



Draft Sponsor Guide and Reference Manual v1.5

DRAFT FOR PUBLIC COMMENT

Thank you for taking the time to review the *Draft HPwES Program Sponsor Guide and Reference Manual* (v1.5). We are seeking public comment to inform a final document the U.S. Department of Energy intends to release in late summer/early fall 2013. Once the final *Sponsor Guide and Reference Manual* is released, Sponsors will have one calendar year to make any necessary modifications to their programs to meet v1.5 requirements. Any new Sponsors or partners will be expected to comply with v1.5 requirements upon matriculation with the Program.

We welcome your feedback on all aspects of the following document—its format, content, language, proposed glossary of terms, etc. Specifically, DOE would like your comments/suggestions on the following topics included in the document:

- Definition of a Program Sponsor
- Workforce Qualifications
- Home Performance Assessment
- Project Installation Requirements
- Use of DOE's Standard Work Specifications
- Quality Assurance Option 2: Quality Management System

We anticipate the final version of the Sponsor Guide will include a links to the tools and resources referenced and updated Appendices.

Please provide your comments and suggestions by emailing homeperformance@energystar.gov in a format that works best for you. For example, you may use the comment feature in the PDF document, provide comments in the body of an email, or in a separate Word document.

We appreciate your feedback and look forward to reviewing your comments and suggestions.

- The HPwES Team

Acknowledgements

Thank you to the U.S. Environmental Protection Agency (EPA), the Home Performance with ENERGY STAR (HPwES) Program Sponsors, participating contractors, and the many stakeholders who have contributed to the HPwES Program's evolution and success in its first decade. Together we have embarked on a path to transform the market for home performance services. Homes improved through HPwES use less energy, are more comfortable, and reduce the risk of health and safety issues. The U.S. Department of Energy (DOE) looks forward to continued collaboration by cultivating the value of home performance services and solutions.

Preamble

HPwES is public-private partnership designed to motivate behavioral change in consumers' decision-making about the home improvement process. By working with diverse industry stakeholders, DOE seeks to advance the health, safety, and energy-use performance of existing homes. HPwES provides a unique market transformation platform by defining a process for translating complicated building-science principles into solutions for homeowners seeking to improve the energy efficiency, comfort, health, and durability of their homes.

HPwES challenges the traditional approach to home improvement because it evaluates the entire house including each of the systems and their interactivity to identify solutions to homeowner needs and desires. HPwES offers homeowners qualified contractors who have been trained to evaluate the entire home and offer solutions that have been tested in the most advanced laboratories and applied in hundreds of thousands of homes.

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Introduction

Home Performance with ENERGY STAR (HPwES) is a public-private voluntary partnership program, the purpose of which is to turn building science based recommendations into solutions for improved, energy-efficient homes. The U.S. Department of Energy (DOE), in coordination with the U.S. Environmental Protection Agency (EPA), offers HPwES as a programmatic platform designed to systematically improve a home's performance resulting in healthier and more comfortable living environments, enhanced structural durability, and energy savings.

HPwES, like all ENERGY STAR programs, facilitates market transformation by increasing the availability and adoption of energy efficient goods and services. HPwES is based on a nationally recognized brand supported by a building science driven approach to home improvements that promotes consumer confidence and results in measurable energy savings. Through HPwES, Program Sponsors and stakeholders support an infrastructure of qualified contractors who engage customers, deliver quality work, and drive the market forward for increased penetration of HPwES projects and related services.

Organizations that typically sponsor HPwES programs include utilities, states, municipalities, and non-profit organizations that promote energy efficiency and renewable energy. Eligibility for sponsorship is reserved for organizations that implement residential home improvement programs or offer home improvement services that meet the criteria of the HPwES Program.

