

Building Better Energy Efficiency Programs for Low-Income Households

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Executive Summary

Low-income energy efficiency programs are an important component of ratepayer-funded efficiency portfolios throughout the country, but there is room for improvement and expansion. In this report we address the challenges and opportunities of low-income programs that target single-family homes. We include a survey of the low-income program landscape and advice on scaling up energy efficiency in this sector. Finally, we detail practices that program administrators are using to overcome challenges, and we explore strategies to incorporate underutilized technologies and measures into programs to realize greater savings.

NEED FOR LOW-INCOME PROGRAMS

Of the total spending on residential energy efficiency programs in 2014, 18% of electric efficiency expenditures and 34% of natural gas efficiency spending went toward low-income programs.¹ Particularly for electricity, there is a need for more equitable spending on efficiency programs targeted to low-income households, which make up roughly 33% of the population nationally.² These households tend to have older, less efficient appliances and equipment, making them good candidates for energy efficiency programs. They also have energy costs that account for a higher percentage of household income than in non-low-income households. The challenge is to run programs that minimize cost and maximize energy savings.

LOW-INCOME ENERGY EFFICIENCY AND THE CLEAN POWER PLAN

Guidance on low-income programs is particularly relevant now because utilities have an opportunity to expand these efforts under the Clean Power Plan (CPP). This report offers guidance on using low-income energy efficiency to gain credits for CPP compliance. In setting limits on carbon dioxide emissions from existing power plants, the CPP includes a Clean Energy Incentive Program (CEIP) that encourages early investment in energy efficiency in low-income communities. States and utilities with existing low-income efficiency programs can leverage them to scale up assistance to target households. Those with less established programs in this sector can use the CPP and CEIP to meet emissions reductions goals while also addressing the energy needs of low-income customers.

RECOMMENDATIONS FOR RUNNING A LOW-INCOME ENERGY EFFICIENCY PROGRAM

Many utilities run low-income efficiency programs but find aspects of them challenging. We present the following recommendations for successfully reaching low-income households and addressing their energy challenges.

¹ CEE (Consortium for Energy Efficiency), *2014 State of the Efficiency Program Industry: Budgets, Expenditures, and Impacts* (Boston: Consortium for Energy Efficiency, 2015) www.cee1.org/annual-industry-reports.

² US Census Bureau, *People with Income Below Specified Ratios of Their Poverty Thresholds by Selected Characteristics: 2014* (Current Population Survey, 2015 Annual Social and Economic Supplement, accessed December 10, 2015) www.census.gov/hhes/www/poverty/data/incpovhlth/2014/table5.pdf.

Offer a range of eligible measures. Programs have traditionally focused on building-shell improvements, but many are now incorporating additional measures into program offerings. Programs must adapt to address new conditions such as more electric plug loads.

Coordinate with other organizations. Utilities can coordinate with existing efforts to serve low-income households, especially those that have a good reputation in the community and where households already go for help. These include Community Action Partnership (CAP) agencies that run state and federal weatherization efforts, and food bank and food shelf networks for the distribution of energy-efficient products.

Use a portfolio approach. Program administrators are no longer offering just one program option for the low-income sector. Many now offer a range of strategies and initiatives to reach owners and renters of single-family housing with diverse energy needs.

Address health, safety, and building integrity issues. Housing deficiencies can prevent low-income energy efficiency upgrades from being completed. Programs should be designed with the flexibility to address minor health and safety issues, and they should develop relationships with local housing rehabilitation organizations to help address larger issues in the homes of program participants.

Incorporate customer energy efficiency education. Administrators can build trust within low-income communities and interest in their programs via energy education initiatives and materials. Integrating educational components into programs also improves the realization and persistence of installed measures.

Develop dual-fuel and fuel-blind programs. Electric and gas utilities can join together for joint delivery of efficiency programs. In the context of the CPP, states and utilities can leverage spending on electric measures to develop comprehensive programs that meet the needs of low-income people regardless of what type of energy they use to heat their home.

Coordinate between efficiency and bill payment assistance programs. Eligibility requirements can be coordinated between energy efficiency and bill payment assistance programs to allow for more streamlined participation. These programs can share customer information to help address the energy needs of the highest-use households.

Increase electricity savings through high-efficiency products and equipment. The majority of savings from low-income energy efficiency upgrades currently result from weatherization shell measures and direct install measures, primarily lighting, faucet aerators, and showerheads. Programs could rely more heavily on appliances, equipment, and electronics to produce savings. To best serve low-income customers, programs may need to consider more than just high efficiency ratings; they should carefully consider program criteria and qualifying product lists to ensure that customers can find products that meet their needs. This might mean developing program-specific criteria and/or product lists rather than relying on established qualified product lists such as ENERGY STAR®.

CONCLUSION

Energy efficiency programs can provide critical assistance to households that struggle to keep up with the cost of energy, which for them accounts for a higher percentage of

household income than the average for all households. Programs can provide greater support to low-income households through energy and cost savings as well as a variety of associated health, safety, and quality of life benefits. Key strategies include integrating low-income energy efficiency into CPP compliance plans, increasing savings through smart partnerships with local organizations serving the target population, and increasing product efficiency in low-income households.

Introduction

Low-income energy efficiency programs support households that spend a large portion of their income on utility bills. An estimated 44% of low-income households struggle with energy insecurity, defined as an inability to meet basic household heating, cooling, and energy needs (Hernandez, Aratani, and Jiang 2014).¹ While an average residential household spends 2.7% of its income on energy bills, low-income households pay an average of 6% of their income for energy (LIHEAP Clearinghouse 2015). Policymakers at all levels recognize the need to fund these programs. While they have long been a staple of ratepayer-funded energy efficiency portfolios at some utilities, others have few if any programs that serve low-income people. Many existing programs have a strong track record of delivering energy savings and nonenergy benefits to both low-income households and utilities. They can help utilities meet energy-savings goals while improving quality of life for low-income people.

While some utility programs have been working to serve low-income customers for a long time, there are still significant opportunities for expanded efforts. In the United States, 2014 energy efficiency spending for low-income programs accounted for 18% of residential electric efficiency spending and 34% of residential natural gas efficiency spending, while the target segment of the population accounts for roughly one-third of total households (CEE 2015; Census 2015). While low-income people are not excluded from programs offered to all residential customers, data show that participation is limited (Frank and Nowak 2015). Well-known barriers such as high up-front costs often prevent low-income households from accessing utility rebates for efficient products. Because a majority of programs require an up-front customer investment to leverage valuable utility rebates and associated savings, they are largely inaccessible to low-income people. This furthers disparities in home and appliance efficiency. Utilities have an obligation to make sure the ratepayer-funded programs to which all paying customers contribute reach a more representative segment of the population.

This report focuses on low-income programs for single-family households. About a quarter of households below the poverty line live in multifamily buildings (Pivo 2012). Thus utilities can also reach low-income people through multifamily energy efficiency programs. A comprehensive utility program portfolio should include multifamily energy efficiency programs, particularly in more-urban areas where many low-income people live in multifamily buildings. A number of ACEEE resources, including *Apartment Hunters: Programs Searching for Energy Savings in Multifamily Buildings* (Johnson and Mackres 2013) and *Effective Strategies for Achieving High Participation and Deeper Savings in Income-Eligible Multifamily Buildings* (ACEEE 2014), explore best practices for overcoming particular challenges associated with reaching households in the multifamily sector. Throughout the country utilities also have opportunities to realize savings for low-income households through programs for manufactured homes. Particularly in the area of weatherization and

¹ Qualifications for low-income programs vary among energy efficiency programs, but for the purposes of this report, we define low-income as those with an income at or below 200% of the federal poverty level (FPL). This is in line with qualification requirements for the federal Low Income Home Energy Assistance Program (LIHEAP) and the Weatherization Assistance Program (WAP).

shell measures, manufactured homes require different program measures for realizing savings, largely due to different physical building characteristics. While this report does not cover programs that specifically address manufactured housing, ACEEE's report *Mobilizing Energy Efficiency in the Manufactured Housing Sector* (Talbot 2012) provides guidance specific to this housing type. These areas lie outside the scope of this report, but they are important for utilities to consider to reach low-income people.

CLEAN POWER PLAN INCENTIVES

Low-income energy efficiency programs can help utilities meet new requirements in the Clean Power Plan (CPP), which sets limits on the amount of carbon dioxide emissions from existing power plants.² States and utilities can use energy efficiency to cost effectively reduce carbon dioxide emissions, and programs that address the needs of low-income households can be an integral part of state plans.

The CPP includes a Clean Energy Incentive Program (CEIP), which provides incentives for early investment in energy efficiency in low-income communities. The CEIP provides double credit for energy savings from energy efficiency, awarding two allowances for each ton of emissions avoided. (In a rate-based approach the units are emission rate credits, or ERCs.) States can use CEIP allowances for compliance and apply them toward the overall reduction goal. They can also make low-income energy efficiency programs part of their portfolio of activities to meet emissions reduction demands beyond the CEIP and through 2030. States and utilities with existing low-income energy efficiency programs can leverage them to scale up assistance for low-income households. Utilities and states with less established programs in the low-income sector can use the CPP and the CEIP to reduce energy use while scaling up assistance to financially vulnerable households.

FOCUS OF THIS REPORT

For all of the above reasons, interest in low-income energy efficiency has never been greater. In response ACEEE has prepared this report to help address many of the key questions and challenges around low-income programs that target single-family homes, and to offer guidance for most effectively realizing the opportunities for low-income programs today. This report draws from a range of programs to provide recommendations for increasing the savings and reach of low-income energy efficiency utility programs. We rely on public utility commission filings, annual reports, program evaluations, and program administrator interviews to understand program types, reach, costs, and savings.

The report is organized as follows. First we lay out the housing and energy use characteristics of the low-income sector. Next we explore the landscape of existing program activity that addresses low-income energy efficiency and energy affordability. We show the program types, approaches, and delivery mechanisms for existing low-income energy efficiency programs offered by utilities, as well as spending and savings results and how they compare to general residential programs. We then present the primary challenges for

² As of this report's publication date, the Supreme Court has granted a stay to the Clean Power Plan rule pending the resolution of legal challenges.

low-income energy efficiency programs and detail key strategies and best practices that program administrators are using to overcome these challenges. We explore technologies and measures that are underutilized in current programs and discuss opportunities to realize greater savings through their incorporation into programs. The report concludes with guidance for recognizing the full value of low-income energy efficiency programs and representing it to customers, the utility, and society at large.

Housing and Energy Use Characteristics in the Low-Income Sector

Housing characteristics and energy end uses in low-income households differ from those of the residential sector as a whole. The differences have implications for how programs can be designed to more equitably serve low-income customers. These differences also have implications for the types of measures that can lead to the greatest savings in low-income programs.

ENERGY COSTS

Total household energy expenditures for low-income households are less than those for non-low-income households. On average low-income households spend \$1,690 annually on energy, while non-low-income households spend \$2,134 (EIA 2013b).³ This is typically understood to be due to the fact that low-income households tend to reside in smaller dwellings and multifamily buildings and have fewer discretionary energy-consuming devices. Despite lower usage low-income households spend more per square foot, at an average of \$1.23/square foot versus \$0.98/square foot in the general population, which suggests that equipment and appliances are expending more energy to perform the same functions (EIA 2013b). Furthermore low-income households spend a higher portion of their overall income on energy expenses than non-low-income households (Drehobl and Ross 2016).

Clean Power Plan: Opportunities for Targeting Major Electric Appliance Loads in Low-Income Households

Product rebate programs (which usually include lighting, appliances, and consumer electronics) cost less per unit of energy saved than other efficiency measures. To date, there are few programs targeted to low-income households that target appliances and electronics. Housing appliance characteristics indicate significant opportunities for electric utility programs to target replacement and removal of inefficient appliances such as clothes washers and refrigerators. Penetration of efficient ENERGY STAR® refrigerators and clothes washers is much lower in low-income households. This means that on average, baseline energy use is likely to be higher in these product categories, resulting in greater opportunities for energy savings. Energy efficiency programs targeting improvements in appliances and electronics for low-income households have a significant role to play in the CEIP and CPP.

