



# Single & Multifamily Low-Income Energy Efficiency

Program Resource Manual

Tennessee Department of Environment & Conservation | May 2018



# How to Use this Manual:

*This manual is a working document of the Tennessee Department of Environment and Conservation (TDEC) Single & Multifamily Low-Income Energy Efficiency Exchange Group.<sup>1</sup> Much of the content found in this manual has been provided by members of the stakeholder group to aid in the creation and expansion of low-income resident-based energy efficiency (EE) programs in Tennessee.*

**WHO:** This manual is intended to assist nonprofits, local and state governments, local power companies (LPCs), and other entities that support or administer EE programming, particularly for hard-to-reach or traditionally underserved low-income demographics.

**WHY:** Low-income populations across the country dedicate a significant portion of household income to energy costs: in Tennessee households with incomes of below 50% of the Federal Poverty Level pay 27% of their annual income simply for their home energy bills.<sup>2</sup> Energy burden is a measure of energy affordability, and is based on the percentage of total annual gross household income committed to annual utility spending for electricity and heating.<sup>3</sup> Tennessee has a higher energy burden than the national average, with Memphis having the highest energy burden of any city in the nation.<sup>4</sup> EE is a cost-effective strategy for reducing high levels of energy consumption, while making homes more affordable, comfortable, and healthier. In rural areas, many of which are locations of persistent poverty,<sup>5</sup> electric co-ops are uniquely positioned to serve their communities as trusted energy advisors. Likewise, many urban areas, particularly those in the Southeast, are home to energy burdened communities.<sup>6</sup> Low-income households

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<sup>1</sup> The Single & Multifamily Low-Income Energy Efficiency Exchange Group was formed by TDEC in December 2015 to share best practices regarding single and multifamily low-income energy efficiency exchange programming efforts in Tennessee; to leverage existing technical and financial resources to further design, implementation, and administration of energy efficiency programming targeting low-income single and multifamily audiences; and to explore opportunities to develop resources that can assist with implementation of energy efficiency programming targeting low-income single and multifamily stakeholders.

<sup>2</sup> Tennessee households at 50-100% of the Federal Poverty Level have an average energy burden of 15%, while households at 100-125% of the Federal Poverty Level have an average energy burden of 10%. Statistics are based on 2016 reporting from Fisher, Sheehan & Colton, April 2017, “Home Energy Affordability Gap”, [http://www.homeenergyaffordabilitygap.com/03a\\_affordabilityData.html](http://www.homeenergyaffordabilitygap.com/03a_affordabilityData.html).

<sup>3</sup> Abby Fox, Southeast EE Alliance, July 2016, “Utility-Administered Low-Income Programs in the Southeast”.

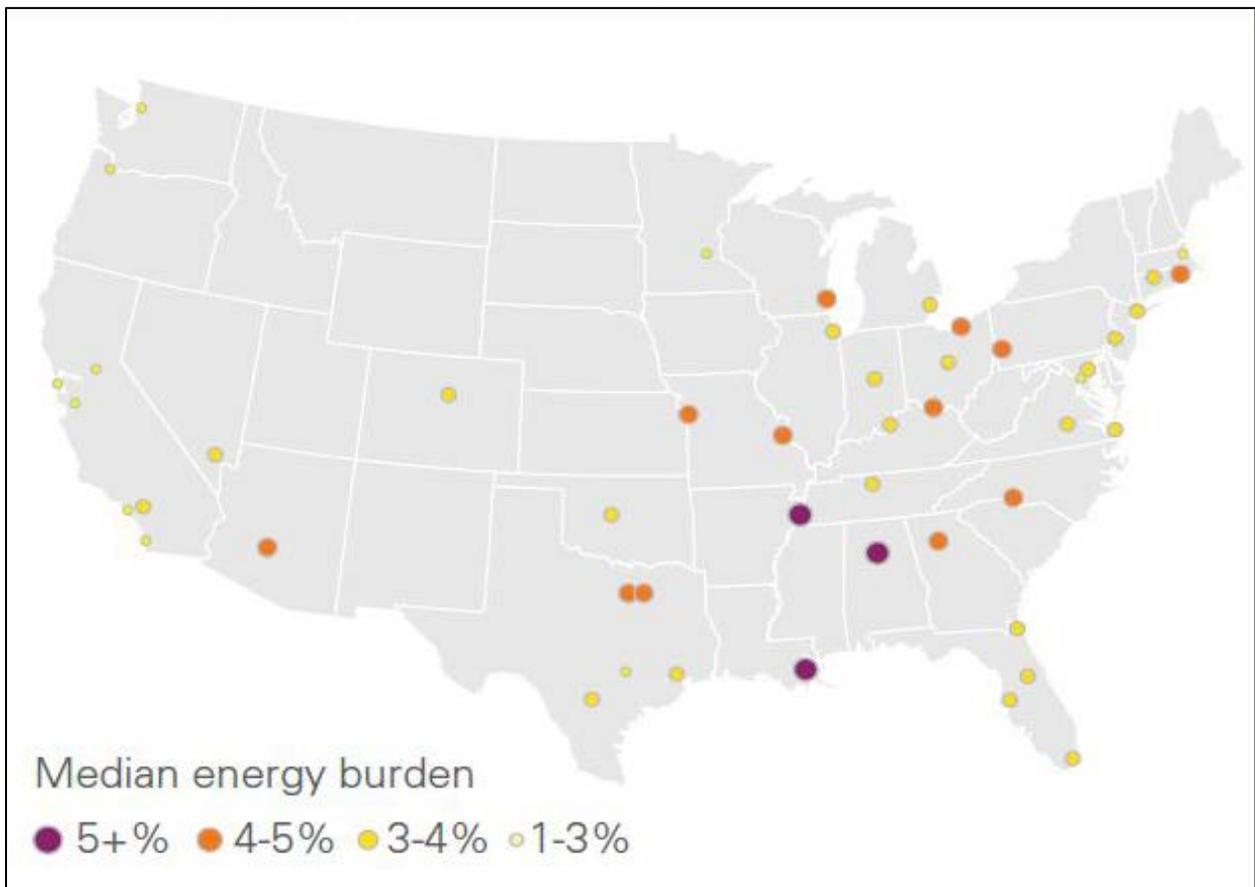
<sup>4</sup> Ariel Dreihobl and Lauren Ross, ACEEE, April 2016, “Lifting the High Energy Burden in America’s Largest Cities”.

<sup>5</sup> According to the National Rural Electric Cooperative Association (NRECA), 93% of persistent poverty exists in rural counties.

<sup>6</sup> “Metro areas in the Southeast and Midwest regions face the highest median energy burdens. It is noteworthy that many of the metro areas in the Southeast—a region with relatively low electricity prices and lower average incomes—faced the highest energy burdens compared with cities nationally. Low electricity prices do not equate to low bills.” from Ariel Dreihobl and Lauren Ross, ACEEE, April 2016, “Lifting the High Energy Burden in America’s Largest Cities”.

make up roughly 33% of the population nationally, but in 2014 only 18% of EE expenditures went towards low-income residential EE programs, indicating that there is a disconnect between EE program funding and households that are the best candidates for being targeted by EE programs.<sup>7</sup> In an even clearer depiction of disparate spending on utilities, please see Figure 1, which shows that the median metro-area energy burden for all households is 1-5% as opposed to 27% for Tennessee households below 50% of the Federal Poverty Line. This means that Tennessee households below 50% of the Federal Poverty Line dedicate 27% of their income to energy, compared to the typical family spending 1-5% of their income on energy related expenses. Additionally, Tennessee households at 50-100% of the Federal Poverty Line contribute, on average, 15% of their income to energy, compared to the typical family spending on energy related expenses.

Figure 1. Median Metro-area energy burden for all households<sup>8</sup>



<sup>7</sup> Rachel Cluett, Jennifer Amann, and Sodavy Ou, ACEEE, March 2016, “Building Better Energy Efficiency Programs for Low-Income Households”

<sup>8</sup> Ariel Drehobl and Lauren Ross, ACEEE, April 2016, “Lifting the High Energy Burden in America’s Largest Cities”

**WHAT:** This manual provides a framework for designing, implementing, and evaluating key elements of low-income focused EE programming. The manual is accompanied by extensive resource annotations and an online asset map<sup>9</sup>.

- **MANUAL:**

- **Phase One: Planning:** This section enumerates the primary concerns in developing single and multifamily low-income EE programming. Of particular concern are fundamental considerations for program design and techniques and discussion on the considerable benefits of community engagement and public participation. Finally, basic program structuring, including funding mechanisms, are provided in the last portion of Phase One, which are accompanied by examples of existing low-income EE programs. These examples can serve as a reference for how to build or enhance programs.
  - **Phase Two: Implementation:** Phase Two of the manual discusses opportunities for launching, expanding and supporting a more effective single and multifamily low-income EE program. Tools presented in this section range from auditing and homeowner educational resources, to Do-it-Yourself (DIY) workshop resources, to outreach methods. This section also discusses the benefits of a well-trained workforce and techniques for measuring and verifying EE upgrades.
  - **Phase Three: Evaluating Program Success:** Phase Three of the manual discusses the importance of evaluating EE programming to document and measure its effects and to support targeted growth and improvement. This section borrows from the State and Local Energy Efficiency Action Network report “Energy Efficiency Program Impact Evaluation Guide” and offers considerations for developing an evaluation program.
- **ASSET MAP:** The online asset map correlates the 22 electric cooperative territories of Tennessee with various EE and low-income service providers and other community resources in each co-op region. The map has approximately 2,000 color coded “pins,” each denoting a program related asset—contractors, vendors, community centers, libraries, nonprofits, and LPCs. The map utilizes a Google Maps platform that can be embedded on your agency’s website.

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<sup>9</sup> The online asset map can be found at <https://www.tn.gov/environment/program-areas/redirect---policy-and-sustainable-practices/policy/low-income-energy-efficiency-resources.html>.

- **RESOURCE ANNOTATIONS:** The resource manual features annotations linking concepts discussed throughout the manual to resources which provide examples of state and/or regional programs. In addition to examples of materials utilized by existing successful programs, annotations also direct users to actionable content for workshops, direct marketing, and programming.

**END GOAL:** After reading this manual, readers will:

- Be better equipped with resources for the three phases of successful program development—planning, implementation, and evaluation—and will be knowledgeable about key takeaways for each phase.
- Be better acquainted with regionally specific low-income EE program success stories, models, and contacts for follow-up.
- Have access to an online map of 2,000 data points related to EE programming assets in Tennessee.
- Have access to supporting resources.

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## **PHASE ONE: PLANNING**

**Building a successful program begins with understanding program goals, objectives, and resources available for execution. Let's get started.**

## **Planning Your Program**

This section details primary considerations for developing single and multifamily low-income EE programming.

First, identify and understand the demographics of the community you intend to serve so that you can effectively target areas with the highest energy burden and/or areas that have been the most underserved. Understanding your target community is essential for engaging in meaningful outreach.

Second, address programmatic design considerations in light of community demographics while utilizing the community's existing infrastructure. For instance, if there is a highly-successful Community Action Agency providing weatherization services in your targeted area, this may present an opportunity to partner with the organization to utilize their existing resources and connections to maximize your program's effectiveness (by offering both EE services combined with weatherization retrofits). These and other design considerations are detailed in the "Successful Program Design Considerations" section.

Third, engage the community: engage the community early and often. Community engagement provides insight that assists in program design and development decisions. Public participation also supports program buy-in, can assist with education and outreach, and can provide input that evaluates program successes and opportunities for improvement.

Finally, consider funding resources. Low-income EE programs are funded through a wide variety of sources, from federal grants, to state and local funding, to ratepayer funded programs. This section provides both a funding matrix with traditional program funding opportunities as well as examples of funding models utilities or LPCs can utilize to develop their own mechanisms for supporting low-income EE programming. This section also offers examples of existing low-income EE programs from around the country and state, as a reference for developing new programs based on your community's landscape, public participation, and funding sources.

Phase One does not provide discussion or best management practices related to developing an evaluation, measurement, and verification (EM&V) regimen, the effectiveness of specific EE measures at the individual project level, or the broader program level successes. However, Phase Three of this document addresses program level EM&V. Included in Phase Two are examples of field tools that exist to support the measurement and verification components of EM&V efforts used to assess EE measure effectiveness in individual participant spaces, or at the project level.

## Value of Low-Income Energy Efficiency Programs

Funding for low-income EE programs is often justified as providing broader social value in addition to reducing customer’s energy bills and consumption. These programs offer significant non-energy benefits such as the creation of new jobs to accommodate the installation of EE measures<sup>10</sup> and improved air quality.

The financial benefits of these programs carry over not just to consumers, but also utilities. Utilities benefit from reduced collection costs, fewer billing notices and customer calls, fewer shut-offs and reconnections for delinquency, avoided rate subsidies, and lower bad debt write-off.<sup>11</sup> Table 1 illustrates how EE benefits low-income residents, utilities, and communities alike.

