

The background of the page features a large, abstract graphic composed of several overlapping, flowing ribbons in shades of blue, orange, and green. These ribbons create a sense of movement and depth, framing the central text area.

Residential Dual-Fuel Programs

Most energy efficiency programs target only one fuel, usually electricity or natural gas. While they achieve savings, they sometimes miss opportunities by failing to address other fuels. Dual-fuel programs, on the other hand, have the potential to save more energy, reduce program costs, and improve customer satisfaction. Yet many utilities still do not offer them because they often require collaboration with other utilities or program administrators, making them more difficult to run.

The American Council for an Energy-Efficient Economy (ACEEE) profiled dual-fuel programs in a 2014 report called *Successful Practices in Combined Gas and Electric Energy Efficiency Programs*.¹ The current brief takes a closer look at these practices in residential offerings. It highlights innovative program approaches and technologies that can unlock deeper savings across fuels.

The Opportunity

The National Renewable Energy Laboratory (NREL) estimates potential annual savings of \$49 billion through efficiency improvements in US residential buildings.² In 2016 alone, utilities invested \$2.4 billion in residential energy efficiency.³ With 75% of US households relying on two or more fuels, dual-fuel programs can be instrumental for improving efficiency because they help residents save energy across fuels.⁴

Dual-Fuel Program Structures

Residential dual-fuel programs come in many shapes and sizes. Single-family programs include new construction, whole-home retrofits, and direct installation of individual efficiency measures. Multifamily programs range from direct install to comprehensive retrofits that target both common and tenant spaces.

Offering dual-fuel programs will be easiest for combination utilities (those that offer both electricity and natural gas). Most other providers will need to work in collaboration. These collaborative programs usually have one of three institutional structures:

- *Two-utility coordinated programs.* In this approach, two single-fuel utilities collaborate to offer a dual-fuel program. They typically enter into a contract that outlines qualifying measures and allocation of costs and energy savings. The additional energy savings and reduced program costs for each utility make the extra administrative lift worthwhile. Successful examples include Home Energy Savings (operated by Nicor Gas and Commonwealth Edison Company [ComEd]) and Home Performance with ENERGY STAR® (operated by Southwestern Electric Power Company [SWEPCO] and Black Hills Energy Arkansas).*
- *Statewide integrated programs.* In this model, utilities collaborate to develop a program that each individually administers. The program standardizes offerings, incentive levels, forms, and branding to help simplify participation for customers, contractors, and suppliers. MassSave in Massachusetts and Home Upgrade California are successful examples of this institutional relationship.[†]

- *Third-party statewide administrators.* These partnerships are similar to statewide integrated programs, but policymakers or participating utilities appoint third-party administrators to run them. The administrator pools funds into a central program but allocates costs and resulting energy savings separately for each utility. Successful examples of this approach include New York State Energy Research and Development Authority (NYSERDA) and Wisconsin's Focus on Energy.

Barriers to Collaborative Dual-Fuel Programs

Collaborative programs can be difficult to launch because of the initial administrative effort required. Utilities must be willing to compromise and agree on a wide variety of design elements, including marketing, quality control, treatment of confidential information, each utility's role, evaluation process, and many more. In addition, utilities must maintain continuous engagement and communication throughout implementation.

Regulatory structures can also complicate program design and administration because natural gas and electric utilities may comply with different requirements and reporting timelines. In addition, fuel-switching regulations impact cross-utility collaboration. These regulations restrict programs from incentivizing customers to switch from electric equipment to gas or vice versa. Fuel-switching restrictions can increase single-fuel utilities' comfort with collaborating on dual-fuel programs by reducing concerns about customer attrition. On the other hand, removing such regulations can benefit dual-fuel program offerings by giving administrators more flexibility in the types of technologies they can provide. For example, Massachusetts granted Mass Save permission to use fuel-blind cost-effectiveness tests so that administrators can claim savings for customers who switch from gas to electric space- and water-heating equipment.

No single regulatory or program design approach will work for all collaborative dual-fuel programs. Regulators and utilities will need to determine the best approaches to meet their goals. Furthermore, each utility partnership will need different structures, designs, and implementation plans to overcome the barriers unique to its region.