³ In working with the Residential Energy Consumption Survey (RECS) data (EIA 2009), we define low-income as a household with 150% or less of FPL income. At the time of the 2009–2010 American Recovery and Reinvestment Act (ARRA) funding of WAP, the definition was expanded to 200% of FPL income, increasing the number of households that fell into the low-income category. RECS data include both renter- and owner-occupied low-income households.

APPLIANCES

Low-income households are more likely to have older appliances that are less frequently retired from use, or that have been purchased from a secondhand market or obtained at no cost as friends and family retire older models. About 33% of low-income households have refrigerators older than 10 years, versus about 26% of non-low-income households (EIA 2013b). Fewer low-income households have ENERGY STAR® refrigerators compared to the general population (29% versus 45%) (EIA 2013b).

The age of clothes washers does not differ significantly between low-income and non-low-income populations, but low-income households are less likely to have ENERGY STAR washers, with a 24% penetration versus 46% (EIA 2013b). Fewer low-income households use clothes dryers at home than non-low-income households (67% versus 90%).

These findings suggest that there are greater energy savings opportunities for appliance programs targeting low-income households than for those targeting the general residential population. Many higher-income households have long had access to programs incentivizing efficient appliances. Although appliance programs are available to customers of all income levels, the up-front appliance costs required to access available rebates, combined with fewer marketing and outreach efforts targeted at low-income households, have limited low-income customer participation. Data comparing the demographic characteristics of participants in California's appliance programs to the general population show that fewer low-income households participate in appliance programs (Frank and Nowak 2015).

EQUIPMENT AND USE CHARACTERISTICS

Low-income owner-occupied households are more likely to heat their homes primarily with electricity (37% versus 29% for all households). In addition, 4% of low-income owner-occupied households use portable electric heaters as their primary heating equipment, while 0% of non-low-income households do. While there are exceptions, space heating with electric resistance heaters (including portable space heaters, electric baseboard heaters, and electric furnaces) is generally more energy intensive. Low-income households are more likely to have electric water heaters (48% versus 38% for all households), which, with the exception of heat pump water heaters, are generally a costlier form of water heating due to greater energy expenditures (ACS 2013).

Low-income households are less likely to have programmable thermostats. Only 24% of low-income households have programmable thermostats, while 47% of non-low-income households do (EIA 2013b). Relatedly, in the winter heating season, fewer low-income households turn down the heating temperature when residents are away from home. Forty percent of low-income households reported leaving the temperature at 70°F or above when away, while 29% of non-low-income households reported this (EIA 2013b). Thermostat set points appear to be higher on average in low-income households – about 60% of low-income households reported setting the temperature at 70°F or above, while 30% of non-low-income households reported this. This finding may signal an inability to get sufficient heat and comfort from keeping the thermostat at lower temperatures.

Table 1 presents data showing key differences in how households use energy that impact what measures programs can target. While these data give us an idea of the primary differences to look for, they cannot replace regional building stock and energy use data as guidance for best targeting efforts. Regional residential building stock assessments can be useful in helping to uncover differences between low-income and non-low-income populations on a more localized scale that would be useful for program development.

Table 1. Summary of key appliance, equipment, and use characteristics for low-income households

Use	Low-income household characteristics	Implication for programs
Overall energy use	Lower expenditures, but higher cost per square foot and higher percentage of income spent on energy	For more accurate realization rates, baseline energy use should be estimated specifically for low-income households.
Appliances	Older and less efficient models	Opportunities to increase penetration of high-efficiency appliances
Heating	More likely to use electricity for heating; more likely to use space heaters as a primary source of heat	Opportunities for high-efficiency electric heating measures, such as ductless heat pumps
Control	Less likely to have a programmable thermostat; less likely to turn down temperature when away	Opportunities for installation of programmable thermostats and proper control of temperature based on occupancy
Water heating	More likely to have older electric water heaters	Opportunities for high-efficiency electric water-heating measures, such as heat pump water heaters

Low-income households also have less ability as energy pricing changes to switch fuels for major energy loads, including heating, water heating, and appliances, to take advantage of lower-cost energy sources. *Sources:* EIA 2013b; ACS 2013.

By understanding these appliance, equipment, and use characteristics and how they differ from those of the general population, program developers can design energy efficiency programs that best address the needs of low-income households and, ultimately, more equitably serve the ratepayer base. Attention to use characteristics and equipment baselines of low-income households is also important for accurate planning and evaluation of programs, including calculation of appropriate baseline energy use and appliance types. Achieving more-accurate program realization rates will require estimating baseline energy use specifically for low-income households.

The Low-Income Energy Efficiency and Affordability Landscape

Utility energy efficiency programs constitute one part of a larger effort to address the energy needs of low-income households. Bill payment assistance or energy affordability programs help low-income households pay their utility bills, while energy efficiency programs make physical improvements to the building to reduce energy use. Bill payment assistance and energy efficiency programs receive support from various levels of government, utility/ratepayer, and private funding. States vary in the degree of interaction between energy efficiency programs and bill payment assistance programs that are funded by

different entities. We explore the management and delivery of low-income programs later in this report.

FUNDING

Federal Funding

The federal government provides funding for state and local program efforts through the Low Income Home Energy Assistance Program (LIHEAP) and the Weatherization Assistance Program (WAP). LIHEAP helps low-income households pay their energy bills, while WAP helps them reduce energy costs through installation of energy efficiency measures. In 2015 a total of \$3.39 billion in federal funds for LIHEAP was allocated to each state (DHHS 2015). A total of \$193 million in federal funds was allocated for the WAP program for 2015 (Garcia 2015). At the discretion of states, grantees may spend up to 15% of LIHEAP funds on energy efficiency measures.⁴ It is unclear how much LIHEAP funding has been used in the past for energy efficiency improvements. In 2006, the most recent year for which data are available, \$213 million in LIHEAP funds were transferred to WAP programs for energy efficiency. This was about 6% of total LIHEAP funds that year, almost double federal WAP spending (\$240 million) in 2006 (Rowe, Cowan, and Quercia 2009; LIHEAP Clearinghouse 2016). This decision is made at the state level and at the state's discretion. Some states do not use any LIHEAP funds for their WAP programs. The 2016 LIHEAP budget of \$3.39 billion passed as a part of the omnibus spending bill in late 2015. It allows states to set aside up to 40% for energy efficiency, versus the current maximum of 25%. A 40% increase in spending on energy efficiency and weatherization from LIHEAP funding could mean an increase in funding for energy efficiency of \$1.35 billion, which dwarfs federal spending on weatherization through WAP in 2015. WAP has successfully handled ramp-up in the past due to an influx of resources during the years when the federal American Recovery and Reinvestment Act of 2009 (ARRA) allocated \$5 billion to the program to spend from 2009 to 2011, as figure 1 on the next page shows (Tonn et al. 2015).

WAP Funding History

Spending on WAP is lower than it has historically been. As a part of ARRA, WAP received \$5 billion, which is about 25 times the funding the program has received in each year since, as figure 1 shows (LIHEAP Clearinghouse 2016). Large increases in funding resulted in a significant ramp-up of weatherization efforts between 2009 and 2011, including building the capacity of the workforce and implementing agencies. During its peak year the program weatherized about 340,000 homes. In comparison the program weatherized 98,000 homes in 2008, when federal program funding was about \$230 million (DOE 2015; LIHEAP Clearinghouse 2016). Post-ARRA funding left many weatherization agencies looking for funding to supplement smaller federal allocations. In some states utilities ramped up their weatherization program components, leveraging local community action agencies for program implementation, a welcome strategy from the perspective of both the utilities and the providers.

⁴ States may spend up to 25% of allocated funds on energy efficiency if they request and are granted a waiver from the federal Department of Health and Human Services (DHHS) (Perl 2013).

Utility Ratepayer Funding

Ratepayer-funded utility spending on low-income energy assistance and energy efficiency for the most recent year available (2013) was \$3.91 billion, with \$3.13 billion going to bill payment assistance and \$777 million, or roughly 20%, going to efficiency programs (LIHEAP Clearinghouse 2016).⁵

Other Funding Sources

In addition, supplemental funding from community- and faith-based sources contributes to energy assistance and energy efficiency efforts for the low-income population (LIHEAP Clearinghouse 2016). In 2010, when supplemental funding was last tracked by the LIHEAP Clearinghouse, these contributions amounted to \$132 million nationwide. Some state and local governments also supplement federal LIHEAP and WAP funds. In 2010, the most recent year for which data are available, state and local government contributions amounted to \$249 million (LIHEAP Clearinghouse 2016).

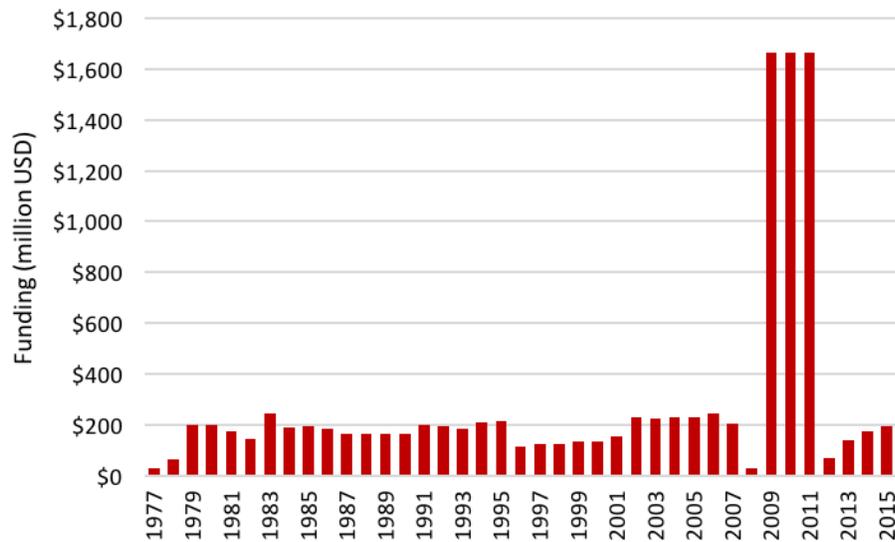


Figure 1. History of federal WAP funding. *Source:* LIHEAP Clearinghouse 2016.

Energy Efficiency Programs and Bill Payment Assistance

Figure 2 summarizes funding for low-income energy efficiency and bill payment assistance. Spending on energy efficiency programs for low-income households is significantly lower than spending on bill assistance. About 81% (\$6.31 billion) goes to bill payment assistance, 14% (\$1.17 billion) goes to energy efficiency, and 5% (\$38 million) is unspecified. Cost-effective energy efficiency solutions could be important to helping low-income households have more-affordable monthly bills. There is a significant need both for bill assistance to

⁵ Ratepayer program spending amounts do not account for spending on commercial programs. Some multifamily programs that serve low-income households are classified as commercial programs and are not captured in our spending estimates for low-income energy efficiency. Some utilities also contribute voluntarily to energy efficiency and/or rate assistance programs. We do not include voluntary contributions here.

help households that are in immediate need and for energy efficiency to help permanently reduce energy use and lower utility bills. Energy efficiency improvements can help to reduce the amount of bill assistance customers need, so that assistance programs can free up resources to meet the needs of additional households.