Table 1. Energy efficiency benefits for low-income households, utilities, and communities<sup>12</sup>

Benefit Recipient	Energy efficiency outcome	Resulting benefit
Low-income program participants	Lower monthly utility bills	Lower household energy burden and greater disposable income
		Reduced stress and fewer trade-offs between energy and other necessities
		Reduced exposure to risk from utility rate increases
	Improvements in the efficiency of housing stock	Improved health and safety greater household comfort
		Increased property value, more reliable equipment, and lower maintenance costs
		Greater satisfaction with the building/unit and improved household and neighborhood stability
Utilities and ratepayers	Demand-side management (both gas and electric)	Avoided excess costs for increased generation, capacity, and transmission investments
		Contribution toward compliance with energy efficiency portfolio standards and other environmental legislation
	Cost savings to utilities and ratepayers	Reduced arrears and cost to shutoffs, which lowers utility operating costs
		Improved customer service
Communities	Lower electric and gas demand	Reduced environmental pollutants and improved public health

<sup>10</sup> Casey Bell, James Barrett, and Matthew McNerney, ACEEE, September 2015, “Verifying Energy Efficiency Job Creation: Current Practices and Recommendations”.

<sup>11</sup> Martin Schwietzer and Bruce Tonn, Oak Ridge National Laboratory, April 2002, “Nonenergy Benefits from WAP: A Summary of Findings from the Recent Literature”.

<sup>12</sup> Ariel Drehobl and Lauren Ross, ACEEE, April 2016, “Lifting the High Energy Burden in America’s Largest Cities”

Benefit Recipient	Energy efficiency outcome	Resulting benefit
	Lower monthly utility bills due to avoided utility costs	More money spent in the local economy due to greater household disposal income, with higher local multiplier effect
		Poverty alleviation and increased standard of living
	Improvements in the efficiency of the housing stock	Local job creation through weatherization programs and energy efficiency providers and trade allies
		Improved quality of life
		Increased property value and preservation of housing stock

### Successful Program Design Considerations

Many resources exist to assist entities in navigating the design, development, funding, and implementation of EE programs. After a careful review, this working group has identified a couple of particular value:, EPA’s “National Action Plan for Energy Efficiency”, American Council for an Energy-Efficient Economy (ACEEE)’s “Building Better Energy Efficiency Programs for Low-Income Households”, and Tennessee Valley Authority’s (TVA) “EnergyRight Solutions Benchmarking Study for Tennessee Valley Smart Energy Communities” report. This section reviews significant program design considerations as identified by these resources.

In July 2006 the EPA issued the “National Action Plan for Energy Efficiency” to support the expansion and improvement of EE programming nationwide. As part of this plan, a multi-sector working group developed the “Energy Efficiency Program Best Practices”, which includes specific considerations for low-income EE program planning, such as:

- the opportunity to coordinate with existing federal programs such as the Low-Income Heating and Energy Assistance Program (LIHEAP) and the Weatherization Assistance Program (WAP);
- the quality and energy-efficiency of housing of low-income customers;
- the age and energy-efficiency of appliances used by low-income customers;
- the percentage of low-income customers comprising the utility residential customer base (up to one-third of utility residential customers); and,
- the opportunity to coordinate efficiency education and incentives with credit counseling, which can increase EE program effectiveness in the single and multifamily low-income sector.<sup>13</sup>

<sup>13</sup> U.S. Department of Energy and U.S. EPA, July 2016, “National Action Plan for Energy Efficiency – Chapter 6: Energy Efficiency Program Best Practices”.

ACEEE also released a report in March 2016 entitled “Building Better Energy Efficiency Programs for Low-Income Households” which developed a range of recommendations for designing or revamping low-income EE programming. The report’s recommendations include<sup>14</sup>:

- **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. Lighting, appliances, mechanical ventilation, and electronics should increasingly play a role in low-income energy efficiency programs.
- **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 EE 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 EE 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. 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.

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<sup>14</sup> Rachel Cluett, Jennifer Amann, and Sodavy Ou, ACEEE, March 2016, “Building Better Energy Efficiency Programs for Low-Income Households”.

- **Coordinate eligibility requirements between efficiency and bill payment assistance programs<sup>15</sup> 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 EE 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®.

In March 2014 TVA conducted research for a benchmarking study to assist in the design of an EE retrofit program, known as Extreme Energy Makeover (EEM).<sup>16</sup> EEM was focused on deep energy retrofits, utilizing EE measures and a whole-house approach, targeting residents of homes 20 years or older, in lower income communities. The TVA study described a wide array of EEM programs and business practices from around the United States and distilled the commonalities of these programs to provide LPCs with a roadmap to developing low-income EE programming.

TVA defines EEM projects as including “cost effective deep energy retrofits, maximizing the use of the energy efficiency measures and focusing on a whole house approach.”<sup>17</sup>

*A deep energy retrofit is a whole building analysis that seeks to achieve much larger energy savings than conventional energy retrofits. Conventional energy retrofits tend to focus on isolated system upgrades (i.e. lighting and HVAC equipment), whereas a deep energy retrofit approaches the building as a complete system. A whole home approach addresses heating, air conditioning, insulation, air sealing, moisture management, lighting, water, and other systems with an emphasis on structural and equipment systems improvements with long service lives and synergistic effects. As a result of their comprehensiveness, whole house retrofits can create uniquely broad and valuable energy and non-energy benefits (such as increased comfort).<sup>18</sup>*

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<sup>15</sup> Rachel Cluett, Jennifer Amann, and Sodavy Ou, ACEEE, March 2016, “Building Better Energy Efficiency Programs for 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 programs are distinct from on-bill tariff or financing programs.

<sup>16</sup> Deloitte for TVA, March 2014, “EnergyRight® Solutions Benchmarking Study for Tennessee Valley Smart Energy Communities”

<sup>17</sup> *Id.*

<sup>18</sup> *Id.*

Deep energy retrofits are typically run as part of a “One Stop Shopping Program” which is discussed in further detail in the “Single and Multifamily Low-Income Energy Efficiency Program Types” section below. There are a number of models for running one stop shop programming:

1. Utility-Led Model: A utility—or, in this case, an LPC—runs the project, though it may contract with other companies or organizations to provide specific program components.<sup>19</sup>
2. Third-Party Implementer Model: A utility/LPC partners with a third party implementer to run a utility-branded project.<sup>20</sup>
3. Retailer Partnership Model: A utility/LPC partners with a big box home improvement retailer to implement a co-branded project.<sup>21</sup>

This benchmark study produced a framework to “help contextualize the various components of EEM marketplace.”<sup>22</sup> Figure 2 and Table 2 below outline the specific components that were considered by TVA and should be considered by entities when developing an EE program.<sup>23</sup>

Figure 2. Extreme Energy Makeovers Market Framework<sup>24</sup>



Table 2. Extreme Energy Makeovers Market Framework<sup>25</sup>

Main Component	Description	Examples (non-exhaustive)
<b>Engagement</b>	The process of determining homeowner eligibility and performing outreach to make eligible homeowners/residents aware of the program.	<ul style="list-style-type: none"> <li>• Community outreach and partnerships</li> <li>• Customer segmentation</li> </ul>

<sup>19</sup> Deloitte for TVA, March 2014, “EnergyRight® Solutions Benchmarking Study for Tennessee Valley Smart Energy Communities”

<sup>20</sup> *Id.*

<sup>21</sup> *Id.*

<sup>22</sup> *Id.*

<sup>23</sup> *Id.*

<sup>24</sup> *Id.*

<sup>25</sup> *Id.*

<b>Delivery</b>	The process of delivering work via contractors who perform home audits and/or retrofits. Contractors involved in delivering EEM programs.	<ul style="list-style-type: none"> <li>• Contractor certification</li> <li>• Audit to retrofit process</li> <li>• Measure guidelines</li> <li>• Quality assurance (QA)</li> </ul>
<b>Management</b>	Management of program by utility, implementer, and/or partner, and the measurement of energy/emissions savings that result from home retrofits.	<ul style="list-style-type: none"> <li>• Oversight</li> <li>• Documentation</li> <li>• Evaluation</li> <li>• Reporting</li> </ul>
<b>Sub-Part</b>	<b>Description</b>	<b>Examples (non-exhaustive)</b>
<b>Awareness</b>	Approach to increasing consumer awareness of the program and interest in participating. Includes messaging, consumer education, marketing channels, and marketing spend.	<ul style="list-style-type: none"> <li>• Direct mail and email</li> <li>• Billing outreach</li> <li>• House calls</li> <li>• Community events</li> <li>• Ad-hoc events and activities</li> <li>• Contractor co-op marketing</li> <li>• Community organizations</li> <li>• Participant spokespeople</li> <li>• Cross-marketing</li> </ul>
<b>Sub-Part</b>	<b>Description</b>	<b>Examples (non-exhaustive)</b>
<b>Participation</b>	Eligibility required for participation and incentives offered to drive participation. Encompasses process of income verification. Also includes targeting participants based on household income levels, age of home, climate zone location, neighborhood characteristics and/or participation in other low-income programs.	<ul style="list-style-type: none"> <li>• Homeowners/Renters</li> <li>• Single family/Multifamily</li> <li>• % of poverty line/% of median income</li> <li>• Homes with high energy usage</li> </ul>
<b>Contractor Management</b>	Recruitment, screening, and management of contractors who perform retrofit work, whether a single contractor for the whole home or multiple specialized contractors. Can include rewarding higher performing contractors and mentoring/training lower performing contractors. May address standardization of requirements across programs or geographic areas.	<ul style="list-style-type: none"> <li>• Contractor involvement in design and ongoing management</li> <li>• Certification and qualifications</li> <li>• Training</li> <li>• Consumer tool for accessing contractor network</li> <li>• Utility/contractor data sharing</li> <li>• QA and feedback process</li> </ul>
<b>Home Audits</b>	Process of performing the audit and how it integrates with the rest of the home	<ul style="list-style-type: none"> <li>• Blower door tests</li> <li>• Walk-through audits</li> </ul>

	retrofit process. Includes who conducts audit and what level of audit is performed.	<ul style="list-style-type: none"> <li>• Virtual audits</li> <li>• Utility, contractor, or third-party audits</li> </ul>
<b>Retrofits</b>	Scope of measures to be performed in each home, including guidelines for contractors on which measures to perform and at what cost. Could include measures beyond typical weatherization and/or address health and safety issues.	<ul style="list-style-type: none"> <li>• Air sealing and insulation</li> <li>• Duct replacement/repair</li> <li>• Windows</li> <li>• High efficiency heat pumps</li> <li>• High efficiency appliances</li> <li>• High efficiency light fixtures</li> <li>• Smart thermostats/smart plugs</li> <li>• Replacement of old wiring</li> </ul>
<b>Program Oversight</b>	Management of the program by the lead implementer, whether a utility, community organization, or third party. May include ongoing stakeholder and community engagement and revising program based on lessons learned.	<ul style="list-style-type: none"> <li>• Program design</li> <li>• Advisory/stakeholder group</li> <li>• Monitoring and evaluations</li> <li>• Revision of processes or requirements</li> </ul>
<b>Savings</b>	Measurement of the energy and emissions savings associated with home retrofits.	<ul style="list-style-type: none"> <li>• Deemed savings</li> <li>• Calculated savings/Modeling software</li> <li>• Actual savings/Utility bills</li> <li>• Impact of customer behavior</li> </ul>

Once the market framework for EEM programming was established, TVA identified a number of key elements to be addressed in program design for a regional approach as identified in Figure 3 below. It is recommended that similar key elements be identified during program design.

Figure 3. Key Design Elements for Extreme Energy Makeovers



Consideration of the elements detailed in the EPA, ACEEE, and TVA reports will provide the framework for a successful EE program. Next, this manual will address additional considerations for multifamily dwelling units.

### **Multifamily Program Design Considerations**

A multifamily low-income EE program requires different considerations than a single family program, due to a variety of factors including but not limited to the number of occupants, building design, building owner-tenant relationships, metering abilities, etc. A valuable resource specific to multifamily low-income EE program design is the report “Program Design Guide: Energy Efficiency Program in Multifamily Affordable Housing” published in May 2015 by the multi-agency working group Energy Efficiency for All.<sup>26</sup> The report suggests 12 actionable best practices for policymakers, regulators and program administrators to better reach multifamily affordable housing (MFAH) stock. The 12 actionable best practices are provided, in their entirety, hereinbelow.

*While the 12 recommendations may be directed at MFAH they provide important considerations for all low-income EE program planning:<sup>27</sup>*

<sup>26</sup> Recommendations from this report are also beneficial for single family households.

<sup>27</sup> Energy Efficiency for All, May 2015, “Program Design Guide: Energy Efficiency Programs in Multifamily Affordable Housing”.

