiency (MFBE)	Yes	Yes					Yes	Yes
CenterPoint Energy	MN	Low Income Rental Efficiency (LIRE)	Yes				Yes			
Xcel Energy	MN	Multi-Family Building Efficiency	Yes	Yes					Yes	Yes

Program administrator	State	Program name	Project planning assistance	Energy benchmarking	Contractor ally network	Contractor training or education	Health and safety funding	Financing options	Resident education materials	Staff education materials
Xcel Energy	MN	Multi-Family Energy Savings							Yes	
CenterPoint Energy	MN	Low-Income Multi-Family Housing Rebates (LIMF)								
Ameren	MO	CommunitySavers	Yes						Yes	Yes
Kansas City Power and Light	MO	Income-Eligible Multi-Family								
Spire	MO	CommunitySavers			Yes	Yes			Yes	
Spire	MO	Income Eligible MF Direct Install Program			Yes	Yes			Yes	
NYSERDA	NY	Multifamily Performance Program Version 8	Yes	Yes	Yes	Yes	Yes	Yes		
PGW	PA	Low Income Multifamily Efficiency (LIME)	Yes						Yes	Yes
Duquesne Light	PA	Multifamily Housing Retrofit Program (MFHR)	Yes						Yes	
PECO Energy	PA	Low-Income Energy Efficiency Program (LEEP)							Yes	
National Grid	RI	Income-Eligible Multifamily	Yes	Yes	Yes	Yes			Yes	Yes
Dominion Energy	VA	Income and Age Qualifying Home Improvement Program							Yes	

Table A4. 2017 Program budgets

Program administrator	State	Program name	Total electricity	Total natural gas	Electricity incentives	Natural gas incentives	Electricity non-incentive	Natural gas non-incentive
Southern California Gas Company	CA	Energy Savings Assistance Program (ESAP)		\$4,500,000		\$3,922,000		\$578,000
California CSD	CA	Low-Income Weatherization Program for Multifamily Properties (LIWP-MF)	\$24,000,000		\$18,480,000		\$5,520,000	
San Diego Gas and Electric	CA	Energy Savings Assistance Program (ESAP)						
Southern California Edison	CA	Energy Savings Assistance Program (ESAP)						
Pacific Gas and Electric	CA	Energy Savings Assistance Program (ESAP)						
Xcel Energy	CO	Affordable Housing Rebate Program	\$1,126,565	\$564,023	\$1,019,704	\$487,038	\$106,861	\$76,985
Eversource	CT	Multifamily Initiative—Income Eligible			\$5,424,669	\$1,738,903		
DCSEU	DC	Income Qualified Efficiency Fund						
DCSEU	DC	Low-Income Multifamily Custom						
Georgia Power	GA	Residential Energy Assessment and Solutions Program (EASP—formerly LIEE)	\$1,019,000					
Georgia Power	GA	Home Energy Improvement Program (HEIP)						

Program administrator	State	Program name	Total electricity	Total natural gas	Electricity incentives	Natural gas incentives	Electricity non-incentive	Natural gas non-incentive
National Grid	MA	Low-Income Multi-Family (Income Eligible Coordinated Delivery)	\$15,303,801	\$12,065,045	\$12,745,881	\$10,539,278	\$2,557,920	\$1,525,767
MD DHCD	MD	Multifamily Energy Efficiency and Housing Affordability Program (MEEHA)	\$7,356,000		\$6,666,667		\$689,334	
DTE Energy	MI	Multifamily Low Income Pilot	\$400,000	\$100,000	\$315,000	\$100,000	\$85,000	
Consumers Energy	MI	Residential Multifamily Income Qualified						
CenterPoint Energy	MN	Multi-Family Building Efficiency (MFBE)						
CenterPoint Energy	MN	Low Income Rental Efficiency (LIRE)		\$280,000		\$0		\$280,000
Xcel Energy	MN	Multi-Family Building Efficiency	\$656,606	\$280,740				
Xcel Energy	MN	Multi-Family Energy Savings	\$805,646		\$604,088		\$201,588	
CenterPoint Energy	MN	Low-Income Multi-Family Housing Rebates (LIMF)		\$85,572		\$50,572		\$25,000
Ameren	MO	CommunitySavers						
Kansas City Power and Light	MO	Income-Eligible Multi-Family						
Spire	MO	CommunitySavers				\$500,000		
Spire	MO	Income Eligible MF Direct Install Program				\$191,000		
NYSERDA	NY	Multifamily Performance Program Version 8	\$13,520,277		\$5,200,500		\$8,319,877	