To support the national Program platform, Sponsors are encouraged to incorporate the following elements into their local programs' design:

1. **Customer Friendly:** Products and services that address homeowner concerns and effectively meet their desires for comfort, safety, and reduction in wasted energy
2. **Streamlined Business Protocols:** Administrative procedures that minimize the burden of participation for contractors and homeowners
3. **Business Friendly:** Contractor services that can effectively engage customers, allow their businesses to operate profitably long term, and deliver quality work that meets DOE's minimum HPwES Program requirements

How to Use the Sponsor Guide and Reference Manual

The Sponsor Guide is organized to assist HPwES Sponsors and their implementers by clearly identifying the minimum requirements for the national HPwES Program, as well as provide additional guidance and resources which may be used to implement these requirements. The Guide is divided into seven sections, each covering a specific requirement of the HPwES Program:

1. Use and Management of the HPwES Mark
2. HPwES Program Design and Development
3. HPwES Workforce Development and Support
4. The HPwES Assessment
5. The HPwES Project Installation
6. HPwES Quality Assurance
7. HPwES Tracking and Reporting

Users will find the guide is organized to allow quick access to information and each section includes the following elements:

- **Checklist of Minimum Requirements:** Requirements that are specific to the current section's topic
- **Minimum Requirements:** Narrative and specifications for compliance with the minimum requirements checklist
- **Recommended Approaches:** Optional guidance for implementation and suggested strategies based on lessons learned from successful residential programs nationwide

The Sponsor Guide also includes **Appendices** with the following items:

- A. Minimum Requirements Checklist Reference
- B. HPwES Partnership Agreement
- C. HPwES Implementation Plan
- D. Tools and Resources Matrix
- E. DOE's Guidelines for Home Energy Professionals
- F. Energy Savings and Cost Effectiveness
- G. Quality Management System (QMS) Overview

Guide Updates

The Guide will be maintained and updated over time. Changes to the national Program's minimum requirements will be subject to a public comment period prior to publication and active Sponsors will be allowed a designated time period to fully comply with new requirements.

Updates specifically related to the *Recommended Approaches* and *Tools and Resources* will be released as new content and resources become available. Sponsors and stakeholders are encouraged to contribute examples of successful approaches, as well as materials, for inclusion in the Sponsor Guide and Reference Manual. These sections of the *Sponsor Guide and Reference Manual* are intended to help support HPwES Program Sponsors by identifying and facilitating access to promising and industry-proven practices and resources.

Compliance and Enforcement

As a public-private partnership, Sponsors, participating contractors, and the Federal Government are joined in an effort to develop the value and understanding of HPwES. As the administrator of the national Program, DOE is required to maintain the integrity of the HPwES name and marks. This includes ensuring that Sponsors and their partnering organizations are in compliance with the requirements outlined in the Sponsor Guide and Manual.

DOE and EPA will actively pursue resolution of noncompliance related to the use of the ENERGY STAR marks and requirements. The HPwES Program is a voluntary partnership with Sponsors that can be terminated by either party at any time for any reason. Failure to comply with any of the terms of the Partnership Agreement can result in termination. In good faith, DOE will work with Sponsors to resolve any conflicts or non-compliance by initially seeking to resolve all matters informally to preserve maximum public confidence in ENERGY STAR.

Connecting with HPwES

In addition to the Sponsor Guide, DOE offers a variety of tools and resources for Program Sponsors, their participating contractors, and partners. New and existing Sponsors can work with their HPwES Account Manager, who will provide assistance with the following:

- Access to templates, tools, and other resources to on the development, execution and marketing of HPwES programs;
- Networking and information exchanged via regional program collaboration, webinars, the Better Buildings Residential Network, and the quarterly HPwES e-newsletter;
- Recognition for Sponsors and successful participating contractors with access to the nationally recognized and consumer trusted ENERGY STAR mark, and opportunities to be honored with the ENERGY STAR Partner of the Year or HPwES Century Club awards; and
- Collaboration opportunities with DOE to explore new opportunities, streamlined approaches, and cost-cutting measures to scale the home performance market.

For additional information and support for developing and implementing a HPwES program, email HomePerformance@EnergyStar.gov.