## Policy and Planning

1. **Establish a goal to capture all cost-effective efficiency in MFAH.** To reach MFAH, programs will require adequate funding levels sustained over time. It is important for a program to commit to capture all cost-effective efficiency in the sector. An important first step is to assess the EE potential in the local MFAH building stock, including not only the direct potential energy savings, but also non-energy benefits, and long-life measures. A commitment to capture all cost-effective efficiency will give program teams the needed support and flexibility to implement good programs with a process of continual improvement.
2. **Assure coordination and count savings across electricity, gas, and water programs.** Efficiency projects in MFAH often result in savings in electricity, gas, and water. Because these utilities are often supplied by different entities, there is risk that utilities may not encourage projects that aim at comprehensive savings. There are models that help solve these problems, including a cost-effectiveness framework that creates incentives for comprehensive projects by allowing the lead utility to capture the value of savings across all fuels and water, or apportioning the costs and benefits to the appropriate utility. It is important for program administrators to engage with counterparts at other utilities on methods to assure that opportunities for savings in all resources are explored early in efficiency projects.
3. **Assure that cost-effectiveness tests work for MFAH.**
  - a. Account for non-energy benefits. Non-energy benefits (or non-energy impacts) include many very real values directly resulting from efficiency projects, such as health benefits (for instance, from reduced mold as a result of better humidity control) and reduced maintenance costs. Because these values are often hard or costly to measure with precision, they have often been excluded from cost-effectiveness tests. They should be included; the uncertainty associated with approximate values is better than systematic undervaluation.
  - b. Apply cost-effectiveness tests across a portfolio. Programs targeting MFAH should be treated with some flexibility due to the unique challenges of the building sector. Cost-effectiveness thresholds should be met at the portfolio level. This flexibility allows cost-effectiveness to be achieved without applying a formulaic approach to every project or program.
4. **Improve building owners' access to energy usage information.** Access to basic information on the energy performance of their buildings is a problem for many owners of multifamily affordable buildings, especially for those buildings with separately metered units. Utilities must be partners in the endeavor to remedy information barriers. Utilities should assure they have good processes for delivery of whole-building utility

usage information to building owners. First, regulators should assure utilities have express authority to aggregate information from multiple individual customer accounts into a whole-building energy usage summary for building owners. Second, utilities should offer processes that help the owner obtain the information with minimum practical difficulties, such as through an automated download to benchmarking tools.

## **Program Design**

5. **Develop programs specifically targeted to MFAH.** MFAH is a unique, specialized building sector. Regulators and administrators must tailor programs to the MFAH sector. It is not enough to make MFAH eligible for other residential or commercial programs. In addition, program administrators should tailor outreach and program features to specific building types. Groups to target include subsidized housing, such as buildings that receive assistance from the U.S. Department of Housing and Urban Development (HUD), buildings financed with low-income housing tax credits, and those with central cooling and heating. Master metered buildings should also be a target because owners may be more receptive to efficiency improvements with all energy savings realized directly on the owner's utility bill.
6. **Structure incentives for whole-building savings.** Tying incentives to the amount of efficiency realized in the whole building encourages the owner to implement the combination of measures most likely to produce the highest levels of savings. Prescriptive incentives, such as contributions to lighting projects or appliance replacement, can also be useful, but should not be the only pathway to obtain or determine incentive levels for larger projects.
7. **Assure incentives are reliable at project outset.** Building owners should be able to determine the amount of incentive contributions at the time projects are likely to be approved and budgeted. "Pay for savings" incentives can fit this model if they are based on estimates at project design and do not depend on post-project measurements.
8. **Support benchmarking, audits, and other assessments.** Incentives for intensive energy audits (e.g., ASHRAE Level II) are a common program feature and a best practice, but it is important to also support owners performing benchmarking and less intensive energy needs assessments to approximate the efficiency potential in their buildings.
9. **Support a "one-stop shop" for building owners to access integrated program services.** Program experience shows that building owners benefit from access to people who can help navigate program offerings and provide project development and technical assistance, such as initial assessments, audits, and project support. The individuals in a "one stop shop" can become trusted advisors to local building owners. The people in this

function should be specialists and empowered to build relationships with local partners, such as lenders, contractors, and utility staff. It is important also to preserve flexibility for building owners to use other resources for certain functions—they should not be required to use a “one stop shop” as the exclusive path to all program offerings.

10. **Build partnerships with key local market participants.** Reaching owners and other key people at properties that can benefit from efficiency measures is often a challenge for efficiency programs, even with very appealing incentive packages. Establishing relationships and partnerships with local market participants is essential and will enable much greater market penetration. One of the key tasks of an efficiency program administrator should be to engage with partners in the local MFAH market, including state housing finance agencies, community development financial institutions (CDFIs), local WAP providers, multifamily lenders, and housing development departments.
11. **Help building owners finance efficiency projects.** It is difficult for most owners of MFAH to obtain a new loan for the purpose of funding an efficiency project. Program administrators should consider these strategies to help building owners obtain needed financing:
  - a. Target incentives to fit with conventional building financing events. Both owners and lenders may be most open to financing an efficiency project when the added funds needed are included with a purchase, refinancing, or rehabilitation loan. This is the time when owners and lenders normally consider and plan for capital improvements. Program administrators should seek to reach owners in preparation for conventional financing events, and incentive offerings should be tailored to owners in the conventional financing process, such as offering to fund a “green” physical needs assessment acceptable to a lender.
  - b. Partner with lenders active in the local market. Most markets have several lenders that handle a large amount of multifamily affordable financing (purchase, refinance, and rehabilitation loans), often including CDFIs with specialty products. Many multifamily lenders want to be in a position to educate their borrowers—building owners—on opportunities to obtain program incentives for improvements. Program administrators should seek to engage local and regional lenders to find ways to work together to reach owners in the process of planning refinancing, purchasing, or rehabilitating.
  - c. Explore on-bill payment arrangements. Implementing and operating a financing program can be challenging for any utility, but on-bill payment arrangement can enable certain building owners to undertake improvements they might not otherwise consider. On-bill payment arrangements can solve a problem for MFAH owners because the loan payment is offset by utility savings on the same bill, and therefore might not be treated as additional debt by existing lenders. Program administrators

should engage local property owners to understand whether an on-bill program would be valued in the market.

12. **Provide robust quality assurance.** Policymakers, lenders, property owners, and other key stakeholders need assurance that energy savings in MFAH buildings are real and lasting. This requires attention to quality assurance. Best practices include support for an energy analyst throughout the program process, so that energy audits, project specifications, project inspections, and other technical functions are conducted consistently. Training and monitoring of installation professionals and post-installation verification and quality inspections are important as well. Utilities have many compelling reasons to help make affordable housing more energy efficient—it captures cost-effective efficiency potential, provides residents with meaningful benefits, and helps to sustain affordable housing for the community.

### **Community Engagement in Program Design**

As a general technique for informing and structuring low-income EE programs, community engagement offers an effective and low-cost approach to solicit public involvement and community buy-in. Community members can identify the obstacles to reaching and serving traditionally underserved and/or underrepresented communities. Public participation is also an effective mechanism for maximizing public buy-in for programs on the front end. This section proposes a number of tools for engaging stakeholders: from listening tours, to workshops, to leveraging community rating systems.

#### **Conducting Listening Tours:**

Listening tours can benefit program development as they allow communities to verbalize their desires and expectations of EE programming. Ultimately, the community serves as a project consultant. Community meetings focused on soliciting community feedback – rather than providing community education – is a crucial step in program design. Addressing resident concerns is an important step in ensuring programming is built to fit the needs of the community members the program serves.

- **LOCAL EXAMPLE:**
  - [Tennessee Community meetings conducted by Southern Alliance for Clean Energy \(SACE\)](#)

### **The Alignment Research Collaboration (ARC) Engagement Process:**

Another strategy for ensuring community engagement is the ARC Engagement Process. The ARC Engagement Process is a four-phase approach intended to frame public engagement through a community's cultural lens. ARC utilizes:

- Alignment – this phase establishes a shared vision in order to achieve alignment for effective implementation of the process.
- Research – this phase grounds the engagement process in facts through the analysis of all stakeholders and key audiences.
- Collaboration – this phase of the process establishes a collective entity used to inform, develop and respond to a shared goal or specific outcome.
- Engagement – this phase seeks for the collective entity to work together to implement the founded principles of engagement by using shared outreach collateral and resources guided by the values that drive key audience members and best practices for developing messages and strategies that truly active them.

The ARC Engagement process is anchored in cultural awareness and values for achieving meaningful engagement with stakeholders and key allies. ARC Engagement identifies what it takes to activate stakeholders and key audiences through the analysis of perspectives and experiences, which leads to deeper, more meaningful engagement.

- **REGIONAL EXAMPLE:**
  - [SEEA ARC Engagement Process - A Model Process for Achieving Meaningful Engagement in Energy Planning and Decision-making](#)

### **DIY Workshops:**

Like listening tours, community workshops can serve as the “gateway” to increasing awareness and providing uptake of other EE programming. Workshops are a cost effective way to provide easy, no-cost and low-cost measures to residents, so they can save on utility bills while building trust (an oft-cited challenge when working in communities). TVA provides free energy kits to LPCs that provide DIY workshops. Instructions for ordering the kits are in the toolbox below.

- **LOCAL EXAMPLES:**
  - [TVA DIY Workshop Event Process for LPCs](#)
  - [TVA DIY Workshop Overview](#)

### **STAR Community Rating System:**<sup>28</sup>

The STAR system enables communities to assess their sustainability efforts and find data-driven opportunities for improvement. The results of the assessment can be utilized to inform low-income EE program design. This rating system also assists nonprofits, universities, businesses, and other institutions engaged in local sustainability to gauge the impact of programming. For more program specifics, the toolbox program design subfolder has a STAR slide deck overview.

- **LOCAL EXAMPLE:**
  - [City of Memphis – Office of Sustainability STAR Experience](#)

### **Funding and Technical Resources**

One of the most critical aspects to developing a sustainable low-income EE program is funding. TDEC has developed a resource matrix that outlines 30+ single and multifamily low-income EE funding opportunities and technical resources across 8 sectors.

See Appendix A for Funding Matrix.

### **Ratepayer Bill Assistance Program Types**

In addition to traditional grant funding, LPCs can utilize ratepayer bill assistance programs. While these programs are not designed to increase EE, they are designed to reduce energy burden for low-income ratepayers. Examples of existing bill assistance funding models with local examples are provided below.

#### **LPC Round up Programs:**

A round up program model functions by enlisting customers of utilities to agree to have their utility bill rounded up to the next whole dollar amount; or in some instances rounded up plus a few additional dollars to support bill assistance programs for low-income customers. Utilities generally establish a round up program as either an automatic opt-in program or an opt-out program. Under the opt-out strategy utilities engage in a widespread, highly communicative effort to notify customers that at a certain date their bills will be rounded up to fund programming, customers must then opt-out of having their bills rounded up. Following the opt-in approach, utility customers must actively sign up to participate in the program. There are a number of considerations to take into account when determining whether to deploy an opt-in or opt-out program model. In particular, participation rates for Tennessee utility or coop run opt-out programs range from 50-85% whereas participation rates for Tennessee opt-in programs ranges from 1.5-5%. However, there are generally more negative responses to opt-out programs from customers who failed to understand the implications of the program.

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<sup>28</sup> The STAR Community Rating System is a framework and certification designed by the nonprofit entity Star Communities.

- LOCAL EXAMPLES:
  - [Knoxville Utilities Board \(KUB\) Round It Up Program in Knoxville](#)
  - [Memphis Light, Gas and Water's \(MLGW\) Share the Pennies Program in Memphis](#)

### **LPC Pre-Paid Programs:**

Pre-paid programs are not explicitly considered a low-income EE program or solution. Instead, they allow LPCs to work with customers (often low-income) to help conserve electricity based on a pre-determined deposit for utility bills.<sup>29</sup> This program model is more pervasive among rural co-ops than among municipalities. Under this model, eligible participants are allowed to deposit amounts of money into their account, when and how often they want, for the purposes of prepaying their utility expenses. Pre-paid programs also allow consumers to track daily balance—online or by phone—adding funds as needed in order to maintain a positive account status. A review of relevant customer protections laws should be completed as part of the planning and design process.

- LOCAL EXAMPLE:
  - [Appalachian Electric Cooperative FlexPay Program \(Note: there are several other examples in Tennessee\)](#)

### **Single and Multifamily Low-Income Energy Efficiency Program Types**

This section identifies low-income EE program examples from other states, non-profits, and utilities. Established single and multifamily low-income EE programs tend to fall into one of four types: rebate programs, one stop shopping programs, on-bill programs, and commercial property assessed clean energy financing (PACE). The structuring and implementation of these programs is outlined below, drawing from examples of robust programs established across the country.