*Learn more about these programs at nicorgasrebates.com/your-home/home-assessments and www.energystar.gov/about/content/southwestern_electric_power_company_aep_swepeco.

†Learn more about these programs at www.masssave.com/en/saving/energy-assessments/multifamily-facilities-5-units-plus and www.energyupgradeca.org/home-energy-efficiency/home-improvements/.

Promising Measures and Technologies

Dual-fuel programs offer measures and technologies that save both electricity and natural gas:

- ♦ Energy audits
- ♦ Air sealing
- ♦ Duct sealing
- ♦ Insulation
- ♦ Window replacement
- ♦ Thermostats
- ♦ Clothes washers
- ♦ Clothes dryers
- ♦ Dishwashers

Heating and cooling account for over 40% of a home's energy consumption. Improving a home's shell through air sealing, insulation, and upgraded windows helps keep conditioned air inside while preventing outside air from entering. Similarly, sealing and insulating heating, ventilation, and air-conditioning (HVAC) ducts minimizes leaks and reduces energy waste. Such measures directly affect the system's operation. For example, HVAC equipment in a home with a leaky building shell will have to work harder to heat and cool rooms, reducing efficiency.

These measures are essential for achieving deep energy savings because they reduce heating and cooling loads. They are the main reason that single-fuel utilities implement dual-fuel programs. Building shell and duct improvements are expensive and labor intensive, and the energy savings from a single fuel are usually not enough to offset these high costs. Dual-fuel programs

count savings from both fuels in cost-effectiveness tests.

- ♦ Washers, dryers, and dishwashers all use electricity, some consume hot water (which can come from electricity or gas), and one (clothes dryers) comes in electric and gas versions. In addition, because clothes- and dishwashers use water, sometimes water utilities work with energy utilities to promote efficient models.⁵
- ♦ Dual-fuel programs can also offer measures that save either electricity or natural gas. Electricity-only measures include lighting retrofits, LED exit signs, smart power strips, and HVAC and water-heating equipment. HVAC and water-heating systems may also use gas only.

While all of the preceding measures are also included in single-fuel programs, dual-fuel programs can often reap more savings by using a whole-home approach. For example, pairing an efficient gas furnace with duct sealing and building shell improvements further reduces the amount of energy the furnace uses. Fuel-blind programs can additionally encourage whole-home energy savings because they provide equipment that meets individual homeowners' needs, regardless of whether it requires switching from one fuel to another. For example, some dual-fuel programs encourage homeowners to switch from gas water heaters to electric heat pump water heaters.

Home technologies such as smart HVAC, next-generation thermostats, and connected water heaters are also creating new opportunities for dual-fuel programs.⁶ These smart devices

provide more control and information than traditional technologies. Homeowners can use this information to better understand and control energy use. Utilities can also use data from these devices to better understand each home's individual energy consumption.

Some smart devices with automation capabilities can also reduce their energy usage by analyzing user behavior. For example, a smart thermostat can learn when homeowners leave for work and adjust the temperature settings until they return. These devices can achieve even deeper savings by communicating with other smart devices. That same thermostat can tell smart lighting to turn off when the homeowner leaves. Dual-fuel programs can maximize the savings from smart technologies by connecting both electric and gas-fueled devices to a single network.

Connected thermostats are popular with dual-fuel programs. Besides driving both natural gas and electricity savings, they can reduce loads during critical peak times by modestly adjusting temperature set points. For example, Southern California Gas and the Los Angeles Department of Water and Power work together to promote these thermostats. The gas company uses them to help manage winter peaks, and the electric company uses them to help manage summer peaks. In addition, the success of countless connected thermostat pilots and programs gives administrators more confidence to incorporate them into their programs. Finally, administrators need reliable energy savings data to prove their programs pass required cost-benefit tests. ENERGY STAR has developed a specification

and standardized testing procedure for connected thermostats, enabling administrators to use deemed savings to demonstrate the cost effectiveness of their thermostat programs.