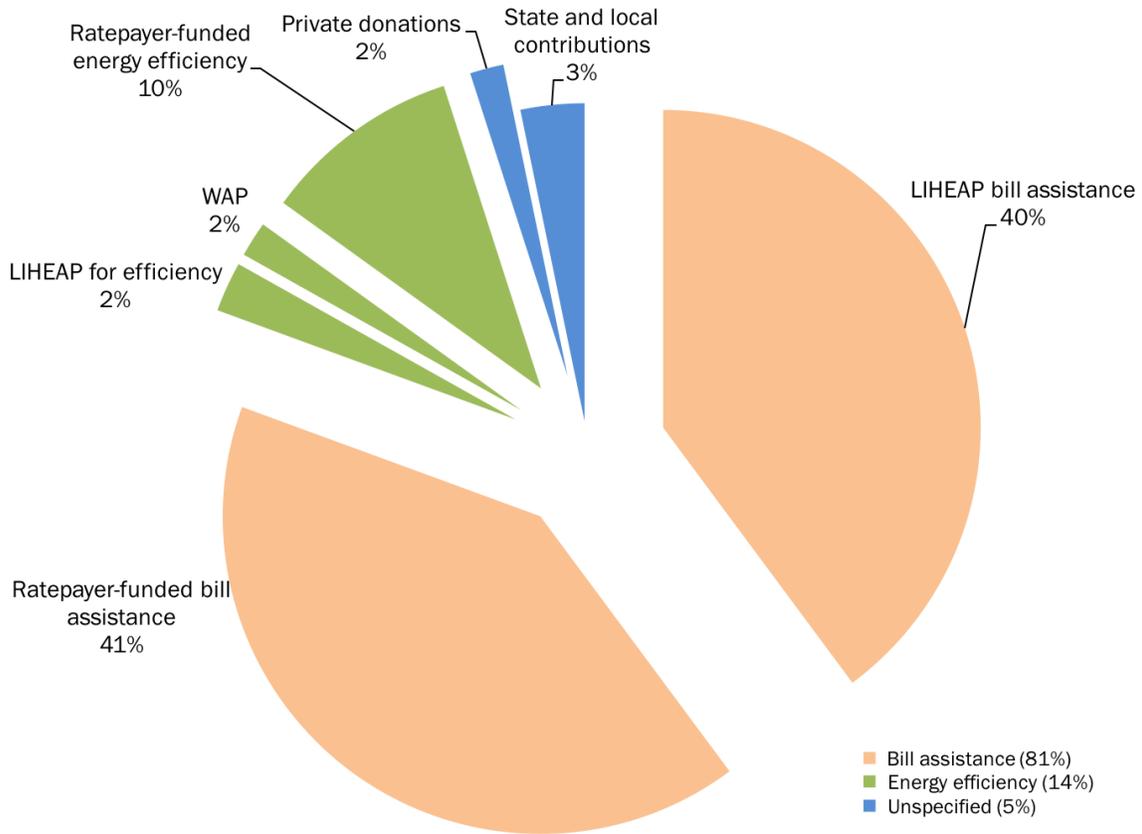


Figure 2. Support for low-income energy needs. Data on ratepayer-funded bill assistance, ratepayer-funded energy efficiency, WAP, and LIHEAP assistance are from 2013. LIHEAP spending on efficiency is approximated based on 6% of LIHEAP funds spent on efficiency in 2006. Data on state and local contributions and private donations are from 2010. *Source:* LIHEAP Clearinghouse 2016.

RATEPAYER-FUNDED PROGRAM TYPES

A majority of existing single-family low-income programs are whole-building retrofit programs, also commonly called weatherization in the low-income sector. These programs often complement state weatherization programs. They typically address heating and cooling energy use through insulation, air sealing, and heating, ventilation, and air-conditioning (HVAC) measures. Some programs also target other end uses through lighting, appliance, and water-heating measures. Programs generally determine which measures to install in the home through an energy audit, which can include diagnostic testing (e.g., blower door testing) and visual inspection. Based on findings from the energy audit, programs then rely on computer modeling or a priority measure list to determine which

measures to install.⁶ Programs generally install the most cost-effective measures up to a certain cost threshold after prioritizing critical health and safety issues. These services are usually offered at no cost to the homeowner.

Another common approach in the low-income sector is the installation of low-cost energy efficiency measures in customers' homes. This program type (commonly referred to as a direct install program) typically relies on contractors to install lightbulbs and low-flow water-saving fixtures (showerheads and aerators), yielding relatively modest savings per household. Direct install programs may target both single-family and multifamily households, at no cost to the homeowner (Johnson and Mackres 2013). Some of them are integrated with comprehensive whole-building programs or help to identify other measures eligible for upgrade through other utility programs. In this case households receive direct install measures during the audit or in conjunction with comprehensive retrofit programs. Some programs integrate delivery of direct install measures with outreach by other social service organizations, an approach that we will discuss later in the report.

Some utilities also offer energy-savings kits, which typically include measures like energy-efficient lightbulbs and low-flow water fixtures such as showerheads and aerators for homeowners to install themselves. Energy savings kits target similar measures and savings as direct install programs, but rely on home dwellers to install the measures.

A majority of the electric and natural gas savings from low-income utility programs result from comprehensive whole-building retrofits. This differs considerably from residential programs, in which most electric and natural gas savings result from prescriptive rebate programs (E Source 2015).⁷ Figure 3 shows the distribution of electricity savings from various program types, and figure 4 shows the distribution of natural gas savings.

⁶ A priority measure list itemizes measures that are determined to be cost effective for that region to obviate the need to use computer models to determine the cost effectiveness of the measures in each home (Tonn et al. 2014).

⁷ This is not surprising, as prescriptive rebate programs rely on customers to purchase the energy efficiency measures (appliances, lighting, insulation, and so on), and the low-income population typically lacks the discretionary funds to make such purchases.

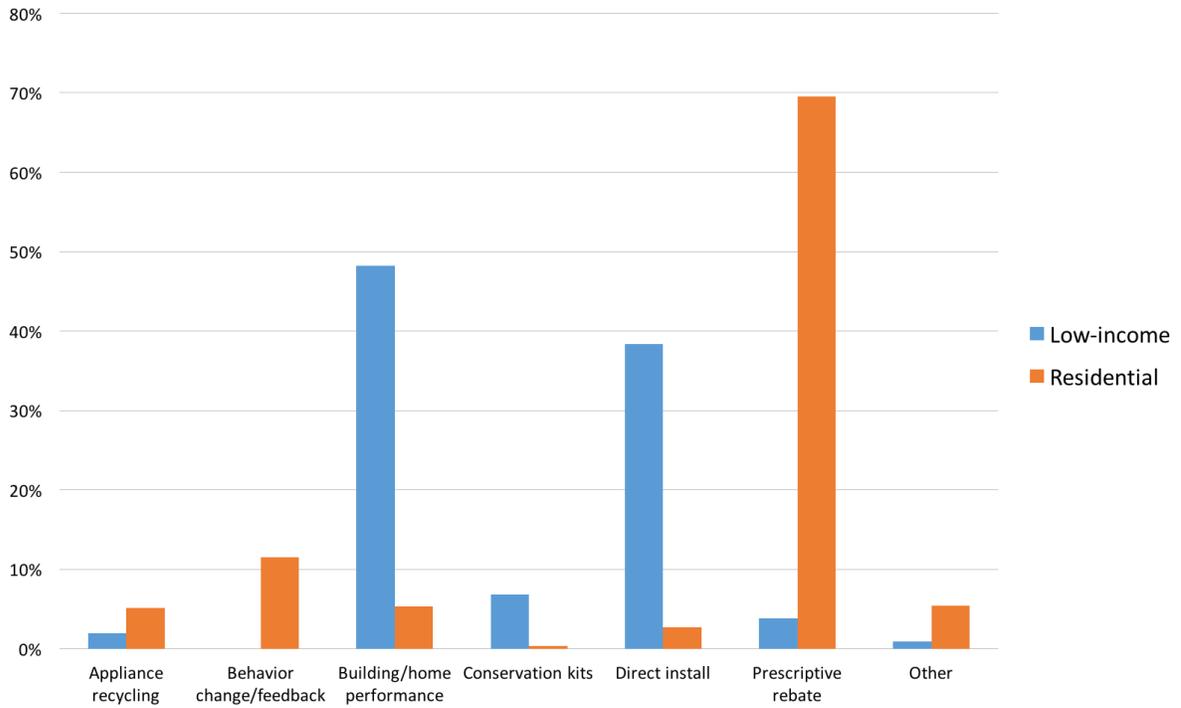


Figure 3. 2014 electricity savings by program type for low-income programs compared to all residential programs. Savings are post-program reported savings from compiled state filings on program performance. *Source:* E Source 2015.

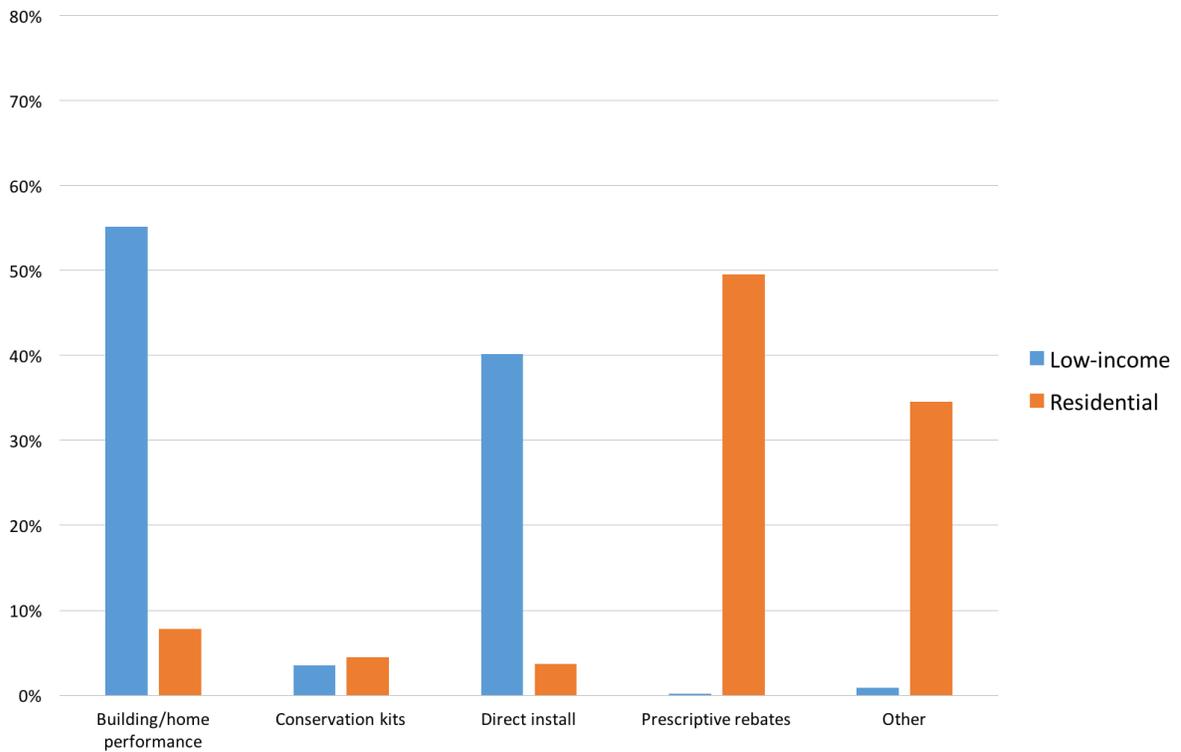


Figure 4. 2014 natural gas savings by program type for low-income programs compared to all residential programs. Savings are post-program reported savings from compiled state filings on program performance. *Source:* E Source 2015.