### **Incorporate Direct Installation and Rebate Programs**<sup>30</sup>

Utilities and public grants often provide direct installation and/or rebates for EE projects, which serve to incentivize developers to invest in EE measures for their multifamily rental properties. These programs are structured to target landlords, and not tenants, but the benefits are also realized by tenants through lower utility bills. Some examples of these programs include:

- Puget Sound Energy, a direct installation program funded by several utilities in Washington, offers a multifamily retrofit program that provides prescriptive rebates for

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<sup>29</sup> While questions still remain regarding whether pre-paid programs result in reduced electricity consumption, proponents of such programs note that by heightening awareness of money dedicated to utility expenditures, customers take action to reduce electricity consumed.

<sup>30</sup> ACEEE. May 2014, "Recommendations and Best Practices for Revising Multifamily Incentive Structure".

equipment and free onsite energy audits. Following the energy audit, the building owners are given retrofit options, such as low flow shower heads and insulation, and then a plan is built for their specific property. The Puget Sound Energy program has reached 49% of the multifamily buildings in its territory and 345 of the buildings underwent EE projects.

- Chicago Multifamily Comprehensive Efficiency Program, offered by four utilities in the Chicago area, is another rebate program that offers EE upgrades and incentives to building managers and owners. Like Puget Sound Energy, this program begins with a free assessment and customized report of recommendation and eligible EE incentives and rebates. The building owners are eligible for free energy products and installations and are also offered discounted contractor-delivered services through standard and custom rebates.
- Austin Energy's long-running multifamily rebate program starts with a free onsite rebate audit which gives property owners options for EE measures and an estimated rebate amount. Owners then choose which measures they will install, including windows, insulation, air duct sealing, solar window screens, and lighting. In order to ensure savings for tenants as well as owners, Austin Energy requires that measures be installed throughout the property. Since its launch in 1989, the program has reached a large share of the multifamily housing units in Austin, including 90% of the largest existing communities (those more than 5 years old with over 200 rental units).
- The Energy Trust of Oregon (ETO) Existing Multifamily Program, funded by several local utilities and rebate programs, offers incentives to building owners through one application process regardless of whether the measure is installed in units or common areas. Each ETO business development staff member works with a sub-segment of the multifamily market (e.g., affordable or condominiums) to develop relationships with owners and guide them through the application process. To further streamline the process and capture opportunities when equipment fails and needs to be replaced, ETO works upstream with major equipment distributors. With no need for the owner to apply, the distributor applies the value of the incentives directly to buy down the cost of energy-efficient products. The distributor then collects all the information that ETO needs from the owner in order to process the incentive payment. The upstream incentives make participation easier and quicker, increasing project volume and lowering transaction costs for property owners as well as for the program administrator. The upstream incentives helped ETO reach more than double the number of properties in 2012 compared to 2011 before the incentives were in place.

## **One Stop Shopping Program**<sup>31</sup>

This program model offers a unique format for customer contact. By having one point of contact for building owners interested in EE programs, this program model reduces the steps to undergo EE measures. The process performs an energy assessment for whole buildings and/or individual units to identify the most cost-effective investments and options for low cost financing, rebates, and incentives at the same time. Examples of this type of program model include:

- Funded by Illinois utilities, federal, state, and local foundations and run by Elevate Energy and Community Investment Corp., the Energy Savers Program delivers free energy assessments, follow up consultations to identify cost-effective investments, and access to low cost financing/rebates/incentives, as well as contractor oversight. On average, this program provides 30% cost savings on utilities.
- The Mass Save Low-Income Multifamily Retrofit Program (LIMF),<sup>32</sup> funded by Massachusetts gas and electric utilities as determined by the Program Administrators (PAs)<sup>33</sup> and federal, state, and local funds, is a low-income multifamily retrofit program that provides building owners with one year's access to an online benchmarking tool, two whole-building assessments to identify energy-saving opportunities, and installation of no or low cost EE measures that meet the program's cost-effectiveness test. LIMF's focus on whole- building systems has contributed to an average gas savings of more than 20%.
- Energy Smart Colorado began focusing on multifamily housing in 2012 with \$4.9 million in seed funding from the EE and Conservation Block Grant through DOE's Better Buildings Neighborhood Program. It operates throughout the state and has 3 service centers throughout the state. This program focuses on access to information for customers and contractors through an online platform that showcases targeted incentives/rebates and eligible parties.
- The target market for this particular TVA program is 20-year old homes or older located in lower-income communities. This program was established with the goal of an energy usage reduction of 25% per home and February 1, 2017, as a completion date for implementing all projects. Knoxville, Tennessee was chosen as one of the target communities in April 2015<sup>34</sup> and will receive \$7.12 million to improve the EE of lower-

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<sup>31</sup> ACEEE. May 2014, "Recommendations and Best Practices for Revising Multifamily Incentive Structure".

<sup>32</sup> Mass Save, December 2014, "Low-Income Multifamily Retrofits: Program Guide".

<sup>33</sup> The PAs are electric and gas investor-owned utilities and municipal aggregators that administer LIMF and other Energy Efficiency programs in the state. The LIMF PAs are Berkshire Gas, Cape Light Compact, Columbia Gas, Liberty Utilities, National Grid, Eversource Energy (NSTAR), Unitil, and Western Massachusetts Electric Company (WMECo).

<sup>34</sup> Cleveland Utilities, Huntsville Utilities, 4-County Electric Power Association and Columbus Light & Water were also selected as target communities.

income homes in Knoxville using the whole house approach.<sup>35</sup> With the funding, the Knoxville-Knox County Community Action Committee plans to offer EE retrofit services to over 600 local homes between summer 2015 and fall 2017.

### **On-bill Programs**<sup>36</sup>

On-bill programs are a means for consumers to repay financing for energy-related improvement.<sup>37</sup> These programs are most commonly implemented as either a loan or tariff that is added onto a customer's monthly electricity or natural gas bill, but can also take the form of an energy service agreement. The EE sector has several different terms for the various types of on-bill programs. Below are descriptions of the three most common on-bill models as defined by ACEEE<sup>38</sup>, although most programs tend to include organization specific nuances to their on-bill program:

- **On-bill financing (OBF).** Under an OBF program the utility is the lender. Ratepayer funds collected for energy efficiency programs are the most common funding source, but utility shareholder funds can also be used. OBF is more commonly used than on-bill repayment, possibly because it does not require outside partnerships or agreements. Furthermore, some OBF programs were initiated in the late 1970s and early 1980s, when the interest rate environment made sourcing private capital expensive. The benefits of OBF include the fact that utilities can run the programs entirely in-house and no cost is associated with negotiating terms or recruiting third-party capital providers.
- **On-bill repayment (OBR).** In an OBR scheme, the capital provider is a third party and the utility operates as a repayment conduit for that third-party capital provider. A utility may opt to use its own funds to offer administrative support or credit enhancements. OBR leverages private capital; this can benefit utilities that either do not wish to loan out their own funds to support an on-bill program or do not wish to use ratepayer or public funds for this purpose.<sup>39</sup> OBR can have multiple types of structures, but three receive the greatest attention; (1) In the first model, initial lending is funded by the utility and the resulting customer revenue streams are sold to third-party capital providers (resembling

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<sup>35</sup> A "whole-house approach" refers to the evaluation and upgrade of the home's thermal envelope (the space the homeowner wants heated and cooled – involving insulation and air sealing), the home's appliances, doors and windows, lighting, and the energy systems (HVAC, including duct system; water heater). Health and safety issues would be evaluated as part of the process and addressed on an "as needed" basis. Smart Communities- Extreme Energy Makeovers FAQs.

<sup>36</sup> Green for All, September 2013, "On-Bill Programs that Advance Multifamily Energy Efficiency" and National Conference of State Legislatures, April 2015, "On-Bill Financing: Cost-Free Energy Efficiency Improvements".

<sup>37</sup> State and Local Energy Efficiency Action Network – Financing Solutions Working Group, May 2014, "Financing Energy Improvements on Utility Bills: Market Updates and Key Program Design Considerations for Policymakers and Administrators".

<sup>38</sup> See ACEEE, "On-Bill Energy Efficiency", <http://aceee.org/sector/state-policy/toolkit/on-bill-financing>.

<sup>39</sup> OBF funding is limited by what the utility or commission is willing to allocate to financing; in contrast, OBR can make more funding available through financial institutions.

securitization). (2) In the second model, third-party capital is secured upfront (via a bond sale or other financing agreement) prior to the lending process; so, unlike the first model, utility funds are not used for initial capitalization here. (3) The third model is open market: the utility acts as a matchmaker between third-party capital providers and customers, but does not pool or warehouse any financial agreements. OBR's primary funding source is third-party capital—that is, capital provided by non-utility, qualified lenders, such as banks, community development financial institutions (CDFIs), or private investors. This capital typically does not include other taxpayer-sourced funding; for example, a program capitalized with Regional Greenhouse Gas Initiative proceeds would be considered OBF, rather than OBR. Utilities can help support OBR programs with their own funding by funding staff time or providing credit enhancements. These credit enhancements—such as interest rate buy downs or loan loss reserves—make lending more attractive to third-party capital providers, which may result in better lending terms for customers.

- **Tariffed on-bill (TOB).** In a TOB program, efficiency upgrades are financed not through a loan, but rather through a utility offer that pays for upgrades under the terms of a new, additional tariff. This tariff includes a cost recovery charge on the bill that is less than the estimated savings. The on-bill charge is associated with the meter at the address of the property or facility where upgrades are installed, and the cost recovery charge is treated as equal to other utility charges on the bill. TOB programs use both public and private capital. In these programs the cost recovery for an efficiency upgrade investment is tied to the property's meter rather than the property owner. Thus tariffs remain in force regardless of a change in occupancy, whether that is due to a new tenant, a point of sale, or a foreclosure. New occupants are obligated to pay tariffed charges until utility cost recovery is complete. In most TOB programs, customers can accelerate cost recovery payments for any reason. Because tariffs are attached to meters rather than individuals, TOB programs can invest in upgrades to rental properties, and upgrades can be made at any site regardless of the occupant's income or credit score. Further, assigning cost recovery to meters makes these investments more attractive to occupants, who can pass on the improvement financing responsibilities if they move before cost recovery is complete. TOB programs are designed to ensure immediate net savings for customers. Should efficiency upgrades fail to function as expected, program implementers will fix or replace equipment at their own cost.

According to a May 2014 report, there are 25 states, including Tennessee,<sup>40</sup> which have implemented or are about to implement an on-bill program.<sup>41</sup> On-bill programs are often popular

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<sup>40</sup> TVA offers an OBR program aimed at the residential sector, but not specifically low-income or low-income multifamily inhabitants. As of May 2014 it was the largest OBR program, at \$500 million, in the country.

because of their simplicity: consumers just have to pay their regular utility bill, which now includes payment for EE measures.<sup>42</sup> The growth of on-bill EE programs within low-income and multifamily housing communities will rely on access to lending institutions (including federal lending programs) able to provide low-cost financing.

Depending on the structure of the program, benefits of tariffed on-bill financing may include reduction or elimination of first costs for customers, alignment of timing of costs and benefits of EE measures, leveraging of existing billing relationships between customers and utilities, ability to transfer debt across owners/tenants allowing financing to be tied to a property (often through the meter), and concurrent operation with a rebate program to reduce the total amount financed. In on-bill programs, the monthly energy savings are equal to or greater than the repayment charge, which generates an immediate positive cash flow.

There are also some barriers to on-bill programs. For instance, with utility-funded programs, or programs where the utility takes on a loan in order to capitalize the program, the utility may not have the expertise, means, or desire to become lending institutions, especially to low-income individuals who may have trouble meeting loan approval requirements. Too, this type of program may require a redesign of utilities' billing systems to accommodate adding a surcharge to an existing bill. Finally, financing for projects that generate savings for multiple fuels can be tricky—e.g., should electric customers help pay for natural gas or oil savings?<sup>43</sup> Some examples of these programs include:

- In North Carolina, Roanoke Electric Cooperative, through their tariffed Upgrade to \$ave on-bill finance program, is leveraging a \$6 million low-interest loan guarantee through the US Department of Agriculture's Energy Efficiency and Conservation Loan Program. Upgrade to \$ave launched in 2015 and has retrofitted more than 200 homes -- primarily low-income households -- with an estimated 800 homes being retrofitted over the first four years of the program. Gross savings from the EE improvements average more than \$80 per month, per participating member, while monthly repayments to Roanoke EC average just over \$60 per month, resulting in an average net savings of more than \$20 per month.
- In New Jersey, PSE&G's Multifamily Housing Program, in collaboration with New Jersey Housing and Mortgage Finance Authority, provides upfront interest-free financing and incentives that cover the cost of eligible EE improvements. This on-bill program began in 2010 with \$39 million in capital from PSE&G and has 16,258 units enrolled and

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<sup>41</sup> State and Local Energy Efficiency Action Network – Financing Solutions Working Group, May 2014, " Financing Energy Improvements on Utility Bills: Market Updates and Key Program Design Considerations for Policymakers and Administrators".