Efficiency stakeholders are developing standardized testing procedures for more smart devices. In 2018, ENERGY STAR started scoping a smart home energy management system (SHEMS) label that will potentially include smart thermostats, ENERGY STAR-certified lighting, devices that can control miscellaneous electrical loads (smart plugs), occupancy sensors, and energy optimization algorithms.⁷

Connected water heaters also have potential for dual-fuel programs. Most programs targeting smart water heating are electric only and often pursued through demand-response pilots and programs.⁸ Considering that 47% of households use natural gas for water heating, and another 6% rely on other nonelectric fuel sources, this represents an opportunity for dual-fuel programs.⁹ Administrators can incentivize the installation of smart control devices for existing gas and electric water heaters. Research shows these devices have relatively low costs and a payback period of one to three years.¹⁰



New Program Approaches

Administrators implementing dual-fuel residential programs are generally happy with the results, and utilities continue to renew them each planning cycle. The 2014 *Successful Practices* report describes numerous exemplary program models. Here we focus on two areas that show particular promise for dual-fuel programming.

Multifamily

Efficiency spending for multifamily housing has nearly tripled in the past four years. However, while these properties account for 11% of energy sales, they receive only 6% of total efficiency program spending.¹¹ Most multifamily housing across the United States relies on more than one fuel source for water and space heating (see figures 1 and 2). Program administrators should promote savings across fuels to serve the needs of their multifamily customers.

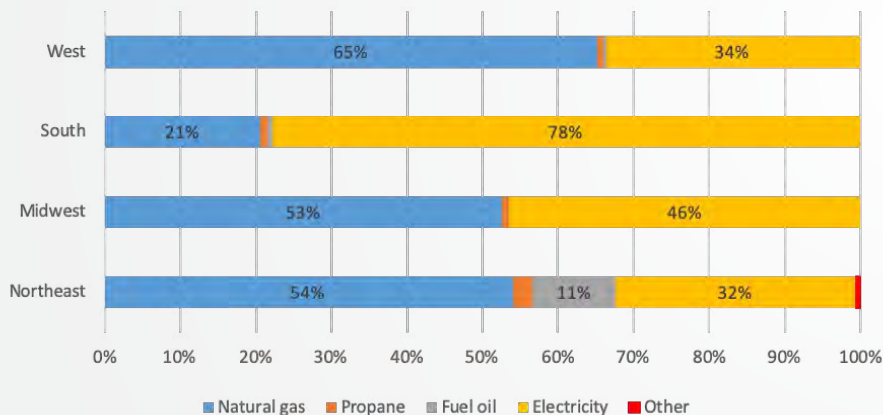


Figure 1. Multifamily water-heating fuel by region. Source: EIA 2015 RECS Survey Data. www.eia.gov/consumption/residential/data/2015/index.php?view=microdata.

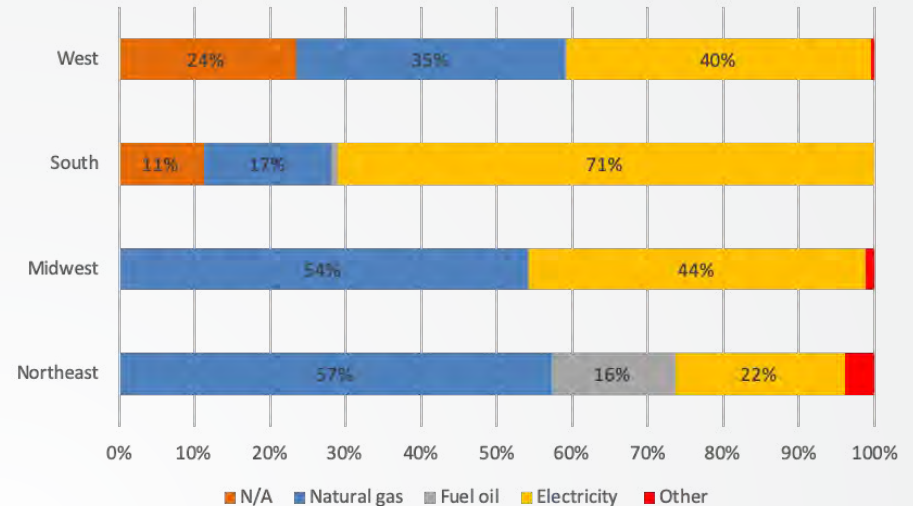


Figure 2. Multifamily housing space-heating fuel by region. Source: EIA 2015 RECS Survey Data. www.eia.gov/consumption/residential/data/2015/index.php?view=microdata.