Section 1: Use and Management of the Home Performance with ENERGY STAR Mark

Minimum HPwES Program Requirements

Use and Management of the HPwES Mark

- ☐ Comply with current *ENERGY STAR Identity Guidelines*
- ☐ Maintain a list of authorized representatives, including participating contractors, to ensure their compliance with the *ENERGY STAR Identity Guidelines*
- ☐ Feature the HPwES name and mark on the Sponsor's website and in other promotional materials
- ☐ Establish a process to ensure your business partners and participating contractors comply with the *ENERGY STAR Identity Guidelines*
- ☐ Send marketing materials, including web designs, to your HPwES Account Manager for review of compliance with the *ENERGY STAR Identity Guidelines*
- ☐ Provide training about the value of and minimum requirements of HPwES to all employees who provide customer service
- ☐ Notify your HPwES Account Manager of any change in the designated responsible party or contacts for the Sponsor's local program

ENERGY STAR is a nationally recognized mark on products, appliances, homes, and buildings. Diverse networks of 18,000 businesses and organizations have become ENERGY STAR partners since the mark was introduced. ENERGY STAR continues to be a powerful tool to promote energy efficiency to homeowners because it is a trusted and widely recognized name. As partners with ENERGY STAR, HPwES Program Sponsors, have the privilege and responsibility to use both the ENERGY STAR Partner mark and the HPwES mark.

Sponsors should be familiar with the [ENERGY STAR Identity Guidelines](#), beyond the requirements listed below, and ensure their participating contractors and support agencies also understand how they may use the HPwES mark. In partnership with you, only your participating contractors and business partners will have access to the HPwES mark under the auspices of your partnership with ENERGY STAR.

Minimum Requirements

Sponsors shall use the HPwES name and mark to promote home performance services in accordance with Home Performance with ENERGY STAR criteria outlined in the following three documents:

1. The Home Performance with ENERGY STAR Partnership Agreement (**Appendix B**)
2. The Home Performance with ENERGY STAR Sponsor Guide and Reference Manual
3. The *ENERGY STAR Identity Guidelines*

As detailed in the *ENERGY STAR Identity Guidelines*, the HPwES name and mark shall be used in marketing and advertising materials to educate consumers or to show that a company provides services that clearly contribute to the integrated improvement of homes' systems. Sponsors may choose to co-brand HPwES with their own organization and/or program names and/or identify their home performance program offerings as offered "in conjunction with", "partnered with", "affiliated with", or similar language to make homeowners and participating contractors aware that

the work being performed on a house is part of HPwES. It is vitally important that Sponsors use the HPwES name and mark on all marketing materials to continue to help the program establish a national consumer awareness of the brand.

Steps for Managing Use of the HPwES Mark

1. Comply with current *ENERGY STAR Identity Guidelines*, which describe how the ENERGY STAR marks and name may be used. Sponsors are responsible for the proper use of the ENERGY STAR marks, as well as the proper use of the Home Performance with ENERGY STAR (HPwES) mark used by participating contractors.
2. Maintain a list of authorized representatives, such as implementation contractors, advertising agencies, and participating contractors who have permission to use the mark in partnership with the Sponsor's program.
3. Establish a process to ensure your business partners and participating contractors comply with the ENERGY STAR Identity Guidelines.
4. Feature the HPwES name and mark on Sponsor's websites and in other promotional materials, particularly those that target consumers. To link to the Sponsor on the ENERGY STAR website, the Partner must first comply with the [ENERGY STAR Web Linking Policy](#) found on the ENERGY STAR website.
5. Submit marketing materials and web designs developed for your HPwES program to your HPwES Account Manager for review to ensure accurate use of ENERGY STAR marks and consistent ENERGY STAR messages. The Sponsor will allow a minimum of five full working days for ENERGY STAR to review and approve website designs and marketing materials. Sponsors who have demonstrated appropriate use of the mark and HPwES name will be given more latitude regarding this requirement.
6. Provide HPwES training to all employees who provide customer service. This training shall include: a) a description of Home Performance with ENERGY STAR, b) tips for answering questions about Home Performance with ENERGY STAR, and c) information on the economic and environmental benefits of energy efficiency.
7. Notify your HPwES Account Manager within 30 days of a change in the designated responsible party or contacts for this agreement.

Recommended Approaches

Managing the Use of the Mark

HPwES Sponsors are responsible for communicating and enforcing the *ENERGY STAR Identity Guidelines* with their partners and contractor networks. An effective way to ensure that partners and participating contractors are in compliance with mark use requirements is to place direct text from the *ENERGY STAR Identity Guidelines* in partnership documents and contractor participation agreements. The HPwES Team recommends referencing sections 9.4 through 9.9.