<sup>42</sup> *Id.*

<sup>43</sup> ACEEE, April 2012, "On-Bill Financing for Energy Efficiency Improvement".

has achieved annual savings of over 9.7 GWh of electricity and 2.5 million therms of natural gas.

- MPower Oregon aggregates grants and incentives so that customers repay only 75% of the total project investment through a monthly fee on their utility bill. The program began in 2013 with \$8.1 million in program funds from a HUD grant and a private lender and has upgraded 2,500 units since 2014.

### **(Commercial) Property Assessed Clean Energy Financing (PACE)**<sup>44</sup>

This program model is similar to on-bill programs, but financing repayment is paid through property taxes and assessments instead of being added to the utility bill. A PACE assessment is a debt of property, meaning the debt is tied to the property as opposed to the property owner(s), so the repayment obligation may transfer with property ownership depending upon state legislation.<sup>45</sup> This eliminates a key disincentive to investing in energy improvements, since many property owners are hesitant to make property improvements if they think they may not stay in the property long enough for the resulting savings to cover the upfront costs. In the existing programs, local governments finance the up-front costs of the improvements and the owners repay the cost as a line item of their property tax bills.

The benefits of this program structure include secure financing for comprehensive projects over a long term, a repayment obligation that passes with ownership, and it allows the local government to encourage EE and renewable energy without putting their general funds at risk. The drawbacks of this program structure include significant legal and administrative expenses for program set-up and mortgage holder approval, creating a lien concern, especially if there are junior liens involved. More specifically, because PACE financing is via property tax assessments, under traditional lending practices PACE liens become senior to existing mortgages on a property.<sup>46</sup> Some states, such as Maine, subordinate PACE liens to general property taxes and primary residential mortgages, which will allow the first mortgage loan to be underwritten to Fannie Mae's standard guidelines.<sup>47</sup> Finally, scale is required to reduce costs under PACE programs so these programs may not be cost effective in small towns.

This program model was used in Washington, D.C. to provide EE upgrades to a building that houses low-income tenants. PACE financing was especially attractive for this market segment

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<sup>44</sup> PACE enabling legislation has been unsuccessful in Tennessee. ACEEE. May 2014, "Recommendations and Best Practices for Revising Multifamily Incentive Structure".

<sup>45</sup> U.S. Department of Energy (DOE), March 2013, "DOE Clean Energy Financing Guide: Commercial Property-Assessed Clean Energy (PACE) Financing".

<sup>46</sup> Arizona State University Energy Policy Innovation Council, February 2014, "Property Assessed Clean Energy (PACE): What is it, and can it be implemented in Arizona?".

<sup>47</sup> Fannie Mae will not purchase mortgage loans secured by properties with an outstanding PACE loan unless the terms of the PACE loan program do not provide for lien priority over first mortgage liens, Fannie Mae, September 2015, <https://www.fanniemae.com/content/guide/selling/b5/3.4/01.html#Overview>.

because the property tax assessment repayment mechanism could be accounted for as an operating expense and not debt. The EE improvements have reduced energy use by 15% with annual benefits totaling \$40,000 due to lighting improvements, installed control systems, and solar installation.<sup>48</sup>

### **Pay-for-Success (PFS) Model**

PFS is an approach to “contracting that ties payment for service delivery to the achievement of measurable outcomes. The movement towards PFS contracting is a means of ensuring that high-quality; effective social services are working for individuals and communities.”<sup>49</sup> The PFS model leverages up-front capital to shift financial risk from a traditional funder, usually government, to a new investor.<sup>50</sup> These programs often rely on “evidence-based social programs to improve outcomes for a vulnerable population.”<sup>51</sup> According to the Nonprofit Finance Fund, by early 2017 there are over a dozen projects underway using the PFS model, with more than 50 projects in development.<sup>52</sup> “To date, PFS projects have been designed to address a range of issues, including homelessness, recidivism, and early childhood education.”<sup>53</sup>

Figure 4. PFS model overview<sup>54</sup>



<sup>48</sup> Full case study available at <http://pacenation.us/wp-content/uploads/2013/09/9.18.2013-DCPACE- HUD-Case-Study.pdf>.

<sup>49</sup> Nonprofit Finance Fund, “What is Pay for Success?”, <http://www.payforsuccess.org/learn/basics/>.

<sup>50</sup> Urban Institute, “What is pay for success (PFS)?”, <http://pfs.urban.org/pfs-101/content/what-pay-success-pfs>.

<sup>51</sup> *Id.*

<sup>52</sup> Nonprofit Finance Fund, “What is Pay for Success?”, <http://www.payforsuccess.org/learn/basics/>.

<sup>53</sup> *Id.*

<sup>54</sup> For more information visit Nonprofit Finance Fund’s website on PFS at <http://www.payforsuccess.org/learn/basics/>.

While the majority of PFS programs have been focused on social services and social outcomes, the PFS model has been shown to be effective in reducing utility bill costs for government owned multifamily units by implementing EE measures. There have been several proposals for federal legislation to develop a PFS model to leverage private capital for EE upgrades at HUD supported multifamily properties.<sup>55</sup> “HUD currently spends about \$7 billion each year on utility bills in government-supported properties. Through straightforward retrofits that will improve the energy and water efficiency of these buildings, HUD could potentially cut utility costs by up to 20 percent—before accounting for upfront costs—while meaningfully reducing instances of asthma and other health problems for residents.”<sup>56</sup> Figure 4 provides an overview of the investor, intermediary, and partner relationships under a PFS model. A regional example of a PFS program targeting health outcomes for Memphis is the Memphis Healthy Homes Partnership, which is working with Green and Healthy Homes Initiative (GHHI). The Asthma and Allergy Foundation of America named Memphis as the “Asthma Capital” of the nation in 2015 due to the high rate of asthma related hospitalizations and emergency doctor visits, especially amongst pediatric patients. Asthma related emergency doctor visits in Shelby County led to an annual cost of \$54 million in 2013 alone.<sup>57</sup> The Memphis Healthy Homes Partnership seeks to deploy a PFS model in Shelby County to fund home renovation and improvement work, with the projected outcome of reducing asthma conducive-environments, and reducing doctor and hospital service visits for the population. These upgrades will focus on home air quality upgrades and eliminating asthma antagonizing stimuli, while offering secondary non-health benefits, such as reducing energy burden.

- LOCAL EXAMPLES:

- [Green Healthy Homes Initiative Overview and Approach](#)
- [Memphis Healthy Homes Partnership Feasibility Report \(October 2016\)](#)
- [Tennessee Department of Health –Guide to a Healthy Home](#)
  - [TN Healthy Homes Resources](#)

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<sup>55</sup> Enterprise Community Partners, Inc., “Bipartisan House Bill Authorizes HUD Pay-For-Success Demonstration”, <http://www.enterprisecommunity.org/news-and-events/news-releases/bipartisan-house-authorizes-hud-pay-for-success-demonstration>.

<sup>56</sup> *Id.*

<sup>57</sup> GHHI, October 2016, “Pay for Success Financing to Address Childhood Asthma in Memphis: Feasibility Study Final Report”. “TennCare is the source of payment for 67% of combined inpatient and outpatient costs for the pediatric population”.



## **PHASE TWO: IMPLEMENTATION**

**This is where rubber meets the road. Once funding, partners, and program design are in place, it's time to put planning in action and implement programming. The hard work of careful planning yields smooth implementation.**

## Audit and Homeowner Education Resources

Homeowner and renter education is an important tenet of a successful EE program. Most EE programs seek to implement larger EE investments in homes or buildings; however there are a number of simple strategies that homeowners and renters can utilize to make their homes use less energy. Education programs are also important in helping homeowners and renters better understand vulnerabilities in their residences, such as hotspots for leaking or wasting energy, and maximizing the effectiveness, optimal operation, and longevity of EE measures implemented. As an example, a home heating system is not just a furnace—it's a system designed to deliver heat, which starts at the furnace and moves heat throughout a home. Even a top-of-the-line, EE furnace will waste a significant amount of fuel if the ducts, walls, attic, windows, and doors of a home are leaky, poorly insulated, or not routinely cleaned.<sup>58</sup> On average a U.S. family spends \$2,200 a year on home utility bills; when pairing short term strategies and larger EE investments, these costs can typically be lowered by 25%.<sup>59</sup>

- LOCAL EXAMPLES:

- [DOE Energy Savers Home Booklet](#)
- [Hands On Nashville's Homeowner Handbook](#)
- [Hands On Nashville Recruitment Flyer](#)
- [TVA No Cost Energy Saving Tips Winter](#)
- [TVA No Cost Energy Saving Tips Summer](#)
- [TVA eScore Self Audit Form](#)

## DIY Workshop Resources

Technical resources to support facilitating DIY workshops can be found in the local examples provided below. A few tips to ensure a successful workshop include:

- General
  - Provide food during the workshop and door prizes awarded at the conclusion of the workshop
  - Engage audience by asking open ended questions
  - Retool and use some of the slide decks in the resource annotations
  - Provide extra program folders and establish a referral program if possible
  - Consider using a train-the-trainer peer model for workshops (review Pete Street Material resource annotation for an effective example)
  - For small groups, arrange the chairs in a circle to encourage dialogue
  - Provide coloring books/crayons for kids
  - Limit content to 30-60 minutes

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<sup>58</sup> U.S. DOE – Energy Efficiency & Renewable Energy, May 2014, “Energy Saver: Tips on Saving Money & Energy at Home”.

<sup>59</sup> *Id.*

- Consider scheduling workshops on weeknights and weekends, when participants are more likely to be available
- Provide good signage
- Host the workshop at a central, accessible, and well-known community location. Confirm A/V logistics available at workshop site in advance, or make sure to bring A/V resources.
- Use multiple communications channels to promote the workshop. If possible commit to a regular set date such as the first Monday night and second Saturday morning of the month to allow promotional materials to last longer.
- **Experiential**
  - Pass around materials such as bulbs, caulk, low-flow sink aerators as props, or set up simple demonstration stations if possible
  - Ensure participant sign in and sign a data release form to allow for data tracking
  - Work with the LPC to get free TVA energy kits ordered
- **LOCAL EXAMPLES:**
  - [Empower Chattanooga Workshop Resources](#)<sup>60</sup>
  - [Hands On Nashville's Workshop Manual](#)
  - [Appalachia CARES 10 Tips for Becoming More Energy Efficient](#)

## **Homeowner Outreach**

Outreach is made most effective when focused towards an intended audience. Knowing how your target audience consumes information is vital to ensuring your message will be heard. A common mantra in the sales world is that it takes 6-8 touches to generate a sale. The same holds true in the education space and getting community members to attend a workshop or take action takes multiple messages. Don't consider one or two methods of outreach adequate.

### **Heat Maps:**

Heat maps are a highly effective method for pinpointing a target demographic using income data, housing data, and energy use data. GreenSpaces as well as the City of Knoxville in collaboration with the KEEM program have used this outreach approach to identify potential program participants. Appalachian Voices was able to use Google Maps to make a more simplistic map for Appalachian Electric Cooperative that allows them to conduct targeted marketing to the members that need it most.

- **LOCAL EXAMPLE:**
  - [KUB Heat Map](#)
  - [Appalachian Electric Cooperative – Presentation on Heat Mapping](#)

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<sup>60</sup> This includes a post-workshop survey, examples of a mail out informational card, and useful diagrams.

### **Strategic Partnerships:**

LPCs partnering with entities that already provide social or educational services to their target demographic can reduce marketing and administrative redundancy.

- Mailing an “outreach kit” to your program partners on a quarterly basis is an easy way to refresh their lobby with flyers and program information. Including ready-made program blurbs that partners can add to their existing communications and eNewsletters is an effective way to increase outreach capacity.
- Creating posters with contact pull tabs and placing them at libraries, community centers and social services agencies is a great way to create awareness with hard-to-reach demographics that don’t have access to the internet.

A local example of a strategic partnership is the EnergySmart Memphis program that was conducted by Memphis Light, Gas and Water (MLGW) partnered with City and County government agencies, community development corporations (CDCs), non-profit organizations, and TVA.<sup>61</sup> EnergySmart Memphis was an energy education and home improvement initiative designed to help Memphians save money on their energy costs. Customers receive energy conservation training and eligible customers will have weatherization improvements made to their home. Additionally, MLGW has set aside funds to weatherize the homes of customers who meet federal poverty guidelines.

### **Train-the-trainer Model:**

A train-the-trainer model leverages experienced individuals to train peers in delivering information to others. Pete Street has developed a successful train-the-trainer model with a proven track record that leverages residents from within in the community to administer EE education through peer-to-peer learning. Both Hands On Nashville and GreenSpaces in Chattanooga have also used this model successfully.