Dual-fuel multifamily programs may offer direct-install measures, financial incentives, and comprehensive retrofits. The latter typically achieve the deepest energy savings.¹²

Direct-install measures are often implemented at the time of an audit at no or low cost. Robust programs provide them for both rental and common spaces and engage both building owners and tenants. Measures typically include ENERGY STAR-certified lighting, advanced power strips, thermostats (programmable and/or connected), and hot-water pipe insulation.

Comprehensive retrofits offer more-intensive interventions such as improving the building shell and replacing inefficient HVAC and water-heating systems. Retrofit programs usually begin with a free or subsidized whole-building energy audit. This results in a report that lists actionable items to cost-effectively reduce energy consumption and indicates which of them qualify for incentives. Some programs require participants to meet a certain level of performance to qualify (e.g., a 15% reduction in total energy use) or offer tiered incentives for leveled saving targets (e.g., one incentive level for a 10%

reduction and a greater incentive for 15%).¹³ Successful programs also help participants find financing opportunities to overcome the high upfront costs associated with deeper measures.

Combined gas and electric utilities may have the easiest time developing and implementing dual-fuel multifamily programs.¹⁴ However coordinated and integrated programs also can offer many advantages to single-fuel utilities. Multifamily programs may require owners to undertake complex projects and interventions. A single streamlined program rather than separate gas and electric programs can help reduce confusion, making building owners more willing to participate. In addition, many administrators running collaborative programs report lower program costs and increased savings compared to single-fuel offerings.

Combined Heat and Power (CHP) Programs

Dual-fuel programs that promote CHP installation in multifamily buildings are growing in popularity.¹⁵ A CHP system generates electricity and heat (thermal energy) that it then provides directly to a building. CHP systems can achieve major energy savings in multifamily properties.¹⁶ They provide electricity more efficiently than the central grid because they have lower transmission losses. Buildings can also use the thermal energy for space conditioning and water heating.

Multifamily CHP programs have further benefits. Installing CHP systems can help electric utilities meet savings targets, while gas utilities benefit from increased retail sales and long-term customer retention. Such programs are most commonly run by dual-fuel utilities (e.g., National Grid Rhode Island) but have also been run by gas-only (e.g., Southern California Gas) or electric-only utilities (e.g., Potomac Electric Power Company [PEPCO] Maryland).

A few leading state and utility programs have contributed to a recent surge in the number of multifamily buildings installing CHP systems. A majority of this growth has been concentrated in New York, Maryland, and Massachusetts. In Maryland, PEPCO and Delmarva Power both administer CHP programs targeting multifamily buildings; NYSERDA in New York works with local utilities to run a statewide program. Massachusetts offers financial and technical support to public housing buildings that install the systems.

Table 1 provides a snapshot of some successful dual-fuel multifamily programs.