Existing and new Sponsors are encouraged to coordinate on marketing their HPwES program in overlapping or neighboring markets. In administering the national HPwES platform, DOE seeks to minimize market confusion. A useful tactic to manage the proper use of the HPwES mark is with a cooperative advertising model. This is a cost-effective means to sharing the costs of locally placed advertisements. Through cooperative advertising, the Sponsors and participants expand the breadth of distribution by sharing the costs needed to create and place marketing materials. For participating contractors with few resources and limited experience designing marketing campaigns, Sponsors'

expertise and branding can be a valuable benefit to help increase consumers' perceived credibility for home performance services offered.

General Use of the HPwES Mark

The HPwES name and mark are useful symbols for the process of home performance. Access to the HPwES name and mark are important features of the HPwES Program because they are opportunities to further leverage brand recognition and reinforce greater consumer awareness of HPwES among Sponsors' partner and contractor networks. Sponsors, and their partner and contractor networks, must use the HPwES name and mark in all consumer materials to include promotional and educational material and websites. Use of the mark may also include t-shirts, hats, letterheads, business cards, and other stationery; company-owned or leased cars and vans, and other collateral materials.

DOE recommends that the full name—"Home Performance with ENERGY STAR" and not the acronym, "HPwES"—be used in consumer materials. Because the HPwES approach and concept can be complex for homeowners, DOE recommends Sponsors use the following language in conjunction with the HPwES mark:

"Working to deliver whole-house energy savings to improve comfort and help protect the environment."

Using HPwES in the Sales and Project Execution Process

In administering the HPwES Program, DOE recommends consistent use of certain terms and phrases when explaining HPwES, conducting HP sales, and completing projects.

Table 1. Recommended Terms		
Use	Avoid	Why
Whole-house Or House as a system	Comprehensive	HPwES considers the entire house (including occupants) when assessing opportunities for performance improvements. Describing the HPwES approach as the "house as a system" is a straightforward way to convey the holistic nature of the approach. The term "comprehensive" can imply that the homeowner must purchase all recommended improvements.
Assessment	Audit	"Assessment" is more positive and more accurate. The term "audit" can have negative connotations.
Energy upgrade or improvement Or Home performance upgrade	Retrofit	"Upgrade" is a more a positive and accurate description. The term "retrofit" can have negative connotations.

In addition to the terms noted above, there are many other building science and industry terms that are well understood by the credentialed HP community but not necessarily by homeowners. DOE created a marketing recommendations and terminology resource to help identify how best to communicate with homeowners (*forthcoming*).

Certificates of Completion

Homeowners who choose to invest in upgrading their homes' performance are often interested in receiving a "Certificate of Completion" that documents the improvements, as well as the organizations and companies involved in their home performance project. The Certificate of Completion offers the homeowner proof that energy improvements have been made to their home – which may contribute to improving the house's future re-sale value.

DOE offers a template HPwES Certificate of Completion (*forthcoming*). Local Program Sponsors who want to develop their own certificates should consider including the following elements:

- The national HPwES mark and statement explaining the HPwES approach
- Address of home where improvements were completed
- Names of companies performing and verifying improvements
- Project completion date
- Specific home improvement measures completed
- Estimated energy savings or home performance results achieved. (e.g., Home Energy Score, HERS® Index, Energy Performance Score, deemed savings, energy modeling software estimations, etc.)
- Estimated environmental impacts of improvements
- Local Program Sponsor logo and mission statement (if applicable)
- Program representative signature block

As per minimum requirements, Sponsors should consult with their HPwES Account Manager to ensure the proposed Certificate of Completion complies with the *ENERGY STAR Identity Guidelines* and is consistent with the ENERGY STAR message.

Section 2: HPwES Program Design and Development

Minimum HPwES Program Requirements

Program Design

- ☐ Review and sign a HPwES Partnership Agreement
- ☐ Complete and annually update a HPwES Implementation Plan
- ☐ Provide quarterly and annual data on the status of HPwES Program implementation

This section outlines the minimum requirements for becoming a HPwES Program Sponsor and recommendations to design an effective local program. Sponsoring a program is a significant commitment and will require an investment of financial resources and time. Therefore, organizations should establish a budget and identify a sustainable source(s) of funding before making a commitment. In addition, to maximize affordability for homeowners and profitability for contractors, Sponsors should design their program to minimize administrative burdens and any potential marketplace confusion by collaborating with other Sponsors and partnering organizations.