- LOCAL EXAMPLE:
  - [Pete Street and Hands On Nashville Leader Guide](#)

### **SEED Youth Model:**

SEED is a Knoxville based nonprofit which has created a peer-to-peer workforce development model as part of TVA’s KEEM program to conduct effective homeowner outreach through door-to-door canvassing. This is a unique experiential education centered workforce development and outreach model that employs youth.

- LOCAL EXAMPLE:
  - [SEED Workshop Recruitment Methods](#)

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<sup>61</sup> EnergySmart Memphis, <http://www.mlgw.com/residential/energysmartmemphis>. Website states that more information will be announced in the future as more EnergySmart initiatives are developed.

### **Hands on Nashville’s Homeowner-to-Homeowner Referral Program:**

One approach to overcoming the trust factor when providing community based programming is relying on homeowner referrals to garner interest in EE programs. As part of homeowner agreement to participate in the Hands On Nashville Home Energy Savings Program, each homeowner is asked to provide the names and phone numbers of at least three other homeowners who may qualify for program participation. This outreach approach has proven to be extremely successful for this program.

### **Workforce Development Resources**

Supporting a well-trained workforce makes personnel more effective in their ability to perform EE work. A particular emphasis must be made to train and equip technical staff, who often act as the frontline in resident education and outreach. Workforce Development focuses on technical knowledge, practical skills, and positive attitudes to attain employment or improved work performance and to provide employers with an effective means to communicate and meet their demand for skilled laborer needs.<sup>62</sup> According to the World Bank, “in today’s economically-integrated and technologically-driven world, a well-functioning workforce development system is an asset that can help economies to compete and grow. It provides new and incumbent workers with up-to-date skills that help firms improve their productivity and competitiveness.”<sup>63</sup>

A 2008 report by the University of Wisconsin entitled “Greener Pathways: Jobs and Workforce Development in the Clean Energy Economy” offers a litany of examples as to why clean energy (including EE) workforce development resources and efforts are critically important. For example, a 2005 survey by the National Association of Manufacturers found that 90 percent of respondents reported a moderate to severe shortage of qualified skilled employees, such as machinists and technicians.<sup>64</sup> In Tennessee, TVA provides professional development training and resources through the eScore program for their Qualified Contractor Network. The nonprofit Green for All as well as the University of Tennessee Green Economy Initiative both offer an array of workforce development resources.

- **LOCAL EXAMPLE:**
  - [University of Tennessee Green Economy Initiative](#)

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<sup>62</sup> Jee-Peng Tan, Robert McGough and Alexandria Valerio, The World Bank Group, January 2010, "Workforce Development in Developing Countries: A Framework for Benchmarking".

<sup>63</sup> *Id.*

<sup>64</sup> National Association of Manufacturers, 2005, “2005 Skills Gap Report—A Survey of the American Manufacturing Workforce”.

## Measurement Tools and Techniques

When implementing an EE program it is important to carry out EM&V focusing on the effectiveness of specific EE measures at the individual project level as well as the broader program level successes. Phase Three of the resource manual addresses program level EM&V. Below are examples of field tools that exist to support EM&V efforts to assess EE effectiveness in individual participant spaces or at the project level.

### **Field Tools:**

- **Thermal Imaging:** provides an infrared thermal image of surfaces which allows the viewer to easily pinpoint where wall/ceiling insulation has fallen away/moved over time or if there is water damage behind walls.
- **Digital Camera:** utilize during audits to document what scope of work and provide a visual reference when purchasing materials for the project.
- **Light Meter:** provides an accurate reading of light levels in the home.
- **Air Quality Tools:** measure mold and particulates in the home that are harmful at elevated levels.
- **Data Loggers:** This field tool is set up throughout the home to track data points of the home for a more accurate diagnosis and whole house approach.
- **Duct Tester:** tests ductwork airtightness to determine if air sealing needs to be performed, duct pans can be used to pinpoint how air tight each duct run of the unit it to allow for more accuracy in air sealing.
- **Blower Door Tests:** A blower door is a machine used to measure the airtightness of buildings. It can also be used to measure airflow between building zones and to help physically locate air leakage sites in the building envelope. It provides a pre-project reading and a post-project reading to provide a % of air infiltration reduced. By using this on each project, programs are able to see what their average air infiltration reduction is.
  
- **EXAMPLES:**
  - [ExTech Instruments CFM/CMM Thermo Anemometer and InfraRed Thermometer Model AN200 User Manual](#)
  - [ExTech Instruments Digital Light Meter Model LT300 User Guide](#)
  - [RetroTec DucTester QuickGuide 341/342](#)
  - [RetroTec DM32 Blower Door QuickGuide](#)
  - [RetroTec QuickGuide DM32 Dual-Channel Digital manometer](#)
  - [RetroTec Cloth Door Panel QuickGuide](#)
  - [RetroTec Operation Manual: Testing Procedures Pressure and Air Leakage](#)
  - [RetroTec DucTester Operation Manual for Model 341](#)
  - [Plug Load Calculator](#)
  - [Input Watts Chart](#)
  - [TDEC Electricity and Plug Load Presentation](#)



## **PHASE THREE: EVALUATING PROGRAM SUCCESSES**

**It's impossible to quantify program success without data. This section covers qualitative and quantitative methods for understanding program performance.**

## Evaluating Program Successes

EM&V describes the process for determining project and/or program impacts. Evaluation efforts tend to be most focused on studying or assessing the effects of a program or an entity's entire portfolio of programs. Measurement and verification are the acts of data collection, measurement, monitoring, and analysis associated with determining energy and demand savings from individual sites or projects. As discussed previously, EM&V practices can be carried out at both the project and program level.

The process for evaluating EE program performance depends largely on the entity administering the program.<sup>65</sup> Utilities that implement low-income EE programming often have more rigorous EM&V mechanisms for assessing, establishing, and attributing energy savings, as well as a designated cost/benefit for projects.<sup>66</sup> In some instances state utility commissions will set state specific benefit cost-ratios for programs to meet. Tennessee is unique in the EE sector in that TVA, the federally-owned corporation, provides electricity to approximately 99.7% of the electricity service territory in Tennessee. TVA is self-regulated with regard to fuel mix and ratepayer-funded EE programs. As such, there is no state utility commission that mandates EM&V measures and/or benefit cost-ratios to LPCs. Therefore, in Tennessee EM&V would be set by the LPC or investor, depending on the program type. TVA still relies on EM&V for their programs. However, there is no centralized requirements amongst state LPCs to meet benefit cost-ratios or establish specific EM&V protocols.

## Methods for Evaluating Programs

A number of resources exist to help program administrators, state and local governments, and others involved in the EE sector perform portfolio, program, or project evaluations. Whatever resource or model is utilized to evaluate the success of a low-income EE program, there are two common objectives:<sup>67</sup>

- 1.) Document and measure the effects of a program; and
- 2.) Understand why those effects occurred and identify ways to improve current programs and select future programs to continue achieving desired effects.

The State and Local Energy Efficiency Action Network released a comprehensive report on methods for evaluation programs and program portfolios entitled "Energy Efficiency Program Impact Evaluation Guide" which clearly defines how to evaluate EE programs; portions of the report are reproduced here. There are three broad categories of EE program evaluation

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<sup>65</sup> Mary Shoemaker, ACEEE, April 2016, "Best Practices in Developing Energy Efficiency Programs for Low-Income Communities and Considerations for Clean Power Plan Compliance".

<sup>66</sup> *Id.*

<sup>67</sup> State and Local Energy Efficiency Action Network - Evaluation, Measurement, and Verification Working Group, December 2012, "EE Program Impact Evaluation Guide".

techniques that exist to help answer the evaluation objectives posed by most EM&V models: impact evaluations<sup>68</sup>, process evaluations<sup>69</sup>, and market evaluations<sup>70</sup>; with the most commonly used technique being impact evaluations.

*Impact evaluations are assessments that determine and document the direct and indirect benefits of an energy efficiency program. Impact evaluation involves real-time and/or retrospective assessments of the performance and implementation of an efficiency program or portfolio of programs. Program benefits, or impacts, can include energy and demand savings and non-energy benefits (sometimes called co-benefits, with examples being avoided emissions, health benefits, job creation and local economic development, energy security, transmission and distribution benefits, and water savings). Impact evaluations also support cost-effectiveness analyses aimed at identifying relative program costs and benefits of energy efficiency as compared to other energy resources, including both demand- and supply-side options.*

Impact evaluation will typically be reported in one of three common metrics; estimates of gross (energy and/or demand) savings<sup>71</sup>; estimates of net (energy and/or demand) savings<sup>72</sup>; or

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<sup>68</sup> State and Local Energy Efficiency Action Network - Evaluation, Measurement, and Verification Working Group, December 2012, "EE Program Impact Evaluation Guide".

<sup>69</sup> "Process evaluations: formative, systematic assessments of an Energy Efficiency program. They document program operations and identify and recommend improvements that are likely to increase the program's efficiency or effectiveness for acquiring Energy Efficiency resources, preferably while maintaining high levels of participant satisfaction." *Id.*

<sup>70</sup> "Market evaluations: assessments of structure or functioning of a market, the behavior of market participants, and/or market changes that result from one or more program efforts. Market evaluation studies may include estimates of the current market role of Energy Efficiency (market baselines), as well as the potential role of efficiency in a local, state, regional, or national market (potential studies). Market evaluation studies indicate how the overall supply chain and market for Energy Efficiency products works and how they have been affected by a program(s)." *Id.*

<sup>71</sup> "Estimates of gross (energy and/or demand) savings: These are the changes in energy consumption and/or demand that result directly from program-related actions taken by participants in an efficiency program, regardless of why they participated." *Id.*

<sup>72</sup> "Estimates of net (energy and/or demand) savings: These are the changes in energy consumption or demand that are attributable to an Energy Efficiency program. The primary, but not exclusive, considerations that account for the difference between net and gross savings are free riders (i.e., those who would have implemented the same or similar efficiency projects, to one degree or another, without the program now or in the near future) and participant and non-participant spillover (i.e., savings that result from actions taken as a result of a program's influence but which are not directly subsidized or required by the program). Net savings may also include consideration of market effects (changes in the structure of a market)." *Id.*

estimates of non-energy benefits (NEBs).<sup>73</sup> These measures are estimates because energy and demand savings as well as NEBs resulting from efficiency actions cannot be directly measured.<sup>74</sup>

Figure 5. Workflow and reporting for planning, implementing, and evaluating EE programs<sup>75</sup>

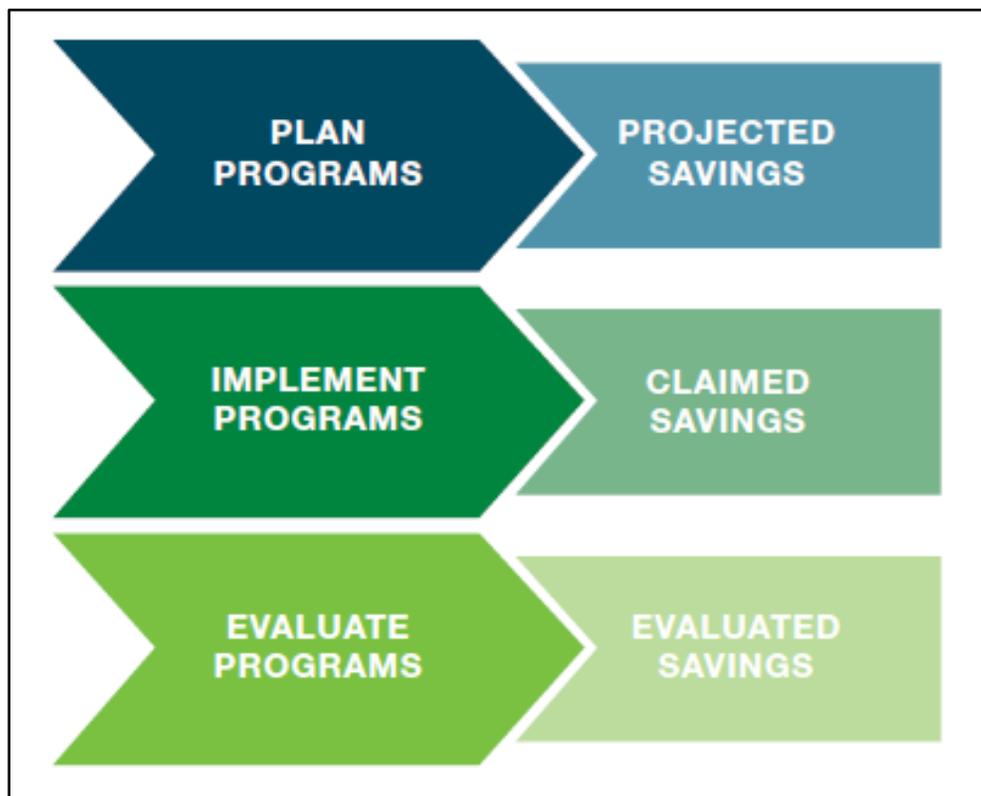


Figure 5 depicts the importance of estimating, measuring and verifying associated energy savings throughout the planning, implementing, and evaluation phases of a program. Throughout this process, savings values are based on estimates prepared as part of each activity. The “Energy Efficiency Program Impact Evaluation Guide” describes the different measures of energy savings as:

- Projected savings: values reported by a program implementer or administrator before the efficiency activities are completed

<sup>73</sup> “Estimates of non-energy benefits (NEBs): These are the impacts associated with program implementation or participation aside from energy and demand savings. These results can be positive or negative. Some examples include reduced emissions and environmental benefits, productivity improvements, jobs created and local economic development, reduced utility customer disconnects, greater comfort for building occupants, lower maintenance costs due to better equipment, or increased maintenance costs due to new and more complex systems.” *Id.*

<sup>74</sup> “The efficiency program process consists of planning, implementing, and evaluating activities. Throughout this process, savings values are typically indicated based on estimates prepared as part of each activity.” *Id.*

<sup>75</sup> *Id.*

- Claimed savings: values reported by a program implementer or administrator after the efficiency activities have been completed
- Evaluated savings: values reported by an independent third party evaluator after the efficiency activities and impact evaluation have been completed. The designation of “independent” and “third-party” is determined by those entities involved in the use of the evaluations and may include evaluators retained, for example, by the program administrator or a regulator.