Program administrator	State	Program name	Total electricity	Total natural gas	Electricity incentives	Natural gas incentives	Electricity non-incentive	Natural gas non-incentive
PGW	PA	Low Income Multifamily Efficiency (LIME)						
Duquesne Light	PA	Multifamily Housing Retrofit Program (MFHR)	\$850,833		\$199,733		\$651,100	
PECO Energy	PA	Low-Income Energy Efficiency Program (LEEP)	\$6,700,000					
National Grid	RI	Income-Eligible Multifamily	\$2,708,400	\$2,216,600	\$1,880,000	\$1,885,800	\$673,300	\$460,100
Dominion Energy	VA	Income and Age Qualifying Home Improvement Program						

Table A5. 2017 Program spending

Program administrator	State	Program name	Total electricity	Total natural gas	Electricity incentives	Natural gas incentives	Electricity non-incentive	Natural gas non-incentive
Southern California Gas Company	CA	Energy Savings Assistance Program (ESAP)		\$10,797,032				
California CSD	CA	Low-Income Weatherization Program for Multifamily Properties (LIWP-MF)	\$24,000,000		\$19,469,840		\$4,530,160	
San Diego Gas and Electric	CA	Energy Savings Assistance Program (ESAP)	\$3,462,732	\$3,415,072				
Southern California Edison	CA	Energy Savings Assistance Program (ESAP)	\$9,552,666					
Pacific Gas and Electric	CA	Energy Savings Assistance Program (ESAP)	\$9,635,802	\$8,480,764				
Xcel Energy	CO	Affordable Housing Rebate Program	\$1,062,473	\$1,098,228	\$944,989	\$980,744	\$117,484	\$117,484

Program administrator	State	Program name	Total electricity	Total natural gas	Electricity incentives	Natural gas incentives	Electricity non-incentive	Natural gas non-incentive
Eversource	CT	Multifamily Initiative— Income Eligible			\$4,704,691	\$1,783,636		
DCSEU	DC	Income Qualified Efficiency Fund	\$402,224	\$31,787				
DCSEU	DC	Low-Income Multifamily Custom	\$1,244,778	\$1,485,666				
Georgia Power	GA	Residential Energy Assessment and Solutions Program (EASP—formerly LIEE)	\$999,581					
Georgia Power	GA	Home Energy Improvement Program (HEIP)			\$700,230			
National Grid	MA	Low-Income Multi-Family (Income Eligible Coordinated Delivery)	\$18,847,955	\$17,511,092	\$15,051,220	\$14,103,475	\$3,796,735	\$2,407,617
MD DHCD	MD	Multifamily Energy Efficiency and Housing Affordability Program (MEEHA)	\$5,708,329		\$4,710,439		\$709,736	
DTE Energy	MI	Multifamily Low Income Pilot						
Consumers Energy	MI	Residential Multifamily Income Qualified	\$857,844	\$1,460,013				
CenterPoint Energy	MN	Multi-Family Building Efficiency (MFBE)		\$140,128				
CenterPoint Energy	MN	Low Income Rental Efficiency (LIRE)		\$252,202				\$252,202
Xcel Energy	MN	Multi-Family Building Efficiency	\$515,419	\$288,513				

Program administrator	State	Program name	Total electricity	Total natural gas	Electricity incentives	Natural gas incentives	Electricity non-incentive	Natural gas non-incentive
Xcel Energy	MN	Multi-Family Energy Savings	\$1,391,040		\$1,200,942		\$190,098	
CenterPoint Energy	MN	Low-Income Multi-Family Housing Rebates (LIMF)		\$136,115		\$98,010		\$38,105
Ameren	MO	CommunitySavers	\$2,124,240		\$1,113,516		\$1,010,724	
Kansas City Power and Light	MO	Income-Eligible Multi-Family						
Spire	MO	CommunitySavers		\$234,225				
Spire	MO	Income Eligible MF Direct Install Program		\$15,086				
NYSERDA	NY	Multifamily Performance Program Version 8	\$4,818,272		\$3,802,650		\$1,015,622	
PGW	PA	Low Income Multifamily Efficiency (LIME)						
Duquesne Light	PA	Multifamily Housing Retrofit Program (MFHR)	\$310,000		\$68,000		\$242,000	
PECO Energy	PA	Low-Income Energy Efficiency Program (LEEP)	\$2,300,000					
National Grid	RI	Income-Eligible Multifamily	\$2,858,600	\$1,916,100				
Dominion Energy	VA	Income and Age Qualifying Home Improvement Program					\$199,872	