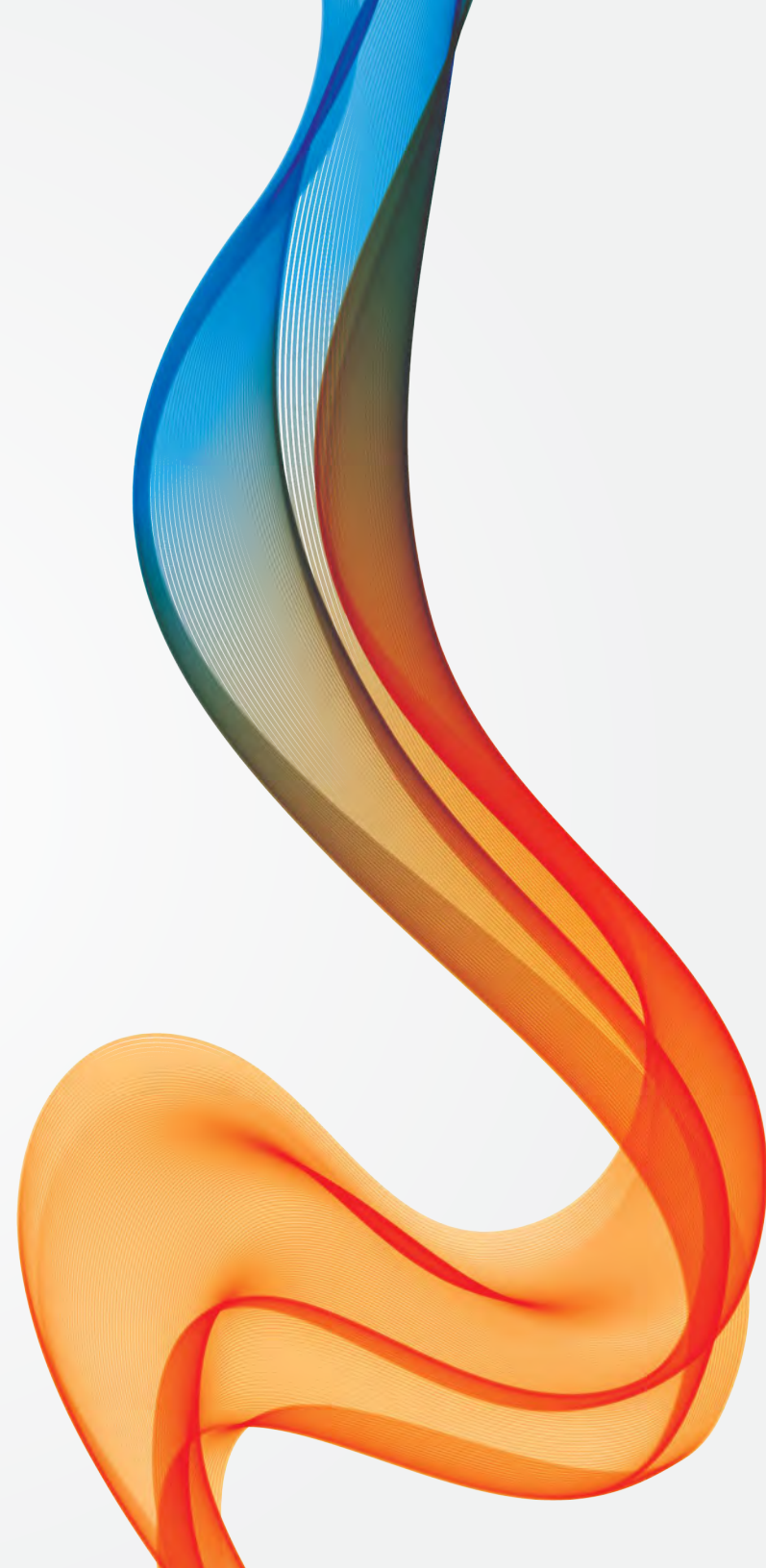


Table 1. Dual-fuel multifamily program examples

Program administrator	Administrator	Offerings
Mass Save Multifamily Retrofit	Mass Save on behalf of Berkshire Gas, Cape Light Compact, Columbia Gas of Massachusetts, Liberty Utilities, National Grid, NSTAR, Unitil	Building assessments Installation of eligible energy conservation measure Free building audit Low-cost direct install at time of audit
Multifamily building efficiency	Xcel Energy and Center Point	Energy use report with identified efficiency measure that can qualify for incentives Incentives tiered according to whole-building savings: 15% savings earns incentive covering 25% of qualifying costs; 20% savings, incentive covering 35% of costs; 25% savings, incentive covering 40% of costs
Energy Trust Multifamily Incentives	Energy Trust of Oregon on behalf of Pacific Power, Portland General Electric, Northwest Natural	Free energy assessment that identifies energy-saving opportunities and direct install measures Incentives for qualifying measures and equipment upgrades
Focus on Energy Multifamily Energy Savings	Focus on Energy on behalf of numerous Wisconsin utilities	Free building assessment ROI calculations for efficiency projects Prescriptive and/or custom incentives for measures

Sources: Mass Save, "Rebates and Incentives for Multi-family Properties (5+ Units)," 2019. www.masssave.com/en/saving/energy-assessments/multi-family-facilities-5-units-plus/; CenterPoint Energy and Xcel Energy, "Multifamily Building Efficiency," 2019. www.multifamilyenergysolutions.com/; Energy Trust of Oregon, "Multifamily," 2019. www.energytrust.org/programs/multifamily/; Focus on Energy, "Multifamily Energy Savings," 2018. focusonenergy.com/programs/multifamily-energy-savings.