The “Energy Efficiency Program Impact Evaluation Guide” outlines basic steps in planning impact evaluations:

1. Define the evaluation objectives and metrics in the context of the evaluated program’s (or portfolio’s) intended benefits, risks, and policy objectives.
2. Select appropriate evaluation approach(es) and prepare a program evaluation plan that takes into account the critical evaluation issues and the expectation for reliability (certainty) of evaluated impacts.
3. Define data collection requirements.

The “Energy Efficiency Program Impact Evaluation Guide” recommends the following steps to actually implement the impact evaluation:

1. Verify actual implementation of the program, for example, by confirming installation and proper operation of the EE measures. This usually also includes auditing and validating assumptions used in the program planning process and checking program tracking databases, project applications, and other documentation and related data records for accurate recording of information.
2. Determine first-year program energy (and demand) savings using one of the following approaches:
  - a. Measurement and verification (M&V): a project-by-project approach involving estimating energy and/or demand savings by determining the savings for a representative sample of projects and applying these projects’ savings to the entire population (i.e., the program). Options for conducting M&V are defined in the

International Performance Measurement and Verification Protocol (IPMVP)<sup>76</sup> and include two end-use metering options, billing regression analysis and computer simulation. The IPMVP approach determines gross savings values; net savings can be determined with program-wide adjustments to the gross savings values.

- b. Deemed savings values: stipulations based on historical and verified data (in some cases using the results of prior M&V studies). Similarly, deemed savings calculations are standardized algorithms. Both deemed savings values and deemed savings calculations should only be used with well-defined EE measures that have documented and consistent savings values. This approach determines gross savings values or net savings values, if net-to-gross ratios are included in the deemed savings values or calculations.
  - c. Large-scale consumption data analysis: uses metered energy use data to compare the energy use of the program participants with the energy use of a control group. The control group can be either program nonparticipants, as is the case with randomized controlled trials, or participants, as is the case with some quasi-experimental methods. If the program participants are used, their energy use before the program and after the program are compared; in effect, this means that each participant is his/her own non-random control group. All of these methods can provide results that are either gross or net savings values. In some cases, the three approaches listed above are combined, particularly the deemed savings and M&V approaches. Portfolios of programs also often use different approaches for different programs to determine total portfolio savings. Multiple-year programs may also conduct detailed measurement-based studies (e.g., M&V) for one year of the program and then apply the savings values (deemed savings) for other program years.
3. Convert, as needed, first-year gross program energy (and demand) savings to first-year net program savings using a range of possible considerations.
  4. Determine lifetime savings, which are the expected energy (and demand) savings over the lifetime of the measures that are implemented in the efficiency program. These savings are usually calculated by multiplying the first-year annual energy use reduction associated with the subject measures by the expected life of these measures with possible consideration of factors such as performance degradation or in some cases consideration of rebound (an increased level of service that is accompanied by an increase in energy use as a result of a program).

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<sup>76</sup> For more information on the IPMVP approach please reference U.S. Department of Energy "International Performance Measurement & Verification Protocol Concepts and Options for Determining Energy and Water Savings, Volume I."

5. Determine non-energy benefits using a range of subjective and objective analytical tools.
6. Determine the program's cost-effectiveness using one or more of the common cost-effectiveness tests. Inputs into these tests are the lifecycle net or gross energy and demand savings and possibly one or more non-energy benefits. See Appendix B for an overview of cost-effectiveness analyses. The evaluation approaches described in this guide are often referred to as "bottom-up" approaches because they add up the savings from measures and projects to determine program impacts, and they add up the impacts of programs to determine total portfolio impacts. Another evaluation category, called "top-down," uses approaches that rely on energy consumption data or per-unit energy consumption indicators (e.g., energy consumption per-unit of output or per person) defined by market sector, utility service territory, or a geographic region (e.g., a state or region). Top-down evaluation is not commonly used for evaluation of EE programs and portfolios, although interest in the approach is growing, and it has advantages over bottom-up evaluations.

In combination with these methods of program evaluation, entity and/or program specific evaluations are useful. A useful structure of planning documents to support the evaluation planning process includes the following:<sup>77</sup>

- **Evaluation framework.** A framework is a primary document that lays out evaluation principles, metrics, allowable approaches, definitions, and metrics for determination of gross and/or net savings, reporting requirements, schedules, and the roles and responsibilities of various entities. An evaluation framework document tends to be "fixed" for several years, but of course can be updated periodically. It often sets the expectations for the content and scope of the other evaluation documents. This is perhaps the principle document that all stakeholders can focus on and provide high-level input to—the "forest versus the trees" of evaluation planning.
- **Portfolio cycle EM&V plan.** This plan indicates the major evaluation activities that will be conducted during the evaluation cycle (typically one, two, or three years). It includes the budget and allocation among the programs, measures, and market sectors, as applicable.
- **Evaluation activity-specific detailed plans.** Evaluation plans are created for each of the major evaluation activities (typically the evaluation of an EE program but may include studies such as market assessments) in a given cycle prior to the time each activity is launched.

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<sup>77</sup> State and Local Energy Efficiency Action Network - Evaluation, Measurement, and Verification Working Group, December 2012, "Energy Efficiency Program Impact Evaluation Guide".

- **Project-specific plans.** Project-specific plans may be required for custom project sites that are analyzed and inspected. Also complementary to this hierarchy of planning documents is a reporting structure that can include individual site evaluation reports, program reports, and annual portfolio reports. Another typical resource document for large-scale efficiency portfolios (such as those for a state or regional consumer-funded efficiency program) is a technical reference manual (TRM). A TRM is a database of standardized, state- or region-specific deemed savings calculations and associated deemed savings values for well-documented EE measures. EE program administrators and implementation contractors use TRMs to reduce evaluation costs and uncertainty.

### **Qualitative & Quantitative Method Tips:**

- **Best Practices:** The resource annotations below include a variety of reports and research on different qualitative and quantitative EM&V best management practices.
  - [TVA Energy Right Solutions](#)
  - [Tennessee Energy Education Initiative EM&V Overview](#)
  - [North Carolina Environmental Assistance and Customer Service Audit Overview](#)
  - [SEEA Energy Efficiency Program Impact Evaluation Guide](#)
- **Utility Data:** It's hard to track utility data without access. Ask participants to sign a data release form during a workshop or home audit. WeGoWise ([wegowise.com](http://wegowise.com)) provides utility data analysis at \$25 a home.
- **Client Surveys:** This is an invaluable method which allows your program to learn if there any been any substantial life style changes that would contribute to energy usage—such as a family member moves in/out, etc.

## Contributors to this Manual & Supporting Resources

- Appalachian Electric Cooperative | Greg Williams
- Appalachian Voices | Rory McIlmoil & Amy Kelly
- City of Knoxville | Erin Gill
- Electric Power Board (EPB) | Elizabeth Hammitt
- EE Institute | Harlan Lachman
- Glass Ladder Group | Sabrina Garba
- Green & Healthy Homes Initiative | Ruth Ann Norton
- GreenSpaces | Michael Walton
- Habitat for Humanity | Colleen Dudley
- Hands On Nashville | Josef Kaul
- LeBonheur Hospital CHAMP | Susan Steppe
- Mayor Barry's Office of Economic Development | Erik Cole & John Murphy
- Memphis Light Gas Water | Manuel Villanueva
- Metropolitan Development Housing Authority | Shelley Fugitt
- Rooted Group | Seandra Pope
- Southern Alliance for Clean Energy | Taylor Allred
- South East Energy Alliance | Lisa Flick-Wilson
- Socially Equal Energy Efficient Development | Rick Held
- Tennessee Department of Health | Rebecca Gorham
- Tennessee Department of Environment & Conservation | Jason Carney, Christina Ashie Guidry, Jaclyn Mothupi & Matthew Taylor
- Tennessee Housing Development Agency | Kim Speyer
- Tennessee State University | Sue Ballard
- Tennessee Valley Authority | Elizabeth Moore & Frank Rapley
- The Housing Fund | Melanie Lawrence
- University of Tennessee Green Economy Initiative | Emily M. Medley