Table A6. 2017 program savings

Program administrator	State	Program name	Annual electricity savings (kWh)	Annual natural gas savings (MMBtu)	Lifetime electricity savings (kWh)	Lifetime natural gas savings (MMBtu)
Southern California Gas Company	CA	Energy Savings Assistance Program (ESAP)		17,396		
California CSD	CA	Low-Income Weatherization Program for Multifamily Properties (LIWP-MF)	11,242,406	29,076		
San Diego Gas and Electric	CA	Energy Savings Assistance Program (ESAP)	1,146,000	3,489		
Southern California Edison	CA	Energy Savings Assistance Program (ESAP)	5,856,531			
Pacific Gas and Electric	CA	Energy Savings Assistance Program (ESAP)	5,959,000	16,596		
Xcel Energy	CO	Affordable Housing Rebate Program	1,983,546	14,063		
Eversource	CT	Multifamily Initiative—Income Eligible	6,644,718	21,089	80,850,768	415,175
DCSEU	DC	Income Qualified Efficiency Fund	2,244,380	4,003	32,274,000	89,089
DCSEU	DC	Low-Income Multifamily Custom	2,045,652	2,336	35,948,000	45,175
Georgia Power	GA	Residential Energy Assessment and Solutions Program (EASP—formerly LIEE)				
Georgia Power	GA	Home Energy Improvement Program (HEIP)	2,187,780			
National Grid	MA	Low-Income Multi-Family (Income Eligible Coordinated Delivery)	12,556,000	89,338	161,070,000	1,770,797
MD DHCD	MD	Multifamily Energy Efficiency and Housing Affordability Program (MEEHA)	1,507,000	3,041	14,201,000	
DTE Energy	MI	Multifamily Low Income Pilot				

Program administrator	State	Program name	Annual electricity savings (kWh)	Annual natural gas savings (MMBtu)	Lifetime electricity savings (kWh)	Lifetime natural gas savings (MMBtu)
Consumers Energy	MI	Residential Multifamily Income Qualified	2,147,145	32,564	26,264,000	452,850
CenterPoint Energy	MN	Multi-Family Building Efficiency (MFBE)		1,351		16,536
CenterPoint Energy	MN	Low Income Rental Efficiency (LIRE)		1,115		22,293
Xcel Energy	MN	Multi-Family Building Efficiency	2,179,169	7,421		
Xcel Energy	MN	Multi-Family Energy Savings	972,901			
CenterPoint Energy	MN	Low-Income Multi-Family Housing Rebates (LIMF)		9,407		63,919
Ameren	MO	CommunitySavers	7,334,784			
Kansas City Power and Light	MO	Income-Eligible Multi-Family	4,183,846			
Spire	MO	CommunitySavers				
Spire	MO	Income Eligible MF Direct Install Program				
NYSERDA	NY	Multifamily Performance Program Version 8	8,119,286	53,264	121,789,290	798,966
PGW	PA	Low Income Multifamily Efficiency (LIME)				
Duquesne Light	PA	Multifamily Housing Retrofit Program (MFHR)	41,000			
PECO Energy	PA	Low-Income Energy Efficiency Program (LEEP)	1,901,000		11,157,800	
National Grid	RI	Income-Eligible Multifamily	3,970,000	17,601	28,814,000	261,772
Dominion Energy	VA	Income and Age Qualifying Home Improvement Program	1,786,400	17,396	25,009,600	