Program Sponsor Definition

HPwES Sponsors are organizations that take on the responsibility of administering home performance programs in local markets. Sponsors are instrumental in developing and supporting local markets for home performance services following the HPwES approach. In this capacity, Sponsors are responsible for fostering the market for home performance services by managing and monitoring the performance of their implementation vendors and participating contractors to ensure that quality standards are met. *Sponsors do not directly provide front line home performance services to homeowners*, but rather provide these services via an established network which may include: implementation vendors, participating contractors, and other program partners. To preserve public confidence and avoid any perceived conflict of interest, it is important that Program Sponsors and HPwES Participating Contractors are functionally independent and make appropriate efforts to maintain an arm's length business relationship. Organizations that typically sponsor local HPwES programs include utilities, state energy offices, municipal governments, non-profit organizations that promote energy efficiency, and financial institutions; however, other types of organizations with sufficient resources to manage the day-to-day operations of a HPwES program are encouraged to join.

Minimum Requirements

There are three minimum requirements that HPwES Sponsors must address for Program Design and Development.

1. Review and sign a HPwES Partnership Agreement.

To join HPwES, potential sponsoring organizations must agree to the terms defined in the HPwES Partnership Agreement. These requirements include to:

- a) Adhere to the *ENERGY STAR Identity Guidelines*;

- b) Design and implement initiatives that support the tenets of the HPwES approach as described in this Guide; and
- c) Meet quarterly and annual tracking and reporting requirements to document the results of local program efforts.

The HPwES Partnership Agreement also outlines DOE and EPA responsibilities in the Partnership, including provisions to:

- a) Define and promote the HPwES approach;
- b) Recognize Partner achievements; and
- c) Provide guidance, tools, and resources to support the advancement of the HP market.

2. Complete and annually update a HPwES Implementation Plan

Sponsors shall develop a HPwES Implementation Plan. DOE reviews these plans to determine eligibility and readiness for sponsorship. DOE offers an Implementation Plan template (**Appendix C**) to guide Sponsors as they develop program plans to meet the required elements of a HPwES program. Each year, DOE will issue an Annual Report template to Sponsors to facilitate the required update to their Implementation Plans.

3. Provide quarterly and annual HPwES program implementation data

On a quarterly basis, Sponsors shall provide DOE with data to assist in determining the impact of the program and to inform future revisions to DOE's Program rules. Quarterly reports include the following minimum data:

- Number and names of participating contractors
- Number of projects completed by each participating contractor
- Number of field inspections completed by the Sponsor (or its agent) per participating contractor

Annually, Sponsors shall provide an update on activities, including information on the previous year's accomplishments and an overview of the program plans for the coming year(s). At a minimum, the annual report will include:

- An annual summary of contractor recruitment/training activities
- Quality assurance activities
- Marketing activities
- Future program plans, including funding allocations and goals

To streamline reporting, DOE will offer report templates to facilitate data collection and tracking. See **Section 7: HPwES Tracking and Reporting** for more details on tracking and reporting requirements, recommended approaches, and links to templates and tools.

Recommended Approaches

Since the Program's launch a decade ago, the HPwES community has gleaned insights and trends on local programs' evolutions. Additionally, DOE has witnessed in recent years, hundreds of communities working to promote energy

efficiency upgrades in homes and other buildings, through programs such as the Better Buildings Neighborhood Program. Typically local programs need two to three years of ramp up time before seeing a jump in the number of completed projects. The programs with strong planning, market research, and workforce development witness earlier and more sustained rises in their production of completed projects. Below are strategies and tactics to consider as Sponsors develop and update their HPwES programs.