## **Appendix A – Funding Matrix**

	Program Name	Type of Program	Program Implementer/Operator	Timeframe When Available	Application Format/Deadline	Who Can Use Source	Residential, Multi or Commercial?	How Source Can Be Used	Contact Info	Notes
U.S. DOE	Better Building Challenge	Consumer Education	U.S. Dept. of Energy	Annually	Rolling application	Technical Assistance & Peer Exchange	Commercial	Technical Assistance & Peer Exchange	<a href="mailto:Lauryn.K.Alleva@HUD.gov">Lauryn.K.Alleva@HUD.gov</a>	Website contact page: <a href="https://betterbuildingsinitiative.energy.gov/about-better-buildings-initiative">https://betterbuildingsinitiative.energy.gov/about-better-buildings-initiative</a>
	Weatherization Assistance Program (WAP)	Grant	THDA	Annually - Program Year Beginning July 1st	Grant Application - Waiting List	Renters / Tenants and Homeowners	Residential	EE Retrofit / Renovation Measures	Blake Worthington <a href="mailto:bworthington@thda.org">bworthington@thda.org</a>	THDA administers this program on a statewide level, and partners with Community Action Agencies to administer the programming at a local level. Weatherization Retrofit Projects Include: Insulation, Storm Windows, Caulking, and Other Related Activities to Reduce Home Energy Costs.
HUD	HUD's Energy Performance Contracting	Energy Performance Contract	U.S. Dept. of Housing and Urban Development	Annually	Rolling Applications	Renters / Tenants, Homeowners, and Veterans	Residential & Multi	EE Retrofit / Renovation Measures, EE Program Design, and Energy Bills	Tosha LeSure (615) 515-8520	this innovative financing technique allows building users to achieve energy savings without up front capital expenses. The costs of the energy improvements are borne by the performance contractor and paid back out of the energy savings. Other advantages include the ability to use a single contractor to do necessary energy audits and retrofit and to guarantee the energy savings from a selected series of conservation measures. <a href="http://portal.hud.gov/hudportal/HUD?src=/program_offices/public_indian_housing/programs/ph/ph_ecc/epformance">http://portal.hud.gov/hudportal/HUD?src=/program_offices/public_indian_housing/programs/ph/ph_ecc/epformance</a>
	HUD's Rehabilitation Mortgage Assistance: Section 203(k) Loans	Loan	U.S. Dept. of Housing and Urban Development	Annually	Must be Submitted Through an FHA Approved Lender, Rolling Applications	Renters / Tenants, Homeowners, and Veterans	Residential & Multi	EE Retrofit / Renovation Measures, EE Program Design, and Energy Bills	Kevin Stevens, Director of the Home Mortgage Insurance Division Phone: (202) 402-4317 Email: <a href="mailto:Kevin.L.Stevens@hud.gov">Kevin.L.Stevens@hud.gov</a>	<a href="http://portal.hud.gov/hudportal/HUD?src=/program_offices/housing/sfh/203k/203k-df">http://portal.hud.gov/hudportal/HUD?src=/program_offices/housing/sfh/203k/203k-df</a>
	FHA PowerSaver Loan Program	Loan	U.S. Dept. of Housing and Urban Development	Annually	Rolling Applications	Renters / Tenants and Homeowners	Residential	EE Retrofit / Renovation Measures	(800) CALL-FHA (225-5342)	FHA PowerSaver loans offer homeowners up to \$25,000 to make energy-efficient improvements of their choice <a href="http://www.benefits.gov/benefits/benefit-details/5877">http://www.benefits.gov/benefits/benefit-details/5877</a>
	FHA Energy Efficient Mortgages	Loan	U.S. Dept. of Housing and Urban Development	Annually	Rolling Applications	Renters / Tenants and Homeowners	Residential	EE Retrofit / Renovation Measures and Energy Bills	(800) CALL-FHA (225-5342)	This program helps families save money on their utility bills by enabling them to finance energy efficient improvements with their FHA insured mortgage. <a href="http://portal.hud.gov/hudportal/HUD?src=/program_offices/housing/sfh/eem/energy-r">http://portal.hud.gov/hudportal/HUD?src=/program_offices/housing/sfh/eem/energy-r</a>
USDA	High Energy Cost Grant Program	Grant	USDA Rural Utilities Service	Annually	December	Renters / Tenants, Homeowners, Builders / Developers, and Veterans	All	New Construction, EE Retrofit / Renovation Measures, EE Program Design, and Energy Bills	202-720-9545	This program requires energy costs to be at least 275% of the national average energy cost. This grant program is not limited to renewable energy or energy conservation and efficiency measures, but these measures are eligible for this grant program. <a href="http://www.rd.usda.gov/programs-services/high-energy-cost-grants">http://www.rd.usda.gov/programs-services/high-energy-cost-grants</a>
	USDA's Multifamily Housing Direct Loans	Loan	USDA Rural Utilities Service	Annually	Competitive Application	Renters / Tenants, Homeowners, Builders / Developers, and Veterans	Residential	New Construction, EE Retrofit / Renovation Measures, EE Program Design, and Energy Bills	Don Harris 615.783.1388 <a href="mailto:Donald.Harris@tn.usda.gov">Donald.Harris@tn.usda.gov</a>	<a href="http://www.rd.usda.gov/programs-services/multi-family-housing-direct-loans">http://www.rd.usda.gov/programs-services/multi-family-housing-direct-loans</a>
	Rural Economic Development Loan and Grant Program (REDLG)	Loan and Grant	USDA Rural Utilities Service	Annually	Competitive Application	Homeowners and Builders / Developers	All	New Construction and EE Program Design	Rural Business – Cooperatives TN State Office 615.783.1341	This program is intended to increase jobs in rural communities, which includes but is not limited to energy efficiency. <a href="http://www.rd.usda.gov/programs-services/rural-economic-development-loan-grant-program/tn">http://www.rd.usda.gov/programs-services/rural-economic-development-loan-grant-program/tn</a>
	Rural Energy Savings Program (RESP)	Loan / Relending	USDA Rural Utilities Service	Annually	First Come First Serve Until Depletion of Funding	Renters / Tenants, Homeowners, Builders / Developers, and Veterans	All	New Construction, EE Retrofit / Renovation Measures, EE Program Design, and Energy Bills	Titilayo Ogunyale (202) 720-0736	<a href="http://www.rd.usda.gov/programs-services/rural-energy-savings-program">http://www.rd.usda.gov/programs-services/rural-energy-savings-program</a>
	USDA's Energy Efficiency and Conservation Loan Program (EECLP)	Loan / Relending	USDA Rural Utilities Service	Annually	Non-Competitive, Rolling Application	Rural Utility Systems	All	EE upgrades, Program Admin (5% of loan amount)	Carl Wilson <a href="mailto:Carl.Wilson@wdc.usda.gov">Carl.Wilson@wdc.usda.gov</a>	<a href="http://www.rd.usda.gov/programs-services/energy-efficiency-and-conservation-loan-program">http://www.rd.usda.gov/programs-services/energy-efficiency-and-conservation-loan-program</a>

OTHER FEDERALLY FUNDED PROGRAMS	Low Income Home Energy Assistance Program (LIEAP)	Grant	U.S. Dept. of Health and Human Services	Annually	n/a	Renters / Tenants and Homeowners	Residential	EE Retrofit / Renovation Measures and Energy Bills	Blake Worthington bworthington@thda.org	For Low-Income Residential. Applicants must meet federal poverty guidelines. <a href="http://www.acf.hhs.gov/programs/ocs/programs/lieap/about">http://www.acf.hhs.gov/programs/ocs/programs/lieap/about</a>
	Department of Veterans Affairs (VA) Energy Efficient Mortgages	Loan	U.S. Dept. of Veterans Affairs	Annually	n/a	Veterans	Residential	New Construction and EE Retrofit / Renovation Measures	Tennessee Veterans Affairs (615) 741-2931	Loans of up to \$3,000 if only documentation of improvement costs or contractor bids is submitted, or up to \$6,000 if the projected energy savings are greater than the increase in mortgage payments. Loans may exceed this amount at the discretion of the VA. <a href="http://programs.dsireusa.org/system/program/details/243">http://programs.dsireusa.org/system/program/details/243</a>
	Qualified Energy Conservation Bonds (QECBs)	Bond	TDEC's Office of Energy Programs (OEP)	Annually	Rolling Application	QECBs may be issued by state, local and tribal governments to finance qualified energy conservation projects. A maximum of 30% of the aggregate bonds may be used to finance private activity projects.	All	energy efficiency capital expenditures in public buildings, green communities, renewable energy production, various research and development, efficiency/energy reduction measures for mass transit, and energy efficiency education campaigns	615-741-2994 or alexa.voytek@tn.gov	<a href="http://www.tennessee.gov/environment/article/energy-qualified-energy-conservation-bonds">http://www.tennessee.gov/environment/article/energy-qualified-energy-conservation-bonds</a>
IRS	HUD's Low-Income Housing Tax Credit (LIHTC)	Tax Credit	THDA	Annually - Credit Applied to Federal Income Tax	Competitive Application	Builders/Developers	Residential	New Construction and EE Retrofit / Renovation Measures	Blake Worthington bworthington@thda.org	<a href="https://thda.org/business-partners/about-lihtc">https://thda.org/business-partners/about-lihtc</a>
	Residential Renewable Energy Tax Credit	Tax Credit	IRS	Annually - Credit Applied to Federal Income Tax	April	Homeowners	Residential	New Construction and EE Retrofit / Renovation Measures	<a href="http://www.energystar.gov/taxcredits">http://www.energystar.gov/taxcredits</a>	
	Residential Energy Efficiency Tax Credit	Tax Credit	IRS	Annually - Credit Applied to Federal Income Tax	April	Homeowners	Residential	New Construction and EE Retrofit / Renovation Measures	<a href="http://www.energystar.gov/taxcredits">http://www.energystar.gov/taxcredits</a>	
UTILITIES--LOCAL POWER COMPANIES	MLGW--- Affordable Housing Lot Allowance Incentive	Rebate	MLGW	Annually	Competitive, Rolling Application	Builders / Developers	Residential	New Construction	MLGW 901-528-4887	Not true funding source; homes must be built to meet MLGW's EcoBUILD standards; can be used for single family homes or multifamily complexes; information available at <a href="http://www.mlwg.com/images/content/files/pdf/incentivePoliciesforHousing(1).pdf">http://www.mlwg.com/images/content/files/pdf/incentivePoliciesforHousing(1).pdf</a>
	MLGW--- Project Care	\$1,500 grant per recipient	MLGW	Ongoing	Competitive, Rolling Application	Elderly (60+) and or Disabled with max HH income \$32,000/year and MUST be homeowner	Residential	EE upgrades	Mike Villanueva: mvillanueva@mlgw.org 901-528-4887	
	MLGW---Max Impact	\$2,500 loan (on-bill loan at 3% and 7 year term) per recipient	MLGW	Ongoing	Competitive, Rolling Application	No age or condition restrictions, max HH income \$50,000/year and can be homeowner or landlord	Residential	EE upgrades	Shellee Williams: SIWilliams@mlgw.org 901-528-4887	
	TVA---Knoxville Extreme Energy Makeover (KEEM).	Grant / Consumer Education	TVA via Knox County Community Action Committee (CAC) and the City of Knoxville.	Annually	Primary Funding ends September 2017, Rolling Application	Renters / Tenants and Homeowners	Residential	EE Retrofit / Renovation Measures, EE Program Design, and Energy Bills	Jason Estes, Director- CAC Housing & Energy Services, 865-244-3080	Air sealing, attic insulation, HVAC replacement, duct sealing/repair, hot water system replacement, heat pump/water heater installation, CFL swap out, faucet aerators, window replacement (single pane to double pane, or upgrade to Energy Star), Fridge/Freezer replacement, Fridge retirement, Clothes Washer/Dryer replacement, Dishwasher replacement, smart power strips. <a href="http://www.keemteam.com">www.keemteam.com</a>
	TVA---eScore	Rebate / Consumer Education	TVA	Annually	Rolling Applications	Homeowners	All	EE Retrofit / Renovation Measures	John Watts: email: wattsjt@epb.net; (423) 648-3514	<a href="https://www.epb.net/downloads/power/home/escore/rebates.pdf?dc=2015.03.10">https://www.epb.net/downloads/power/home/escore/rebates.pdf?dc=2015.03.10</a>
	Middle Tennessee EMC --- Residential Energy Efficiency Rebate Program	Rebate	Middle Tennessee Electric Membership Corporation	Annually	Rolling Applications	Homeowners	Residential	EE Retrofit / Renovation Measures	(877) 490-9325	Windows replacement: \$25/window -- Storm Windows: \$12.50/window -- Duct Work: \$200 -- Attic Insulation: \$250 -- Water Heater: \$200 -- Air Sealing: \$200 -- Heat pump: \$250 -- Door replacement: \$50 <a href="http://www.mtemc.com/naeas.rfm/name/r16_e5">http://www.mtemc.com/naeas.rfm/name/r16_e5</a>

	Murfreesboro Electric Department-- Energy Efficiency Rebate Program	Rebate	Murfreesboro Electric Department	Annually	Rolling Applications	Homeowners and Builders / Developers	Residential	New Construction and EE Retrofit / Renovation Measures	Customer Service (615) 893-5514	Not focused on low-income specifically, can be used for single family homes as well (up to \$1,600 per home). <a href="http://programs.dsireusa.org/system/program/detail/1983">http://programs.dsireusa.org/system/program/detail/1983</a>
	EPB--Home Energy Upgrade Pilot	Grant / Consumer Education	EPB and Area Foundations (Footprint, Lyndhurst, and Benwood)	Annually	Two Month Cycle	Homeowners	Residential	EE Retrofit / Renovation Measures	Elizabeth Hammit: email: hammittec@epb.net; (423) 648-1426	<a href="http://nooga.com/168828/epb-launches-program-to-help-avondale-residents-save-energy-money/">http://nooga.com/168828/epb-launches-program-to-help-avondale-residents-save-energy-money/</a>
	EPB--Energy Efficient New Homes Program for Builders & Developers	Rebate	Electric Power Board of Chattanooga	Annually	Rolling Applications	Builders / Developers	Residential	New Construction and EE Retrofit / Renovation Measures	EPB of Chattanooga 423-648-1372	Not focused on low-income specifically, can be used for single family homes as well <a href="http://programs.dsireusa.org/system/program/detail/1966">http://programs.dsireusa.org/system/program/detail/1966</a>
Community Development Financial Institution (CDFI)	Energy Efficiency Loan Program	Loan	Pathway Lending	Annually	Rolling Application	Multi housing	All	EE upgrades	Brandon England Phone: (615) 425.7171 Brandon.England@pathwaylending.org	Available only to mult sites with 5 or more units.
	Make a Mark	Loan	The Housing Fund	Ongoing	Rolling Application	Davidson County Artists and Non-Profits with AMI of 120%	Residential	New Construction and Retrofit / Renovation Measures	Melanie Lawrence (615) 780-7000	<a href="http://thehousingfund.org/loans/development-lending/neighborhood/">http://thehousingfund.org/loans/development-lending/neighborhood/</a>
Non Profits	Habitat for Humanity	Loan	Habitat for Humanity	Ongoing	Vary by chapter	Verified low-income residents, having not owned a home (timeframe varies per chapter)	Residential & Multi	New Construction	Varies by chapter: www.HabitatTN.org	
	Empower Chattanooga	Outreach and Education	Green Spaces	Ongoing	n/a	No eligibility requirements, however outreach and programming is focused in specific neighborhoods in Chattanooga - East Lake, Highland Park, Ridgedale, and East Chattanooga	Residential & Multi	Our free one hour basic energy workshops are hosted in each neighborhood once per month, year round.	Sam Fullbright 423.648.0963 sam@greenspaceschattanooga.com	<a href="http://empowerchattanooga.org/">http://empowerchattanooga.org/</a>