Table A7. 2017 program participation

Program administrator	State	Program name	Units served: electricity	Units served: natural gas	Properties served: electricity	Properties served: natural gas
Southern California Gas Company	CA	Energy Savings Assistance Program (ESAP)		26,412		684
California CSD	CA	Low-Income Weatherization Program for Multifamily Properties (LIWP-MF)	4,895		47	
San Diego Gas and Electric	CA	Energy Savings Assistance Program (ESAP)	9,236	9,173		
Southern California Edison	CA	Energy Savings Assistance Program (ESAP)	20,645			
Pacific Gas and Electric	CA	Energy Savings Assistance Program (ESAP)	13,859	12,168		
Xcel Energy	CO	Affordable Housing Rebate Program	3,748	3,748	78	78
Eversource	CT	Multifamily Initiative—Income Eligible	8,560	2,430		
DCSEU	DC	Income Qualified Efficiency Fund	5,382	5,382	27	27
DCSEU	DC	Low-Income Multifamily Custom	1,770	1,770	20	20
Georgia Power	GA	Residential Energy Assessment and Solutions Program (EASP—formerly LIEE)	184			
Georgia Power	GA	Home Energy Improvement Program (HEIP)	1,135			
National Grid	MA	Low-Income Multi-Family (Income Eligible Coordinated Delivery)	6,141	5,325		
MD DHCD	MD	Multifamily Energy Efficiency and Housing Affordability Program (MEEHA)	919			
DTE Energy	MI	Multifamily Low Income Pilot				

Program administrator	State	Program name	Units served: electricity	Units served: natural gas	Properties served: electricity	Properties served: natural gas
Consumers Energy	MI	Residential Multifamily Income Qualified				
CenterPoint Energy	MN	Multi-Family Building Efficiency (MFBE)		640		22
CenterPoint Energy	MN	Low Income Rental Efficiency (LIRE)				60
Xcel Energy	MN	Multi-Family Building Efficiency			130	41
Xcel Energy	MN	Multi-Family Energy Savings				
CenterPoint Energy	MN	Low-Income Multi-Family Housing Rebates (LIMF)		4,851		45
Ameren	MO	CommunitySavers	4,486		62	
Kansas City Power and Light	MO	Income-Eligible Multi-Family				
Spire	MO	CommunitySavers		932		8
Spire	MO	Income Eligible MF Direct Install Program				
NYSERDA	NY	Multifamily Performance Program Version 8	3,517	3,517	27	27
PGW	PA	Low Income Multifamily Efficiency (LIME)				
Duquesne Light	PA	Multifamily Housing Retrofit Program (MFHR)			1	
PECO Energy	PA	Low-Income Energy Efficiency Program (LEEP)	2,227		16	
National Grid	RI	Income-Eligible Multifamily	5,162	3,840		
Dominion Energy	VA	Income and Age Qualifying Home Improvement Program	5,552			

Appendix B. Program Administrator Survey

The purpose of this survey is to help us better understand the design and delivery of utility-sector low-income multifamily energy efficiency programs across the country.

Please complete the following questions based on the programs run by your utility or organization.

1) Contact Information

First Name: _____

Last Name: _____

Utility or Organization: _____

Email Address: _____

Phone Number: _____

2) How many programs does your utility or organization administer that serve the low-income multifamily sector?

Please enter a number (1, 2, 3, 4, or 5)

3) Please attach the documents listed below for our reference. Having these documents on hand may also aid you in answering the remaining survey questions.

- Most recent DSM report that includes information on your low-income multifamily programs
- Most recent program plan that includes information on your low-income multifamily programs
- Most recent program evaluation that includes information on your low-income multifamily programs
- List of all currently available efficiency measures for each low-income multifamily program (e.g. insulation, aerators, refrigerator replacement, etc.), number of each measure provided during the last program year, and percentage of total cost covered for each measure
- Most recent RFP for low-income multifamily programs you administer
- Any other documentation that provides information on your low-income multifamily programs

Program Information

4) Name of low-income multifamily program.

5) Does this program address electric and/or natural gas end uses?

Electric End Uses

Natural Gas End Uses

Both

6) When did this program, in its current version, become available to customers?

Format: mm/dd/yyyy

7) When will the current cycle for this program end?

Format: mm/dd/yyyy

8) What is the anticipated deadline for submitting the next program plan?

Format: mm/dd/yyyy

9) When is the deadline for submitting your next annual program (DSM) report for this program?

Format: mm/dd/yyyy

10) What eligibility requirements exist for customers to participate in this program?