Setting Goals and Objectives

Designing a HPwES program starts with defining the goals and objectives the Program Sponsor wants to achieve. Every market has different challenges and opportunities that will shape the program design and implementation strategy. An evaluation of local market conditions can provide useful background information that may include:

- Local energy issues, such as projected cost of energy, utility deregulation activities, air pollution and energy delivery and supply capacity
- Coordination with other utility demand-side management (DSM) programs and incentives
- Coordination with other HPwES Sponsors or potential partners operating within the same territory and/or media market
- Population and housing stock demographics, including predominant age and style of homes, average homeowner income, average homeowner buying habits, average energy consumption and cost-effective energy improvements
- Understanding of community opinions of clean energy, energy efficiency and valuable links to environmental or economic concerns
- Local workforce environment, including types and number of contractors skilled in residential energy assessment and/or retrofit, local licensing requirements, and contractor training and education opportunities
- Coordination and support from local trade associations

Achieving energy savings from home performance upgrades tends to be the primary goal driving Sponsors' interest in HPwES. Sponsors should assess the barriers that inhibit energy efficiency improvements in their target markets and prepare a plan to overcome identified barriers. Sponsors will want to conduct their own analyses to determine what is possible in their markets keeping in mind that differences between markets, such as energy costs, can greatly impact program design. The amount of energy savings desired and timeframe to achieve savings should be considered. Once an energy savings goal is determined, the plan can identify specific objectives such as how many homes will need to be improved and what type of improvements will achieve these results; and how many contractors will need to participate to realize desired energy savings.

While most Sponsors set energy savings goals as their top priority, quality installation of measures and confidence in participating contractors' work are also valuable program benefits. The list below provides additional sample drivers for the various organizations supporting HPwES programs:

- | | |
|---|--|
| • Profitability and sustainability of local contractor infrastructure | • Quality and durability |
| • Shareholder interests | • Customer retention and satisfaction |
| • Market share | • Workforce development |
| • Environmental or energy mandates | • Valuation of home performance services and results |

Program Administration and Costs

Sponsoring a HPwES program is a significant commitment and requires a long-term investment of substantial financial resources and time. Therefore, organizations should consider costs before making a commitment to sponsor a program. A budget will help Program Sponsors estimate the costs to implement a HPwES program and how to prioritize activities based on goals and available resources. Typical budgets include the following components:

- **Program Administration:** program design and strategy, staff management, customer relations management (CRM) software, and quality assurance
- **Workforce Management:** contractor recruitment, training and certifications, and mentoring
- **Incentives:** homeowners, partners, and/or participating contractors
- **Marketing:** direct advertising, websites, events, campaigns, cooperative agreements, etc.
- **Evaluation, Measurement, and Verification:** market impact studies, research, surveys, and analysis

Tip: Plan budgets and metrics for initial program years to be based on achieving infrastructure-building goals such as completed trainings, contractor certifications or program enrollment, rather than volume of projects completed or energy savings. It will take time to build a home performance delivery infrastructure and successful programs set realistic goals to build strong bases before projecting significant numbers of projects completed and energy savings.

Collaboration and partnerships can be effective ways to extend resources. Program Sponsors are encouraged to develop their local network of organizations such as other utilities, financial institutions, local government, colleges, manufacturers, distributors, retailers, and nonprofit clean energy programs. By working with these entities, Program Sponsors can leverage funding and skills while designing programs to fill gaps in HPwES program administration needs.

Addressing Program Cost-Effectiveness

Utility companies, state energy offices, public utility commissions, and similar entities typically need to assess the impact of energy efficiency measures on an aggregate level. While it is preferable to know exactly how much energy savings can be expected per installed measure in each individual home, such granular data may be too difficult to collect. For example, a utility may need to determine how much energy is saved by its energy efficiency program after air sealing and insulating 1,000 homes. Whether some homes saved significantly more energy than the average and some homes saved a fraction of the average is not as critically important as the aggregate savings were achieved. These aggregate results can be used to determine total program cost-effectiveness and to estimate future demand.

Programs also may be more interested in estimating aggregate energy savings than project level savings. Public Utility Commissions and other entities may require the cost-effectiveness of programs to be evaluated based on the estimated energy savings and the costs to achieve those savings. This process serves as one method to validate the value of the program and demonstrate responsible use of public funds. The Tools and Resources section identifies several resources available describing how to estimate energy savings and determine the cost effectiveness of programs.