PROGRAM MANAGEMENT AND DELIVERY

Low-income energy efficiency programs are managed and delivered in various ways depending on state-level decision making. Individual utilities, groups of utilities, state agencies, or private program implementers may manage these programs (APPRISE 2007; Swedenberg et al. 2014). Program services are delivered through private for-profit contractors, Community Action Partnership (CAP) agencies, other nonprofits, local government organizations, or a combination of multiple contractors, which may include nonprofit and for-profit contractors (APPRISE 2007).⁸ CAP agencies, nonprofits, or local government organizations sometimes deliver utility energy efficiency programs in conjunction with other low-income programs under the charge of the implementing organization, including WAP, LIHEAP, and other housing repair and social service assistance. In a majority of states Community Action Partnership (CAP) agencies serve as the primary intake site for federally funded weatherization assistance, as well as the primary administrator of LIHEAP energy assistance funding (LIHEAP Clearinghouse 2016). CAP agencies often coordinate programs and the integration of program delivery at the local level (Consumers Energy et al. 2013). CAP agencies also work with multiple providers of low-income services to meet the needs of their low-income clients.

SPENDING AND SAVINGS

In general low-income energy efficiency programs cost more per unit of energy saved than market-rate residential programs. These programs nearly always require more incentives or fully funded measures, which increase the program cost for administrators over standard residential programs (figure 5). In addition, especially poor housing conditions sometimes require costlier health, safety, and durability work before efficiency measures can be installed. These factors contribute to a higher cost of saved energy as figure 5 shows.⁹

According to the Consortium for Energy Efficiency (CEE)'s *2014 State of the Efficiency Program Industry*, 2014 US electric demand-side management (DSM) expenditures for the low-income customer class were 6% of total expenditures on energy efficiency programs (\$361 million), while spending for all residential programs was 28% (\$1.68 billion). Low-income electric energy efficiency programs accounted for 1% of savings or 237 gigawatt-hours (GWh), while the residential customer class accounted for 40% of savings (6,586 GWh) (CEE 2015).

US natural gas energy efficiency program expenditures for the low-income customer class made up 22% of spending (\$253 million), while spending for all residential programs made up 42% (\$483 million). Savings from the low-income customer class accounted for 5% of overall savings or 2,160 thousand decatherms (MDth), while all residential programs

⁸ CAP agencies are private or public nonprofit organizations that administer a range of programs to help fight poverty and improve low-income communities. These agencies receive funding primarily through Community Service Block Grants and provide programs that cover a variety of needs including education, food and nutrition, job training, emergency services, utility bill assistance, weatherization, and others (CAP 2016).

⁹ For these reasons most states provide low-income programs with some type of special treatment or exemption from the cost-effectiveness testing that is applied to typical energy efficiency resource programs (Kushler, Nowak, and Witte 2012).

accounted for 25% of overall savings (11,530 MDth). Commercial and industrial programs accounted for the highest level of savings at 63% but only 22% of that sector’s expenditures (CEE 2015).

These statistics indicate that, particularly for electric energy efficiency programs, there is significant opportunity for more-equitable spending on programs targeted at low-income households, which make up roughly 33% of the population.

In the most recent assessment of the cost of saved energy, which evaluates the cost of saving electricity through energy efficiency programs funded by investor-owned utilities, the low-income program sector was not broken out by program type as the residential sector was, due to a small sample size (Hoffman et al. 2015). As detailed in an earlier section, the majority of low-income program activity consists of comprehensive whole-building retrofit programs, which are similar to residential home-performance programs. When these two similar program types from the low-income and residential sectors are compared (figure 5), the difference in the average cost of saved energy is less dramatic.

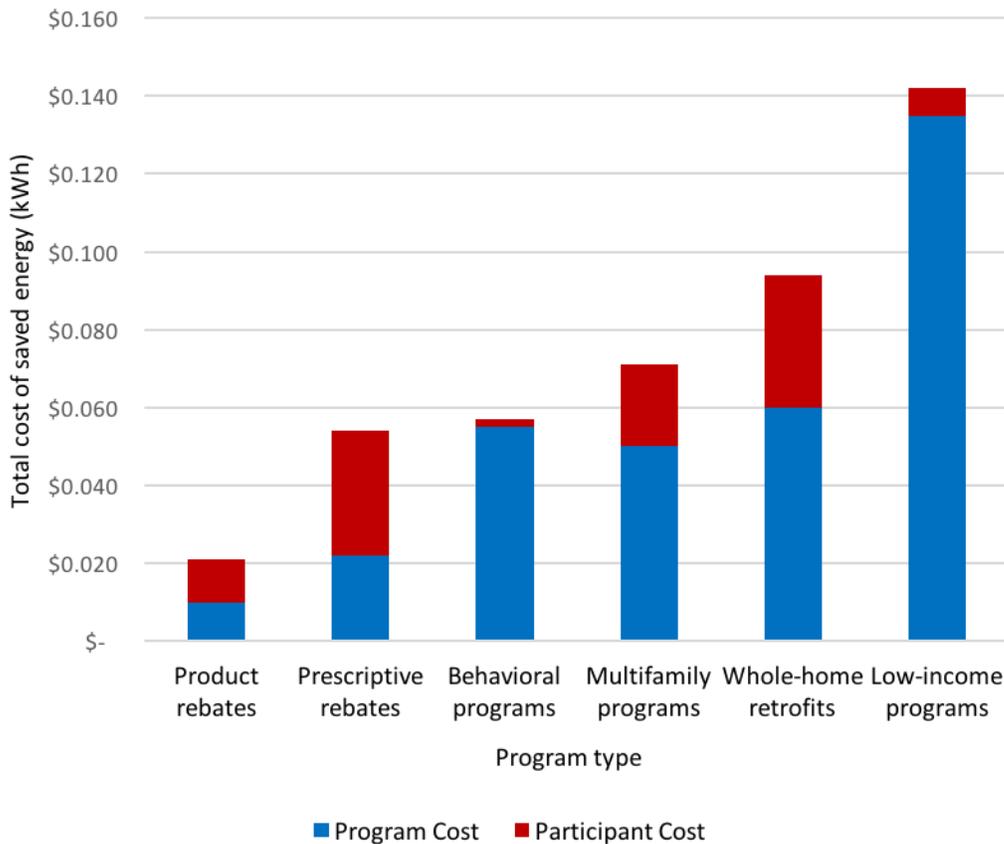


Figure 5. Total cost of saved energy in residential programs for program administrators and participants. Residential prescriptive rebate programs typically provide incentives for HVAC systems, water heaters, and shell improvements (e.g., additional insulation or high-efficiency windows), whereas product rebate programs include lighting, appliance, and consumer electronic rebates. Multifamily and whole-home retrofit programs tend to promote more-comprehensive retrofits in which several measures are installed. While the multifamily programs included in this study do not specifically target low-income multifamily households, it is likely that these programs also reach low-income households. *Source:* Hoffman et al. 2015.

While residential whole-building retrofit programs tend to have a higher cost of saved energy, it is well established that the multiple benefits that result from these upgrades are significant and sometimes more highly valued than the energy savings (Amann 2006; Russell et al. 2015; IEA 2014). Program administrators and regulators recognize that homeowners and building owners invest in whole-building retrofits not just to reap energy savings but for a host of other reasons, including increased comfort, improved indoor air quality, and reduced maintenance, to name a few (Amann 2006; Russell et al. 2015). Cost-benefit calculations in an increasing number of states, including Massachusetts, Rhode Island, and Maryland among others, include multiple nonenergy benefits to occupants and society in assessing the value of various program types (Russell et al. 2015).

It is important to note that evaluations based solely on energy savings do not adequately represent the value of most low-income programs. Low-income programs tend to have even greater nonenergy benefits than their general residential counterparts and are often designed to address multiple goals. Such goals may include improving health and safety, improving energy affordability, reducing the cost of rate affordability programs, reducing arrearages, and addressing equity concerns by ensuring that the low-income sector is adequately served by a utility's energy efficiency program portfolio (APPRISE 2007). Nonenergy benefits for low-income programs are often equal to the value of energy savings (Skumatz 2014).

Low-Income Program Challenges

Low-income programs face a number of challenges.

Cost effectiveness. Although low-income programs are usually not held to the same cost-effectiveness thresholds as general residential programs, program administrators face pressure to show that programs are performing well and are cost effective. Most low-income energy efficiency programs do not operate with the sole goal of reducing energy use. As a result they often include additional measures and target different customers compared to programs whose sole purpose is to save energy.¹⁰

Where do utility services fit in? Another challenge for utilities offering low-income energy efficiency services is how to fit into a landscape of existing program offerings from other agencies and organizations. While need greatly exceeds what is met by current bill payment assistance and weatherization efforts, it can be challenging for utilities to find a niche that provides benefit to low-income households, while also working toward achieving their energy-saving goals.

Addressing housing deficiencies that prevent energy efficiency upgrades. Programs targeting low-income homes with whole-building improvements commonly find some type of health, safety, moisture, durability, and/or structural issue that requires repair before energy efficiency improvements can be made. Outstanding home repair, health, and safety issues

¹⁰ Additional measures might include health and safety measures and minor structural repairs necessary to install measures such as insulation and heating equipment.

both small and large are a challenge for implementing low-income weatherization services. While major issues can render households ineligible for weatherization altogether, more-minor issues can add up to make the cost of energy efficiency improvements too high to meet cost-benefit tests.

Reaching low-income customers. Utilities struggle to find ways to reach low-income households, where language barriers and time constraints may prevent participation in programs. In addition utilities are not always perceived as helpful partners when interactions with them have previously been limited to payment and service disconnect notices. Strategies for accessing hard-to-reach customers are increasingly important for utilities hoping to reach a broader segment of their customer base than they traditionally have. This is one reason why utilities often team up with CAP agencies and other local weatherization providers that have established credibility and communication networks with low-income communities. Some households do not interact with the utility at all during delivery of weatherization services, even when the utility is supporting the program. As a result households may be less likely to look to utilities for energy advice and/or rebates when making smaller product purchases such as televisions, computers, and lighting.

Best Practices for Utility Programs

Many utilities run low-income energy efficiency programs, but find aspects of running them challenging for some of the reasons discussed above. The following section details how utilities are effectively addressing these challenges to run successful programs. This section offers guidance for program administrators on overcoming key challenges in designing and delivering energy efficiency programs for low-income households. It draws from program materials and evaluations of low-income programs that are achieving high levels of participation and energy savings. These recommendations draw from programs targeting single-family buildings.

OFFER A RANGE OF ELIGIBLE MEASURES

An increasing number of low-income programs targeting building shell improvements include measures that target a variety of end uses. These programs employ audit and diagnostic-testing findings to inform the selection of appropriate measures. Weatherization programs have traditionally focused on the building shell and heating system as the primary measures for upgrade. The general rule of thumb is to start with building shell improvements (insulation and air sealing) because they provide the most cost-effective energy savings, and for many existing residential buildings this rule still holds true. At the same time, expanding the scope of eligible measures is advantageous for many reasons. The way households use energy has changed over the last 20 years. The Residential Energy Consumption Survey (RECS) reports that in 1993 heating and cooling accounted for the majority of household energy use in the United States (53%) (EIA 2013b). By 2009, as figure 6 shows, heating and cooling accounted for less than half of the energy used in homes (42%), while appliances, lighting, mechanical ventilation, and electronics accounted for a greater portion of energy use (24% in 1993 versus 35% in 2009) (EIA 2013b).