Pay-for-Performance Programs

Residential pay-for-performance (P4P) programs are an emerging approach that can complement traditional dual-fuel programs.¹⁷ P4P programs monitor energy savings and pay incentives for the measures that achieve them. They measure a home's energy consumption before and after interventions and base incentives on how much energy was saved. This differs from traditional efficiency programs that provide incentives up front based on an efficiency measure's deemed savings or modeled savings estimates but do not usually verify actual savings.

P4P programs have several potential benefits:

- ♦ **Reduced administrator risk.** Administrators pay only for interventions that generate savings, guaranteeing ratepayer dollars go toward energy savings.

- ♦ **More flexibility in measure determination.** Administrators no longer need to determine each qualifying measure and intervention. This gives aggregators more flexibility to customize measures for each customer because incentives are based on actual energy savings rather than predetermined incentive rates for each measure.
- ♦ **Simplified savings allocations.** Using computer automation and advanced metering infrastructure (AMI) data to track energy savings reduces the burden of measuring and allocating savings for each fuel type.
- ♦ **Quicker program evaluations and feedback.** Because aggregators can track pre- and postintervention energy savings, they can more readily determine which interventions achieve deeper savings and adapt their approach accordingly. For example, an aggregator that provides whole-home retrofits can track which projects saved the most energy and use this information to inform future projects.

Residential P4P programs have only recently become feasible due to the widespread installation of AMI, allowing utilities to collect and track detailed consumption data for individual households. To date, Pacific Gas and Electric (PG&E) and NYSEERDA are the only administrators piloting whole-building residential P4P programs, and results are pending.

These programs are too new to have well-established best practices. However, as the pilots mature, they will provide information on how the P4P approach can improve dual-fuel programs. The pilots target whole-home savings and follow a relatively simple structure. First, the program administrators launch a proposal request for aggregators who provide interventions targeting whole-home energy consumption—essentially acting as third-party program implementers. Aggregators can provide any type of intervention ranging from behavioral changes to whole-building retrofits. They manage their own portfolio of customers, and the administrators pay them for actual energy savings over a determined period (for example, one payment each quarter for two years). Savings are calculated at the portfolio level by aggregating the metered savings from each household.

Key considerations for P4P programs include the following:

- ♦ *Collaborative programs still face the same barriers.* While P4P can reduce some barriers, such as tracking and allocating savings, a majority of the design and implementation barriers remain for collaborative programs. Administrators pursuing a collaborative P4P program will still need to compromise on a variety of design elements, streamline their regulatory requirements and schedules, and ensure the aggregators can easily meet each utility's reporting requirements.
- ♦ *Costs and measures not yet understood.* P4P programs move substantial risk to implementing contractors. It is not yet clear whether they can make money at pilot program prices per unit of energy saved or whether prices may need to change. Another way to manage risk is to emphasize low-cost measures and not comprehensive retrofits. Evaluations of the initial pilot programs will provide more information.
- ♦ *More pilots are necessary to confirm the anticipated benefits.* More utilities will need to pilot residential P4P programs before we can discern any verifiable benefits or best practices.



Next Steps

Utilities and regulators can maximize the savings from dual-fuel programs by taking these actions:

- ♦ *Meet with utilities serving the same homes to explore opportunities to work together.* One way utilities can start collaborative relationships is by running pilots. This will enable them to work through their initial concerns and identify areas to improve. Most successful collaborative programs result from administrators building strong relationships and communication over years of implementation.
- ♦ *Work to change regulatory structures.* Utilities can work with their regulators to make changes that support dual-fuel programs. If regulatory practices make it difficult to propose dual-utility program, utilities can suggest reforms to these practices. See the ACEEE report *Successful Practices in Combined Gas and Electric Utility Energy Efficiency Programs* for other regulatory frameworks that support dual-fuel programs.