The [International Performance Measurement and Verification Protocol](#) (IPMVP) is an industry-standard protocol for measuring and verifying energy savings. It is a broad framework that outlines a flexible and broad set of measurement and verification approaches for evaluating energy savings in buildings. Specific techniques are designed to match project costs and savings requirements with particular efficiency measures and technologies. Each option is applicable to different programs and projects based on factors such as the complexity of the efficiency measures under evaluation and the risk expectations. Accordingly, each option varies in accuracy and cost of implementation, as well as strengths and limitations. DOE's [Uniform Methods Project](#) (UMP) is an initiative to provide uniform national guidance for the application of evaluation, measurement, and verification protocols to energy efficiency programs. Sponsors are encouraged to refer to the UMP recommendations when seeking best practices guidance for EM&V for their programs.

Some HPwES programs have struggled with statutory and/or regulatory mandates to use cost-effectiveness tests that were designed for evaluating programs focused on individual measure rebates and utility resource acquisition. Since HPwES is a performance-based program with a strong market transformation emphasis, it can be difficult to demonstrate cost effectiveness using traditional approaches to Total Resource Cost (TRC) tests or other commonly applied regulatory tests.

Consensus within the home performance industry suggests that the standard tests should be modified to more accurately evaluate the benefits of home performance programs but the debate over which tests should be used and how they should specifically be applied is an on-going discussion. For example, it is common to include all of the homeowners' costs of a home performance project in cost side of a TRC calculation. However, this practice can perversely impact the contractor's ability and desire to sell additional measures because the overall cost-effectiveness of the project will appear lower as the total invoice cost increases. Many contractors and Sponsors are frustrated by this calculation because homeowners buying decisions are frequently driven by comfort, health and safety – not necessarily energy savings – however, the benefits of comfort, health and safety are not typically included in the TRC.

Additional discussion of energy savings calculations and cost-effectiveness tests may be found in **Appendix F**. Sponsors seeking additional information on this topic will also find the following articles and reports of interest:

- [Best Practices in Energy Efficiency Program Screening: How to Ensure that the Value of Energy Efficiency is Properly Accounted For](#), National Home Performance Rating Council and Synapse Energy Economics, Inc., July 2012.
- [Is it Time to Ditch the TRC? Examining Concerns with Current Practice in Benefit-Cost Analysis](#), Chris Neme, Energy Futures Group, Marty Kushler, American Council for an Energy-Efficient Economy, 2010 ACEEE Summer Study on Energy Efficiency in Buildings.
- [Measure it Right: Best Practices in the Selection and Implementation of Cost-Effectiveness Tests](#), Robin LeBaron, National Home Performance Rating Council, June 2012.
- [Why Comprehensive Residential Energy Efficiency Retrofits are Undervalued](#), Robert L. Knight, Loren Lutzenhiser, and Susan Lutzenhiser, 2006 ACEEE Summer Study on Energy Efficiency in Buildings

Performance and Prescriptive Approaches

Sponsors' approaches to designing their local programs are typically performance-based, prescriptive-based, or a hybrid of these. Any of these approaches are acceptable methods for designing local programs' procedures and requirements.

A performance-based approach is defined as a process where calculated energy savings predictions for customized packages of measures including interaction among variables are determined on a project-by-project basis. A performance-based approach allows a program administrator to define project-level energy savings targets or goals without necessarily limiting the pool of possible measures and making trade-offs possible.

A prescriptive-based approach is defined as a process where projects are limited to a predetermined list of eligible measures based on cost effectiveness criteria or other Sponsor-defined rules. A prescriptive-based approach may include provisions for bundling or packaging within the context of a pre-defined rule set for creating those packages. Whole house energy simulations or other project-specific modeling is not required.

Some Sponsors use a hybrid approach with elements of both the performance and prescriptive approaches. With a hybrid approach, there is flexibility in how Sponsors achieve goals, cost effectiveness tests or other requirements. For instance, a Sponsor may establish systems which allow for greater flexibility in customizing projects than would be possible in a pure prescriptive-based approach, but still limit the available eligible measures based on cost-effectiveness tests, existing conditions, or other boundary constraints.