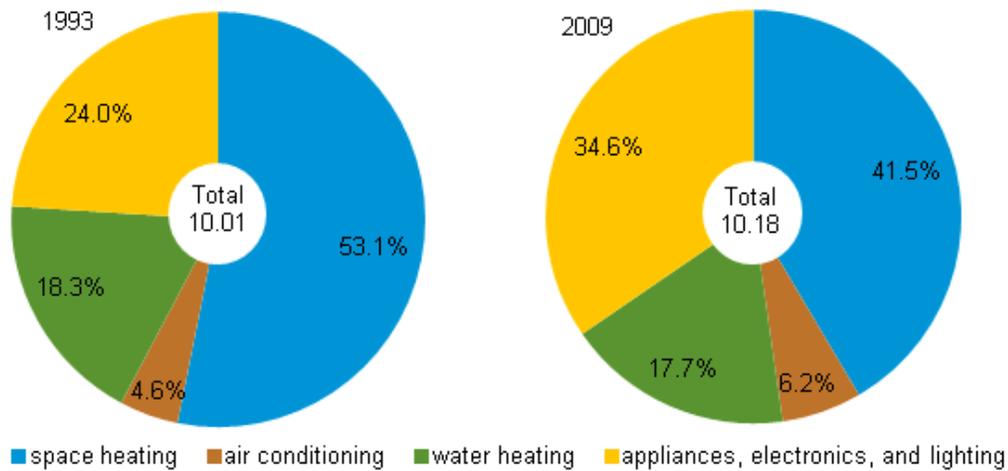


Figure 6. Energy consumption in homes by end uses. Total energy use (center circle) in quadrillion Btu.
 Source: EIA 2013b.

As energy end uses in homes are changing, the loads addressed by energy efficiency programs require updating, too. Lighting, appliances, mechanical ventilation, and electronics should increasingly play a role in low-income energy efficiency programs.

Including a broader range of measures is particularly important for regions where space conditioning loads are not the dominant source of energy use. For example, the Energy Savings Assistance (ESA) Program offered by the California investor-owned utilities (Southern California Edison, Pacific Gas and Electric, San Diego Gas & Electric, and Southern California Gas) includes a range of measures in addition to traditional weatherization measures, including lighting, refrigerators, and air conditioners (Edel and Abeyta 2015).

Including a broader range of eligible measures in low-

CPP Opportunities To Leverage Existing Low-Income Energy Efficiency Efforts

Many regions are home to well-established weatherization efforts, funded at the federal and state levels, that are administered through CAP agencies. Utilities hoping to scale up low-income energy efficiency efforts for compliance with the CPP can leverage the existing expertise of agencies already working to serve low-income communities. Well-managed CAP agencies often have strong reputations in the community among low-income households as a source of housing and energy assistance. These agencies also have systems in place to determine household eligibility, and often already have networks of experienced and qualified contractors to perform upgrades. Utilities scaling up low-income energy efficiency programs for credits from the CEIP and CPP can enlist CAP agencies as implementers. In planning for CPP and CEIP goals, state regulators and utilities should seek information on the existing role CAP agencies play in delivering energy efficiency and energy assistance in their communities to evaluate whether coordination is possible.

In the absence of a robust network of agencies that deliver weatherization services and can be used for implementation, coordination between utilities and other local agencies providing low-income services can be advantageous for identification of and marketing to eligible clients who could benefit from lower energy bills. This could help reduce the burden on utilities of seeking out program participants and verifying eligibility, while helping existing programs do more to serve households that need assistance.

income programs also gives service delivery providers the ability to respond to and put to use findings from the energy audit to address the highest energy end uses based on individual household evaluation. Tailoring energy efficiency interventions to individual household use characteristics can help households realize the highest savings. Additionally, program administrators can address multiple energy savings opportunities during one visit, helping to amortize the cost of outreach over a wide base of savings and reducing the need for further outreach costs later.

COORDINATE WITH OTHER ORGANIZATIONS

A range of opportunities exist for utilities to leverage the efforts of organizations already working to serve low-income households, including contributing to existing weatherization efforts, adding high-efficiency measures to existing programs, and delivering measures through channels used to deliver other social services.

Align with Existing Efforts to Serve Low-Income Households

Programs can leverage existing state and local weatherization efforts to provide energy efficiency services to low-income households. Many utilities align eligible measures and program procedures with those of existing state and federal weatherization programs to enable more-straightforward delivery of multiple programs at the CAP agency level. To maximize the number of homes that can be weatherized, Consumers Energy in Michigan runs an Income Qualified (IQ) Energy Assistance Program that coordinates with local agencies providing state- and federally funded weatherization (Consumers Energy 2013). Eligible measures for the utility program are coordinated with local agencies to keep them consistent with federal- and state-funded offerings (Consumers Energy 2013). This approach has been advantageous for both the utilities and the weatherization agencies, as federal weatherization budgets have declined and agencies have struggled to meet customer demand for energy efficiency services. Consumers Energy brands its program and provides information about other initiatives in an effort to build credibility as a trusted source of energy savings advice (Consumers Energy 2013).

In Ohio, Columbia Gas of Ohio's Warm Choice Program built on the state's robust low-income weatherization provider network to deliver program services, which helped reduce program start-up and training costs. The program shares resources with Ohio's Home Weatherization Assistance Program, and implementation contractors for both programs are reimbursed based on the services they provide (Nowak et al. 2013). Columbia Gas of Ohio was one of the first utilities to partner with existing low-income weatherization networks for delivery of services. Other utilities in Ohio, including Dayton Power and Light, have used the same model (Nowak et al. 2013).

In some regions, coordination between organizations serving low-income households has been established on a regional or state level to facilitate more-streamlined and effective delivery of various services. In Massachusetts state policy requires coordination among

agencies serving low-income households on a statewide level (Ward et al. 2012).¹¹ Agencies including electric and gas program administrators, the Energy Efficiency Advisory Council, the state Department of Housing and Community Development, and the US Department of Energy (DOE) and Department of Health and Human Services (DHHS) weatherization program administrator meet to standardize implementation of programs serving the low-income sector. Coordination occurs through the Massachusetts Low-Income Energy Affordability Network (LEAN), which was established by the lead agencies of the low-income weatherization and fuel assistance program network. LEAN works to standardize eligibility requirements, procedures, and standards to enable delivery of various programs through CAP agencies throughout the state (Ward et al. 2012).

Add on to Existing Weatherization Efforts

Energy efficiency programs have also been successful in identifying energy-saving measures that are not offered in existing weatherization efforts to add on to state weatherization program delivery. In Vermont, Efficiency Vermont supplements the state weatherization program with add-on measures beyond what would otherwise be included in the state- and federally funded WAP. These measures include ENERGY STAR-qualified refrigerators, ENERGY STAR-qualified clothes washers, lighting, ventilation fans, and smart power strips (Nowak et al. 2013). Efficiency Vermont continually assesses potential new measures to include in the scope of the add-on program and has updated its offerings to include heat pump water heaters, dehumidifiers, and mini-split heat pumps (Curtis 2014). CAP agencies offer these measures as a part of the same program delivery as the state weatherization program, so customers must interact with only one program. This relationship is advantageous for Efficiency Vermont, because it can leverage the existing established customer networks of CAP agencies serving low-income customers. It is also advantageous for the weatherization agency because it allows the program to address a wider set of the low-income customer needs that come up during energy assessments, hopefully enabling more cost-effective applications of each measure.

When adding service offerings outside of the traditional scope of weatherization, programs should work with implementing agencies to develop simple and clear but definitive program guidelines, so implementers know when it is appropriate to install various measures. Products that have not traditionally been part of programs and that are not clearly communicated to the various implementing agencies are more likely to be left out of program delivery (APPRISE 2007). In addition to the funding that the Efficiency Vermont program provides for WAP add-on measures, they also provide technical assistance to the agencies in Vermont that deliver weatherization services (Nowak et al. 2013). This helps ensure that the additional measures are installed when there is an opportunity to do so.

¹¹ The Massachusetts Green Communities Act of 2008 required that low-income programs be coordinated among all gas and electric companies in the state and implemented through the existing low-income weatherization program network (Ward et al. 2012).

Deliver Measures through Innovative Channels

In addition to working with traditional providers of energy efficiency services such as weatherization agencies, programs can leverage the interactions and existing relationships that non-energy-related organizations have with low-income households to reach more customers. Programs that successfully reach a broader range of low-income households have been developing ways to provide energy efficiency measures through channels that households already use.

Programs to distribute energy-efficient lightbulbs through food bank and food-shelf networks have proven to be an effective way to get efficient products into the market. The DC Sustainable Energy Utility (DC SEU), Efficiency Vermont, the Low Income Usage Reduction Program in Pennsylvania, AEP in West Virginia, and Dayton Power and Light in Dayton, Ohio, have used this strategy (AEP Power 2014; Glatting 2015; Southworth 2010, DP&L 2015; Kuhn 2015). In the DC SEU program, CFL lightbulb distribution locations included church food pantries, community events, and mobile food markets. DC SEU's distribution strategy included an education component about efficient lighting, and evaluation survey results showed that a majority of bulbs were installed by homeowners after being taken home (Glatting 2015). Efficiency Vermont has also partnered with the Women, Infants, and Children (WIC) program, a federal program that provides food and nutrition assistance to income-eligible families, to provide refrigerator replacements. The program ran as a pilot in 2014 and relied on a collaboration with the WIC program to identify cost-effective refrigerator replacement opportunities for Efficiency Vermont. Efficiency Vermont used direct outreach to income-qualified households through WIC providers, based on the WIC income qualification criteria. WIC referred people to an Efficiency Vermont call center where eligibility was further verified based on the age of the refrigerator, and contractors were sent to replace and remove the old refrigerator (Kuhn 2015). Following the pilot's success the program has been integrated into Efficiency Vermont's low-income program plan for 2015–2017 (Curtis 2014).

USE A PORTFOLIO APPROACH

Program administrators are increasingly realizing that a one-size-fits-all program to address the needs of all low-income households is not sufficient. The low-income sector is diverse and requires more-targeted approaches to effectively reach customers and realize savings. As a result, program administrators are employing a range of strategies and initiatives to reach people with varying energy needs, including owners and renters of single-family housing. They are diversifying their efforts by connecting with successful state weatherization programs, while also offering other programs that allow them to be flexible and test out new approaches to saving energy.

For example, the Connecticut Energy Efficiency Programs, which combine the utility efforts of United Illuminating and Connecticut Light and Power, reach low-income households through a number of different components of their Home Energy Solutions – Income-Eligible program. Components include weatherization projects implemented through agencies that also provide federally funded weatherization, weatherization projects through the utility, comprehensive multifamily projects, neighborhood canvassing for direct installation measures, and neighborhood outreach for program marketing and direct installations (table 2) (Swedenberg et al. 2014).

Table 2. Connecticut Energy Efficiency Programs’ portfolio approach to serving single-family low-income households

Portfolio component	Details
Weatherization projects	Utility-leveraged weatherization projects, implemented by agency networks that deliver federally funded (WAP) weatherization
Weatherization projects	Comprehensive audit, and delivery of energy efficiency and weatherization services delivered by the utility
Neighborhood canvassing	Door-to-door marketing of Home Energy Solutions programs and installation of direct install measures. Marketing to encourage participation in weatherization component.

The Connecticut Energy Efficiency Programs also include comprehensive multifamily projects, which reach low-income tenants. *Source:* Swedenberg et al. 2014.

A number of other programs provide a portfolio of services to reach low-income customers through a variety of initiatives. Table 3 below details these programs.

Table 3. Programs using a portfolio approach to serve single-family low-income households

Program	Portfolio components	Details
Massachusetts Low Income Program	Insulation and weatherization	Insulation and air sealing, health and safety measures, and repairs
	Base load measures	Refrigerator/freezer replacement/removal, efficient lighting, window air conditioners, and water heater replacement
	Heating Emergency Assistance Retrofit Task Weatherization Assistance Program (HEARTWAP)	Heating system repair and/or replacement
Efficiency Vermont Low Income Programs	Single-family deep measures	Insulation and air sealing, including targeting high-use households
	WAP add-on measures	Adding electrical efficiency measures to Vermont’s core WAP services
	Efficient-products initiatives	Partnerships with food bank and food-shelf networks and the WIC food and nutrition program for refrigerator distribution
	Community outreach	Distribution and installation of energy-efficient products; referrals to deeper energy efficiency initiatives
Consumers Energy Helping Neighbors Program, Michigan	Phase One	Basic measures and services including lighting and water efficiency direct install measures and carbon monoxide testing
	Phase Two	Comprehensive measures and services that build on Phase One, including blower door testing, air sealing, insulation, and furnace tune-ups
	À la carte measures	Furnace replacements, refrigerator replacements, crawl space insulation, and duct sealing

Energy education	Education is integrated into both phases of the program through an online tool, leave-behinds, and education by technicians.
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This table captures only efforts to serve existing single-family homes. Efficiency Vermont and Consumers Energy also reach low-income customers through multifamily program offerings. Efficiency Vermont also has initiatives for new-construction homes and manufactured housing that reach low-income people. *Sources:* Ward et al. 2012; Curtis 2014; Chant 2014; Nowak et al. 2013; Cadmus 2015.