Notes

- 1 Seth Nowak, Marty Kushler, and Patti Witte, Successful Practices in Combined Gas and Electric Energy Efficiency Programs (Washington, DC: ACEEE, 2014). [aceee.org/research-report/ui406](https://www.aceee.org/research-report/ui406).
- 2 NREL (National Renewable Energy Laboratory), ResStock—Targeting Energy and Cost Savings for U.S. Homes (Golden, CO: NREL, 2017). www.nrel.gov/docs/fy17osti/68653.pdf.
- 3 DOE (Department of Energy), How Residential Energy Efficiency Can Support State Energy Planning (Washington, DC: DOE, 2017). www.energy.gov/sites/prod/files/2017/10/f38/Pathways-Residential_1017.pdf.
- 4 EIA (Energy Information Administration), What's New in How We Use Energy at Home: Results from EIA's 2015 Residential Energy Consumption Survey (RECS) (Washington, DC: EIA, 2018). www.eia.gov/consumption/residential/reports/2015/overview/pdf/whatsnew_home_energy_use.pdf.
- 5 Rachel Young, Saving Energy and Water Together: Helping Utilities Build Better Programs (Washington, DC: ACEEE, 2013). [aceee.org/research-report/e13h](https://www.aceee.org/research-report/e13h).
- 6 Jen King, Energy Impacts of Smart Home Technologies (Washington DC: ACEEE, 2018). [aceee.org/research-report/a1801](https://www.aceee.org/research-report/a1801).
- 7 ENERGY STAR, "Smart Home Energy Management Systems," 2018. www.energystar.gov/products/spec/smart_home_energy_management_systems_pdf.
- 8 Kara Saul Rinaldi and Elizabeth Bunnen, Redefining Performance in the 21st Century: How the Smart Home Could Revolutionize the Industry and Transform the Home-to-Grid Connection (Moon Township, PA: Home Performance Coalition, 2018). www.homeperformance.org/sites/default/files/HPC_Smart-Home-Report_201810.pdf.
- 9 EIA, "Table HC8.1 Water Heating in U.S. Homes by Housing Unit Type," 2018. www.eia.gov/consumption/residential/data/2015/hc/php/hc8.1.php.
- 10 King, 2018.
- 11 Stefan Samarripas, "Multifamily Energy Efficiency Spending Nearly Triples in Four Years," ACEEE Blog, February 21, 2017. [aceee.org/blog/2017/02/multifamily-energy-efficiency](https://www.aceee.org/blog/2017/02/multifamily-energy-efficiency).
- 12 Stefan Samarripas, Dan York, and Lauren Ross, More Savings for More Residents: Progress in Multifamily Housing Energy Efficiency (Washington DC, ACEEE, 2017). [aceee.org/research-report/ui702](https://www.aceee.org/research-report/ui702).
- 13 Kate Johnson and Eric Mackres, Scaling up Multifamily Energy Efficiency Programs: A Metropolitan Area Assessment (Washington, DC: ACEEE, 2013). [aceee.org/sites/default/files/publications/researchreports/e135.pdf](https://www.aceee.org/sites/default/files/publications/researchreports/e135.pdf).
- 14 ACEEE, "A Regulator's Guide for Multifamily Efficiency," Accessed May 2019. [aceee.org/sector/state-policy/toolkit/regulator-s-guide](https://www.aceee.org/sector/state-policy/toolkit/regulator-s-guide).
- 15 DOE, "DOE Combined Heat and Power Installation Database," 2018. doe.icfwebervices.com/chpdb/state/MA.
- 16 DOE, 2018.
- 17 Sanem Sergici, Return of Pay-for Performance Stronger with M&V 2.0 (Cambridge, MA: The Brattle Group, 2018). files.brattle.com/files/14672_sergici_becc_slides_10092018.pdf.