Minimum building units: _____

Customer type

Residential

Commercial

Both

Metering requirement

Master-metered

Individually-metered

Both

Income eligibility requirements

Other requirements

11) How does your program verify low-income multifamily customer incomes? For example, do you use a government housing program for verification?

12) Please indicate the financial incentive types available through this program. *Check all that apply.*

Direct install

Prescriptive rebates

Custom rebates

Performance-based incentives

13) Are energy audits required for this program?

Yes

No

14) Please specify the type of audit required (relevant to ASHRAE standards).

ASHRAE Level 3 (Detailed Analysis of Capital Intensive Measures)

ASHRAE Level 2 (Energy Survey and Analysis)

ASHRAE Level 1 (Walk-Through Audit)

Less than ASHRAE Level 1 Audit

15) What upfront financial assistance is available to participants for energy audits?

Audits provided at no cost

Some upfront funding for audits provided

No upfront audit funding provided, but some funding is available after a project is approved

No energy audit funding provided

16) How many audits have been completed since the program (in its current version) launched?

17) How many program applicants completed an audit but did not proceed with implementing any improvements through this program?

18) Please describe any upfront costs that the program requires of participants.

19) Please describe any incentive funds provided prior to project completion apart from direct install offers or funding for audits.

20) Does this program provide any of the following? *Please check all that apply.*

- Assistance with initial project planning
- Energy benchmarking services
- Water efficiency measures
- Contractor ally network
- Contractor training/education opportunities
- Funding / measures to address health and safety repairs
- Financing options
- Energy efficiency education materials for residents
- Energy efficiency education materials for building staff
- Behavioral components for residents
- Behavioral components for building staff

21) Please specify what funding and/or measures are available to address health and safety concerns.

22) Please specify what financing options are made available to program participants.

23) Do you partner with another utility for program implementation?

Yes

No

24) Please list the other utility partners for this program.

Utility 1: _____

Utility 2: _____

Utility 3: _____

25) Who is the current program implementer?

26) How does your program coordinate with other organizations or government agencies on program delivery?

27) How does your program coordinate with other organizations or government agencies to identify and/or provide participants with financing options?

28) Please provide the following information for this program for the most recent program year. If you have not completed a full program year, please provide the most recent data available. If you do not have electric and/or natural gas values for the following, please enter "N/A".

The most recent spending, savings, and participation data for the program I am able to provide covers the following period of time (Please use format mm/dd/yyyy):

Start Date: _____

End Date: _____

Program Budget and Spending Data (\$ for Most Recent Program Year)

	Electric Efficiency	Natural Gas Efficiency
Total Annual Budget		
Annual Budget for Incentives		
Annual Budget for Non-Incentive Costs		
Total Spending for Most Recent Program Year		
Most Recent Program Year Spending for Incentives		
Most Recent Program Year Spending for Non-Incentive Costs		

Program Energy Savings Data (For Most Recent Program Year)

	Net Incremental Savings at Generator	Units for Savings (MWh, kWh, Therms, CCF etc.)
Most Recent Program Year Electricity Savings		
Lifetime Electricity Savings (Most Recent Program Year)		
Most Recent Program Year Natural Gas Savings		
Lifetime Natural Gas Savings (Most Recent Program Year)		

29) Please provide the follow program cost-effectiveness benefit-cost ratios, as available, for the most recent program year.

	Electric Efficiency	Natural Gas Efficiency
PCT		
RIM		
PAC		
TRC		
SCT		

30) Annual Program Participation

	Electric Efficiency	Natural Gas Efficiency
Number of low-income multifamily housing units (individual apartments or condos) served in the most recent program year		
Number of low-income multifamily properties served in the most recent program year		

Appendix C. Program Administrator Follow-Up Interview Questions

1. What were the biggest challenges you faced in creating your program?
2. What are the key reasons for your program's success? (Think of important lessons you've learned that you'd want to share with other program managers working on the same type of program.)
3. If your program provides technical assistance, what forms does this take? (e.g., building energy analysis/modeling, project management, benchmarking, design assistance, etc.).
4. What ongoing or emerging challenges does your program face? How do you anticipate or plan to meet these challenges?
5. What do you see as the greatest barriers faced by your target market (building owners, managers, residents) for moving ahead with projects?