ADDRESS HEALTH, SAFETY, AND BUILDING INTEGRITY ISSUES

Recognizing that health, safety, and durability issues are a common barrier for energy efficiency improvements (particularly air sealing and insulation upgrades) in low-income households, some programs have incorporated ways to make repairs into programs (Peters, Moran, and Forster 2014).¹² In some programs a specified amount of each project budget can be allocated to repairs or remediation to bring a home into a condition suitable for energy upgrades. This allocation is appropriate for homes requiring repairs of modest cost that are required for efficiency upgrades to be made. Table 4 details the health and safety spending limits for a sampling of utility and state energy efficiency programs.

Table 4. Health and safety spending limits for a sampling of energy efficiency programs

Program/utility	Spending limit
National Grid (Rhode Island)	\$500/home
Pacific Power (Washington)	50% of the installed-repair costs required to make energy efficiency upgrades possible (homeowner assumes remaining cost)
Massachusetts program administrators	\$2,500 on an individual home, with an average of \$500/home for the whole program
New Jersey Comfort Partners	33% of project cost. For spending over \$500 utility permission is required.
Dayton Power and Light (Ohio)	15% of project cost
Puget Sound Energy (Washington)	30% of implementing agency’s total budget
Nebraska Energy Office	15–20% of annual program budget is set aside each year.
Federal Weatherization Assistance Program	About 15% of program budget; decided at the discretion of states

Sources: Swedenberg et al. 2014; APPRISE 2014; NASCSP 2015

Homes that require more-extensive repairs cannot easily be handled with this allowance. This may require that customer participation in efficiency programs be put on hold until other home issues are addressed. (In the federal WAP this is called deferral.) In areas where low-income weatherization is delivered in conjunction with state, federal, and utility funds, multiple funding sources are sometimes combined to double or triple what an individual funding source is allowed to spend on health and safety related issues (APPRISE 2007).

¹² In the Green Jobs – Green New York program, one in five potential retrofits had health and safety issues significant enough to prevent retrofit (Peters, Moran, and Forster 2015).

Some utilities incorporate health and safety-related programs into their program portfolio. In Connecticut the United Illuminating Company developed a clean-and-tune program to fix unsafe combustion appliances in its territory. United Illuminating developed this program as a result of demonstrated need through its low-income weatherization program (E. Murphy, senior program administrator, UIL Holdings Corporation, pers. comm., July 9, 2015). Other programs such as the Massachusetts Low Income Program (detailed in table 3) integrate heating equipment repair into program offerings to address similar issues.

Lessons from WAP for Addressing Poor Housing Quality

CAP agencies administering the federal WAP have had many of the same challenges associated with housing condition that utility programs struggle with in the low-income sector. Lessons from these agencies offer useful strategies for how health, safety, and integrity issues can be overcome to complete weatherization efforts successfully (Rose et al. 2014). Very few households eventually have weatherization work completed after initial deferment from a program due to housing condition, so it is important for programs to address issues to the best of their ability in order to retain households.¹³ Some of the conditions that most commonly prevent weatherization from being completed include roof leaks, structural issues, the presence of vermiculite (insulation that historically contained asbestos), and mold and moisture (Rose et al. 2015). The following approaches used by weatherization agencies have been particularly successful in addressing housing deficiencies so that households can receive weatherization services.

INCORPORATE IN-HOUSE HOME REHAB PROGRAMS

Some agencies administering weatherization programs also have in-house home rehab programs, whereby both weatherization and housing rehab services are available through the same organization. One nonprofit organization that administers weatherization services, Housing Resources of Western Colorado, also runs a housing rehab program that addresses more-general home improvements. For improvements outside of the scope of weatherization services, homeowners can access loans administered by the nonprofit to cover the cost of housing rehabilitation. Once the loan is secured for home repairs, repairs are completed and weatherization work immediately follows. Due to its streamlined approach to addressing repair issues, this agency turns away almost no households that want weatherization services on the basis of poor housing conditions (Rose et al. 2015).

Another weatherization administering agency, St. Johns Housing Partnership in Florida, also runs a housing rehabilitation program. Crews are trained to perform both housing rehabilitation and weatherization services, and homes are weatherized immediately after repairs are completed. The organization blends funding for these services from a variety of sources including philanthropy, private foundations, and corporate donors, and relies on a workforce of individual volunteers and community volunteer groups for repairs (Rose et al. 2015).

¹³ A review of federal WAP grantees found that in the majority of grantee programs, few deferred households ultimately received weatherization services (between 1 and 25% of deferred units) (Rose et al. 2015).

The joint delivery of housing rehab services and weatherization is fairly uncommon, due in part to the difficulties of coordinating efforts that traditionally rely on federal sources of funding with different eligibility requirements (Rohe, Cowan, and Quercia 2009).¹⁴ The two weatherization agencies in these examples do not rely on federal funding for the home repair programs they provide.

Utilities can work with local housing rehab organizations to improve understanding of which aspects of deferred maintenance and home improvement are critical to address before energy efficiency measures can safely be installed. Housing rehab programs with the mission of improving low-income housing stock can address improvements with an eye toward specifically preparing homes for weatherization. Utilities can develop methods for assessing home qualification before a comprehensive energy audit is performed (as described in the following section) and recommend customers to the appropriate program if weatherization cannot yet be carried out.

FACILITATE ACCESS TO RESOURCES

Guiding households through other local programs to address home repair issues has also proved successful for getting households through the weatherization process. Community Action Partnership, a nonprofit in western Idaho, brings in a social worker to work with households whose needs are beyond the scope of weatherization. With the guidance of the social worker, other resources and programs are found to repair roofs and deal with other home issues to ready the home for weatherization (Rose et al. 2015).

In addition to weatherization programs and housing rehab programs, post-purchase counseling programs are a resource sometimes available to low-income homeowners. Post-purchase counseling programs assist recent home purchasers and generally take one of two approaches: (1) sustainable homeownership programs, which help homeowners acquire the skills to maintain and improve their housing investment, and (2) delinquency and foreclosure prevention services, which help homeowners who have problems meeting mortgage obligations. Sustainable homeownership programs help homeowners deal with rising housing costs through education and counseling on home maintenance, repairs, insurance, home safety, budgeting, financial management, and avoiding predatory lending. Sustainable homeownership programs and programs delivering energy efficiency improvements can provide mutually beneficial services (Rohe, Cowan, and Quercia 2009).

ASSESS HOME ELIGIBILITY FIRST

One program, run through the Opportunity Council in Washington State, uses an initial home visit to assess eligibility for weatherization. During this visit an energy education specialist provides energy education to the clients and installs direct install measures. The specialist also identifies the top three energy-savings priorities in that home. Depending on the condition of the home, the specialist will refer the home to the weatherization program

¹⁴ Home rehab programs are often federally funded by the Community Development Block Grant (CDBG) and HOME programs, with community development corporations and other nonprofit agencies administering the programs (Rohe, Cowan, and Quercia 2009).

for an energy audit and improvements. This process removes from the pool candidates who would not benefit from further weatherization (about 20% at this organization) (Rose et al. 2015).

This approach can help provide initial energy efficiency improvements to homeowners, while assessing whether a house is a good candidate for further improvement. This enables small low-cost measures to be installed for homes that might not be suited for weatherization, but in which there is still an opportunity for energy education, and that do not have conditions that would compromise certain direct install energy efficiency measures. This approach may also improve the likelihood that homeowners experience a predicted value for energy efficiency improvements that motivates them to eventually complete weatherization improvements.

INCORPORATE STRATEGIES FOR CUSTOMER ENERGY EFFICIENCY EDUCATION

Education is a key component for maximizing savings from low-income programs. Educational components can be used to increase interest in the low-income programs in a utility's portfolio, increase savings realization rates from installed measures, and help realize savings through behavioral changes. Energy education that comes from a program representative or technician serving as a trusted adviser can be particularly useful.

First, programs can leverage educational materials to reach low-income customers and build community trust and interest in energy efficiency programs. For some low-income people interactions with utilities have been limited to bills, late-payment notices, and shutoff notices, making customers less likely to think of the utility as a source of assistance. Utilities that include multiple initiatives in their program portfolios, including both direct install or energy-saving kit programs and deeper weatherization measures, can incorporate energy-saving tips, education about direct install measures, and guidance on opportunities for deeper savings through utility programs.

Energy education can help build realization and persistence of energy savings for programs, particularly those that rely on customers to install products that they receive through a program. For example, the efficient-products program through the DC SEU, which distributes LED and CFL lightbulbs to low-income households through food banks and other nonprofit organizations that provide services to these households, had an education component to inform consumers of the benefits of efficient lighting. This took the form of simple and clear messaging about benefits (figure 7), as well as direct education through DC SEU representatives at events at food banks, mobile food markets, and other community gatherings (Glatting 2015).

A Consumers Energy program in Michigan called Building Blocks featured direct interaction with program representatives during energy education

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Helping people thrive

Figure 7. DC SEU's efficient-lighting messaging.
Source: Glatting 2015.

workshops and follow-up coaching to encourage customers to install measures in their own homes. In this initiative customers were directly rewarded with incentives (cash and prize drawings) for engaging in the program. Post-program evaluations indicated that almost all customers (near 100% for most measures) followed through with do-it-yourself installations of the products they were trained on, including CFLs, LED night lights, outdoor light motion sensors, aerators, pipe wrap, and showerheads (Johnson et al. 2014).

[Continued on next page]

DEVELOP DUAL-FUEL/FUEL-BLIND PROGRAMS

Programs can most successfully address energy issues in low-income homes when various energy end uses can be addressed, and when measures can be installed regardless of fuel type. In Massachusetts, where about one-third of homes are heated with oil, the National Grid Low-Income Retrofit Program works with the state WAP service providers to offer service to all households regardless of fuel type. Local CAP agencies administer the two programs, which combine electric program administrator funds with federal WAP funding to provide consistent program offerings (Nowak et al. 2013). This allows the program maximum flexibility to address customers' energy issues.

In other instances programs have been developed in conjunction with gas and electric utilities. In Arkansas the Public Service Commission requires a consistent statewide approach to weatherization programming through coordination of gas and electric programs. This coordination allows for joint energy assessments and delivery of energy efficiency services in a way that minimizes impact on homeowners. This also allows programs to offer a range of energy efficiency measures that address multiple energy loads in the home. A joint weatherization program in Arkansas offered by a natural gas utility (AOG) and an electric utility (OG&E) exceeded program energy and participation goals in 2014 (Johnson 2015).

CPP Opportunities for Fuel-Blind Programs

Increased interest in low-income energy efficiency for CPP compliance is an opportunity to leverage utility spending on electric measures to develop comprehensive fuel-blind programs.

Only electric savings would count toward CPP compliance. Low-income programs focused on whole-building weatherization efforts can combine multiple funding sources including natural gas and electric utility spending, as well as federal and state spending, to provide streamlined services regardless of primary heating and water heating loads. Existing collaborative program efforts can provide guidance for developing programs that can be appropriately evaluated and assessed to determine the share of energy savings resulting from activities of the electric utility versus other entities, for the purpose of CPP compliance.

These programs can promote the best solutions for low-income households regardless of fuel type.

In New Jersey seven utility partners throughout the state administer the New Jersey Comfort Partners Program. One streamlined program serves all low-income customers. This single-program delivery model can reduce administrative costs because of fewer visits to customers. It also reduces the burden of multiple home visits on the customer and allows for energy use to be assessed and addressed more comprehensively regardless of fuel type (APPRISE 2014). Additionally, California investor-owned utilities provide coordinated service delivery for low-income energy efficiency programs in areas where homes receive gas and electric service from separate providers (PG&E 2014).

COORDINATE EFFICIENCY AND BILL PAYMENT ASSISTANCE PROGRAMS

In many instances, energy efficiency programs calibrate income eligibility requirements with bill payment assistance program requirements to allow for eligibility assessment based on a customer's qualification for other programs such as LIHEAP (Swedenberg et al. 2014).

In some states bill payment assistance and energy efficiency programs coordinate and share customer information to help address the energy needs of the highest-use households. In New Jersey and Wisconsin the highest-use households in the affordability program are required to have energy efficiency upgrades (APPRISE 2007). In California the highest users in the California Alternate Rates for Energy (CARE) bill payment assistance program are identified through analysis, notified of their high usage, and provided with resources on program opportunities to improve energy efficiency (Edel and Abeyta 2015; PG&E 2014). Customers must lower their usage and participate in the local energy efficiency program to remain enrolled in CARE. Exceptions to this requirement are available for medical needs and other extenuating circumstances (Edel and Abeyta 2015; PG&E 2014). Non-high-use customers in the CARE program are not required to participate in the energy efficiency program, but are encouraged to do so. PG&E conducts direct outreach to encourage non-high-use customers enrolled in CARE to sign up for its energy efficiency program, ESA (PG&E 2014). Contractors in this program can access energy use data from the CARE program to use in their efforts to enroll customers (PG&E 2014). In New Jersey the state rate affordability program serves as a consistent source of potential participants for both the utility-funded New Jersey Comfort Partners Program and the federally funded WAP services.¹⁵

Energy efficiency programs can also be coordinated with arrearage management programs, which provide financial assistance to households who have bills in arrears. Arrearage management programs generally forgive some or all of a customer's unpaid debt if the customer makes regular on-time payments for new utility charges (Harak 2013). Some arrearage management programs require households to make energy efficiency upgrades to continue to be enrolled in the program. These programs can also help create a favorable relationship between the customer and the utility that can help encourage participation in energy efficiency programs (Harak 2013).

High-Efficiency Products and Equipment

A majority of savings from low-income energy efficiency upgrades result from weatherization shell measures and direct install measures (primarily lighting, faucet aerators, and showerheads). Some comprehensive weatherization programs include appliance and equipment measures (refrigerators, furnaces, and water heaters) as a part of program offerings, but in general these measures are not as commonly relied upon to produce savings. In addition a number of other appliances and electronics can offer savings over products meeting existing federal standards. Program administrators can also reach more low-income households by including consumer products (like electronics) that people purchase regardless of whether they own or rent their homes. In this section we present opportunities for increasing electricity savings in the low-income sector including several opportunities for realizing electricity savings that states can integrate into their CPP and CEIP programs.

¹⁵ This partnership was established through a memorandum of agreement between the state Board of Public Utilities and the state Department of Community Affairs, the latter of which is the state weatherization agency (APPRISE 2007).

PRODUCTS

Appliances and Electronics

Low-income customers are eligible to participate in conventional appliance programs; however data suggest that they are less likely to take advantage of these programs than other customers (Frank and Nowak 2015). Appliance programs designed to address the specific needs of low-income customers can expand participation, increase savings, and advance other program goals (e.g., market transformation). While most appliance programs align their requirements with established qualified product lists such as ENERGY STAR, ENERGY STAR Most Efficient, and the CEE Tiers, programs may need to go further to tailor features and requirements to reach their low-income customers. Specific opportunities include (1) emphasizing the highest-efficiency products, and (2) identifying and increasing the availability of moderate-price energy-efficient products with the features and sizes of greatest interest to low-income customers.

Focusing low-income programs on ultra-high-efficiency appliances maximizes both customer utility bill savings and program energy savings. Within several appliance product categories, most notably refrigerators and clothes washers, the highest-efficiency products offer substantial energy savings relative to the lowest-efficiency ones, even with recent improvements in appliance efficiency standards. Manufacturers offer these ultra-efficient products at a range of price points that could meet the needs of low- and moderate-income customers. Figure 8 illustrates the range of energy use and price points for refrigerators (between 17 and 20 cubic feet) in various product categories. Programs that provide incentives for ENERGY STAR and ENERGY STAR Most Efficient refrigerators should explore ways to develop low-income-targeted programs that incorporate top-freezer models, which have lower absolute energy use and lower retail prices (Arquit-Niederberger and Frank 2015). Figure 9 shows the range of price points, energy use, and water factors for clothes washers in various product categories. The same is true for televisions (figure 10) and potentially other consumer electronic products.

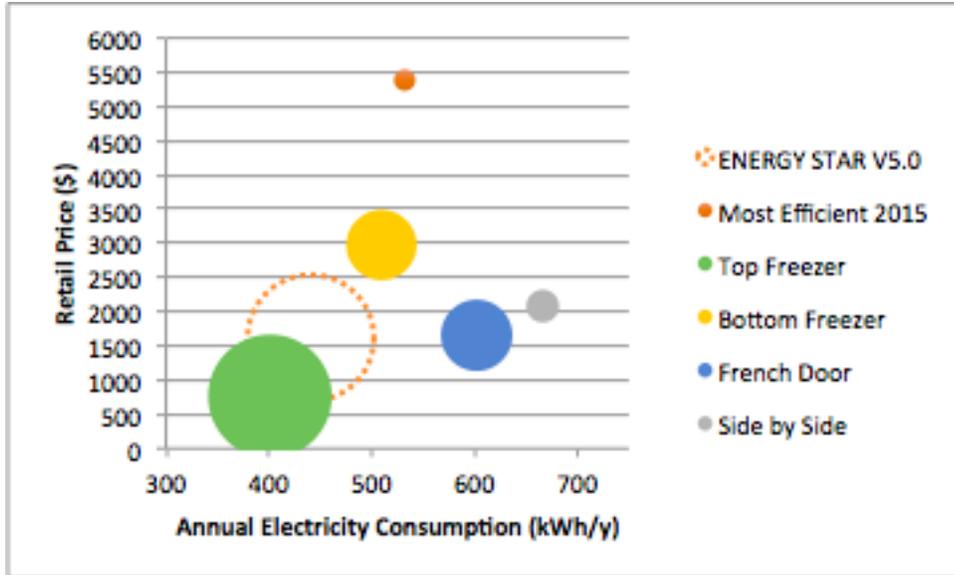


Figure 8. Refrigerator retail price and electricity use. Data represent 175 refrigerator models between 17 and 20 ft³, available for sale on May 1, 2015. The size of each circle indicates the relative number of models in each product category. *Source:* Arquit-Niederberger and Frank 2015.

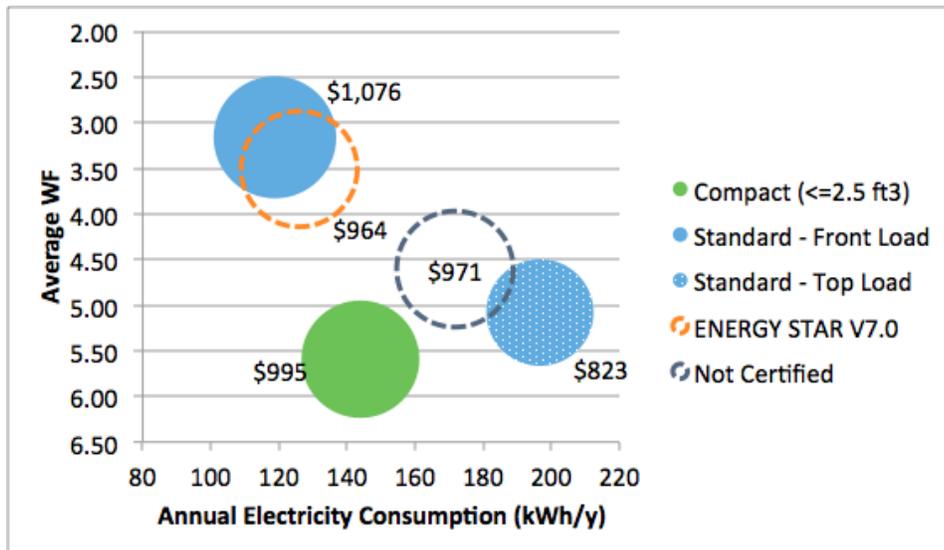


Figure 9. Clothes washer water factor, electricity consumption, and retail price. Data represent 198 clothes washer models offered for sale on May 1, 2015. The size of each circle indicates the relative number of models in each product category. *Source:* Arquit-Niederberger and Frank 2015.

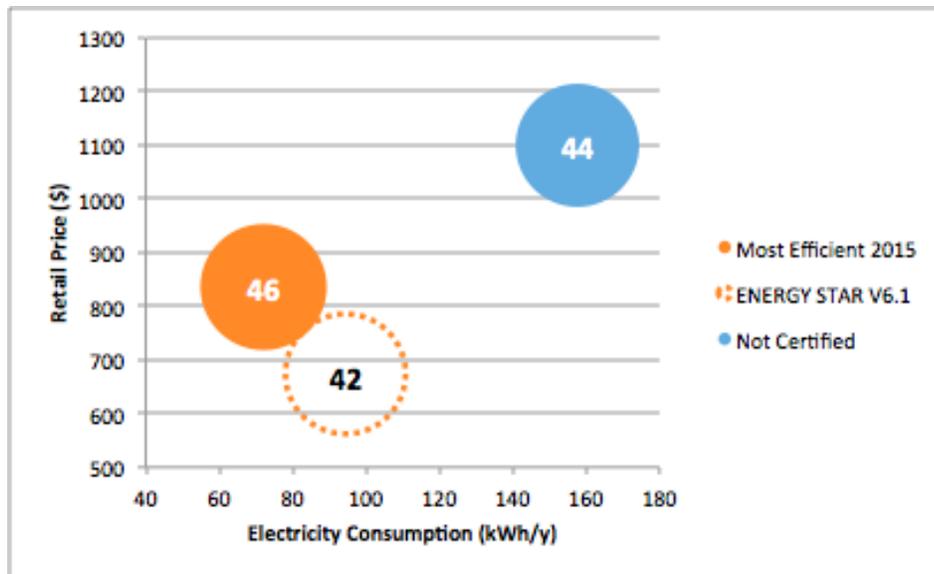


Figure 10. Average price, consumption, and screen size for televisions. Data represent 568 TV models offered for sale on May 1, 2015. The size of each circle indicates the relative number of models in each product category. *Source:* Arquit-Niederberger and Frank 2015.

Higher per-unit energy savings may allow programs to increase rebate levels while still meeting cost-effectiveness criteria. In addition, as noted above, low-income customers tend to own older and less efficient appliances and are less likely to purchase ENERGY STAR models, creating a higher energy use baseline. Furthermore baseline energy use for programs is likely to be higher due to the greater likelihood that appliances will be used until they fail, either by the homeowner or by a relative or friend (Navigant 2015). Expanding markets for ultra-efficient products can also contribute to programs' market transformation goals, yielding greater long-term energy and dollar savings for all customers.

To best serve low-income customers, programs should look beyond high efficiency ratings and carefully consider program criteria and qualifying product lists to ensure that the program meets customer needs. This might mean developing program-specific criteria and/or product lists rather than relying on the ENERGY STAR program. Many smaller and mid-sized top-freezer models do not qualify for ENERGY STAR or ENERGY STAR Most Efficient, even though their annual energy consumption is lower than that of comparably sized bottom-freezer and side-by-side models. With lower purchase prices, lower annual energy costs, and potentially more-appropriate size or capacity, these products can be a better fit for low-income households, particularly for smaller households or elderly customers.¹⁶ Similar issues arise for clothes washers and televisions. In conventional product programs, program administrators are beginning to use tools that incentivize products based on real-time market data on product costs and availability (Bresler 2015). This approach holds promise for low-income product programs as well.

¹⁶ In September 2015 ENERGY STAR announced that the Most Efficient program would recognize all ENERGY STAR-qualified top-freezer models as Most Efficient in an initial attempt to address this issue.

Equipment

ADVANCED WATER HEATING

Water heater replacements are an eligible measure in a number of comprehensive energy efficiency programs, but water heaters are not often replaced unless they are broken. This is because until recently significant energy savings were not available for the replacement of electric resistance hot water tanks. Heat pump water heaters are a much more efficient way to heat water than electric storage water heaters. Hundreds of programs in the residential sector now offer rebates for heat pump water heaters (York et al. 2015). While rebate programs are open to low-income customers, they are not easily accessible due to high up-front equipment costs. Due to the significant savings over standard electric water heaters, heat pump water heaters are a promising option for integration into low-income energy efficiency programs. Heat pump water heaters use about 50% less energy than a standard electric water heater, which uses an average of 2,876 kilowatt-hours (kWh) per year (York et al. 2015). Cutting electric water heating energy use by half for a low-income household can mean considerable utility bill savings—roughly \$175–200 annually. Heat pump water heater installed cost is typically about \$1,500, whereas electric resistance water heaters cost roughly \$600 (York et al. 2015). Efficiency Vermont has integrated heat pump water heaters into its add-on weatherization package (discussed above) (Curtis 2014).

ADVANCED SPACE HEATING AND COOLING

Similar to water heaters, furnaces are often an eligible measure in a number of comprehensive energy efficiency programs, but furnaces are usually replaced only when broken or malfunctioning because savings gains from replacement have not traditionally been significant. For homes heating with electricity, high-efficiency electric heat pump systems are promising improvements for yielding significant electric savings for both heating and cooling loads. In particular, ductless split systems, which are common in Europe and Asia, are gaining momentum in the United States (York et al. 2015).¹⁷ Ductless heat pumps are beginning to be integrated into energy efficiency program offerings including low-income programs, particularly in regions where electric space heating and fuel oil dominate, which is where the consumer cost savings potential is greatest. Electricity savings from replacement of electric furnaces with ductless heat pumps could reduce average annual energy use of 6,000 kWh or more to 2,400 kWh, saving 3,600 kWh annually or about \$350 every year (York et al. 2015).

A 2015 pilot program at the Columbia River People's Utility District (PUD) replaced baseboard electric heating systems, forced air electric furnaces, and electric wall heaters with ductless heat pumps for low-income households (CRPUD 2016). Homeowners had insulation upgrades performed for free and were then eligible to receive a \$3,800 rebate for a ductless heat pump. Efficiency Vermont has integrated mini-split cold climate heat pumps

¹⁷ Ductless heat pumps or ductless split systems are similar to the existing split-system heat pump systems that are common in the United States, but instead rely on variable speed compressors that run at very high speeds, allowing heat pumps to work at much lower temperatures than traditional condenser systems. In addition these systems do not rely on ductwork for distribution, so duct leakage energy losses are not an issue (York et al. 2013).

into its weatherization add-on package (Curtis 2014). The Connecticut utilities have also integrated ductless heat pumps into their Home Energy Solutions – Income-Eligible program (Reeves et al. 2015).

STRATEGIES FOR PRODUCT PROGRAMS

In addition to integration of high-efficiency equipment into utility whole-building weatherization efforts, utilities can look for ways to integrate high-efficiency equipment into the low-income home repair and upgrade projects of other organizations. Consumers Energy is developing an online administrative tool called the Community Partnership Portal, which municipal and nonprofit organizations can use to reserve funds to offset the cost of selecting higher-efficiency measures for their low-income housing projects. The portal allows organizations to supplement their own project funding. This system could allow a housing rehab organization, for example, to install a higher-efficiency water heater than they otherwise would have installed in a new home or rehab project (Cadmus 2015).

In addition, while not common in the United States, equipment rental programs for high-efficiency water heaters and ductless heat pump systems could provide a viable option for increasing the energy efficiency of products in low-income households. In Vermont, Green Mountain Power offers both purchase and leasing options for ductless heat pump systems and heat pump water heaters for all customers including low-income households (Green Mountain Power 2016).

SAVINGS OPPORTUNITIES

Despite existing energy efficiency and energy assistance program efforts, there is still significant unmet need for low-income households struggling to afford energy costs (Drehobl and Ross 2016). Low-income programs can help address that need, while helping utilities realize energy savings and meet the carbon reduction goals set forth in the CPP. Table 5 details opportunities for significant electric savings from the products discussed above.

Table 5. Opportunities for electric savings from high-efficiency equipment

Measure	Existing appliance energy use (kWh)	Replacement appliance energy use (kWh)	Annual electric savings (kWh)	Annual customer cost savings
Ultra-efficient refrigerator	1,180	356	824	\$99
Ultra-efficient clothes washer	500	200	300	\$36
Heat pump water heater	2,876	1,440	1,436	\$172
Ductless split heat pump	6,000	2,400	3,600	\$432

Annual cost savings estimates based on energy cost of \$0.12/kWh. *Source:* York et al. 2015.

Evaluating Cost Effectiveness

In order to address many of the challenges unique to delivery of energy efficiency to low-income households, particularly those discussed earlier that are associated with health, safety, and home durability, many low-income programs contain measures (and associated

costs) that are not included in traditional energy efficiency programs. As a result, it is particularly important for the value of low-income energy efficiency measures to be characterized in terms of both the energy and the nonenergy impacts they provide to low-income customers.

While low-income energy efficiency programs are not usually held to the same cost-benefit requirements or thresholds as residential ratepayer-funded programs, there is still pressure for program administrators to demonstrate the value of overall programs and individual measures (Kushler, Nowak, and Witte 2012). In addition electricity savings will be important for earning credits under the CEIP and the CPP. The value to customers, the utility, and society at large can best be understood when both energy savings benefits and nonenergy benefits are considered.

Utilities and their regulators employ a variety of cost-benefit frameworks for energy efficiency program evaluation, but in practice the tests do not consistently incorporate multiple benefits. This results in an inaccurate assessment of the costs and benefits of efficiency improvements. An approach called the Resource Value Framework (RVF) addresses the shortcomings in the current application of cost-effectiveness tests and recommends particular strategies for incorporating a range of benefits into program cost-effectiveness testing (NESP 2014). The RVF recommends that the value of benefits be quantified and monetized when possible. In cases in which benefits are difficult to quantify in monetary terms, estimates and proxies can be used.

The RVF recommends the use of alternative screening benchmarks or regulatory judgment to evaluate nonenergy benefits that are difficult to quantify. This requires documentation of the incidence of benefits observed in the program. In California efforts are under way to document the level of health, comfort, and safety improvements that result from all measures in the ESA Program, based on four criteria, for incorporation into regulatory cost-effectiveness evaluation. Measures will be evaluated and ranked based on how they achieve the following goals (Low Income Cost Effectiveness Working Group 2015):

- Eliminates combustion-related safety threat
- Eliminates fire safety threat/improves home security (crime prevention) and building integrity
- Reduces or eliminates extreme temperatures and temperature variations inside the home/improves customers' ability to manage in-home temperatures
- Improves air quality, ventilation, and/or air flow

Programs can also categorize and evaluate measures based on the specific impact they are intended to have to help regulators understand their value. For example, in California program administrators are working to divide measures included in the ESA program into two categories – equity and resource.¹⁸ This delineation of measures is intended to give all

¹⁸ In California's classification equity measures provide little if any energy-savings benefit but are widely accepted as important measures for health, safety, and comfort. These include furnace repair or replacement and hot-water heater repair or replacement (Low Income Cost Effectiveness Working Group 2015). Resource benefits provide quantifiable energy savings.

parties involved in program development and evaluation (including program administrators, evaluators, and stakeholders) a better understanding of why certain measures are included in and valuable to a low-income energy-savings program (O'Drain et al. 2013).

In addition to benefits that accrue at the household level, low-income energy efficiency programs also provide benefits to the utility system and to society as a whole that should be considered in cost-effectiveness assessments. Utility benefits include reducing arrearages and their carrying costs, bad-debt write-offs, electricity terminations and reconnections, costs of bill payment assistance programs, customer calls, collection activities, and safety-related emergency calls (Gaffney 2011). Societal benefits include increased economic development, jobs development, reduced air emissions, and reduced reliance on public benefits or services. Both utility and societal benefits tend to be greater in energy efficiency programs targeting low-income households. ACEEE's report *Recognizing the Value of Energy Efficiency's Multiple Benefits* (Russell et al. 2015) details the types and ranges of value for multiple benefits included in cost-effectiveness testing. Understanding the value of the other benefits low-income programs are designed to provide can allow for attribution of part of the program cost to these measures. This can help to better characterize the cost of energy savings in low-income programs.

Conclusions and Next Steps

Low-income households account for about one-third of the population in the United States. These households have housing, equipment, and appliances that are older and less efficient than those in the average US household. Energy efficiency programs can provide critical assistance to households that struggle to keep up with the cost of energy, which for them accounts for a higher percentage of household income than for the general population. The following priorities can help energy efficiency programs provide greater support to low-income households through energy and cost savings as well as a variety of associated health, safety, and quality of life benefits.

INTEGRATE LOW-INCOME ENERGY EFFICIENCY INTO CPP COMPLIANCE PLANS

Low-income energy efficiency programs should be part of every state's portfolio of activities used to meet emissions reduction goals for the CPP. Leveraging the CEIP for early emissions reduction credits for low-income energy efficiency can help utilities start programs that will continue to help meet emissions reduction requirements through 2030. States must submit plans to the Environmental Protection Agency (EPA) demonstrating intended compliance activities by September 2016, so now is the time for conversations with state regulators to ensure that low-income energy efficiency programs have a place in compliance plans. Advocates should push for utility programs to help meet the diverse energy needs of low-income households. Weatherization and whole-building programs can effectively improve the building shell via insulation and air sealing and repair mechanical deficiencies in heating and cooling equipment that contribute to burdensome energy costs. Meanwhile product programs (for lighting and appliances) and direct installation programs (for CFLs, hot water saving measures, and so on) can help reach a broad segment of the low-income population, while building customer trust in the utility and educating customers about more-comprehensive program opportunities.

INCREASE SAVINGS THROUGH SMART PARTNERSHIPS

Utilities can work with organizations also addressing low-income needs to help deliver energy efficiency services most efficiently. We know that many homes require health, safety, and durability improvements before energy efficiency improvements can be made safely and effectively. Sometimes these issues are not discovered until energy efficiency work has already started, so knowing what specific deficiencies are commonly found in a region's housing stock can help utilities articulate to housing rehab organizations some key areas of improvement. In addition designing programs with some leeway for spending on health and safety measures can help projects move forward when minor issues are uncovered.

INCREASE PRODUCT EFFICIENCY IN LOW-INCOME HOUSEHOLDS

The disparities in product efficiency between low-income households and the general population, discussed earlier, illustrate the opportunity for increased focus on appliances and equipment. Advances in appliance, electronic, and equipment efficiency can help realize significant savings for program customers and for the programs themselves. Programs for the general residential sector have relied on product incentives for the bulk of their spending and savings on energy efficiency. While low-income households technically have access to these programs, participation is limited. In addition, while the highest-efficiency products (such as ENERGY STAR Most Efficient products) have increasingly been incorporated into general residential program offerings, efforts to do the same in low-income programs have not kept pace. The highest-efficiency products in some appliance categories such as refrigerators offer considerable savings over federal standard and ENERGY STAR requirements, without a significantly higher price.

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