Table 2. Defining Features of Performance-Based and Prescriptive-Based Approaches for HPwES

Feature	Performance-Based Approach	Prescriptive-Based Approach
Energy Savings Predictions	Energy savings predictions are based on project-specific calculations which may be customized to reflect any or all of the following: <ul style="list-style-type: none"> • Site-specific physical characteristics of the building • Site-specific operational characteristics • Local weather conditions • Historic site-specific utility and fuel data 	Energy savings predictions are based on a predetermined set of measure-level calculations that are applied program wide (deemed savings) or other pre-screening device resulting in a prescriptive list of eligible measures.
Eligible Measures	The pool of eligible measures which may be considered is largely unrestricted with the potential for custom measures to be included. (Local programs may apply measure-specific restrictions as necessary to meet program goals or to comply with local regulations.)	Available measures are limited to those that have passed the eligibility screening for the program.
Interactivity of Savings	Calculated energy savings take interactivity of combined measures into account.	Energy savings interactivity of combined measures is limited to pre-determined measure “bundles” or is not accounted for at all.
Cost Effectiveness Tests	When cost effectiveness screening is used, it is at the project level, allowing for measure-level trade-offs.	Measure trade-offs are limited to combinations of eligible measures using a predetermined rule set.
Packaging of Measures	The customer receives a customized proposal for a package of measures that is specific to their home.	The customer receives a proposal that is customized to their home based on the available eligible measures.
Metrics	Goals may be established based on an average or minimum threshold for energy savings per project.	Goals are typically defined and tracked based on deemed savings calculations for

This could be in the form of Btu's or kWh saved, or a percentage savings based on heating and cooling energy usage, or whole house energy usage.	installed measures.
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Delivery Models

Regardless of a prescriptive, performance or hybrid approach, in designing a local HPwES program, Sponsors should also consider which delivery model will best support achieving goals and meeting applicable cost effectiveness tests. Some Sponsors' goals are tied to market-based solutions for developing a local home improvement workforce. In these cases, an open market delivery model that employs a consultant, contractor, or hybrid-focused tactic, supports the objectives.

- Consultant Delivery Model:** features an “energy advisor” who acts as the homeowner’s representative throughout the HPwES process. Energy advisors might be responsible for the assessment but typically do not provide installation services. Typically they assist the homeowner by facilitating connections with qualified installation contractors and sometimes take responsibility for conducting the final test-out. The customer benefits from third-party oversight of the project. Additionally, in markets where installation contractors are resistant to investing in diagnostic tools, training, and credentialing, the energy advisor model might be an attractive option. However, Sponsors using this model should give due consideration to how the energy advisor will be compensated, by whom, and whether or not that compensation model is viable to be maintained over the long term.
- Contractor Delivery Model:** relies on an integrated contractor business model in which participating contractors provide both the assessment and installation services to the customer. The benefits of this approach include a streamlined “one-stop shop” experience for the customer and assurance that there is a direct connection and line of communication between the person completing the assessment and the crews installing the improvements in the home.

Other models Sponsors may consider include interaction and development of the workforce for home improvement services, but they tend to be less market based. For example, Program Sponsors with high volume production goals, aggressive energy savings targets, or rigid cost effectiveness requirements, may elect to include low cost or no cost “direct install” measures to be installed at the time of the assessment or as part of each HPwES project. Direct install measures are often installed at no charge to the customer, however some programs may require a nominal co-pay to ensure the customer has some good faith investment in the project. Direct install measures are typically pre-screened based on the program’s cost effectiveness criteria and installed based on eligibility criteria established by the program Sponsor. Compensation to the installing contractor is typically paid directly by the program Sponsor, so this model requires a contractual agreement between the Sponsor and its participating contractors which includes agreed upon pricing for direct install measures.

Another approach may be to establish fixed or capped pricing strategies for eligible measures in the local program. Fixed price measures are sometimes offered in conjunction with direct install measures or may be used instead of a direct install approach. Price fixing helps the Sponsor ensure that cost effectiveness criteria are being satisfied, but can also be unnecessarily limiting to both contractors and customers. It can be difficult to establish fixed pricing that accounts for variations in project specifications which may cause the contractor and/or customer to incur additional

costs. Examples include areas that require special tools or techniques to access health and safety issues that must be resolved prior to installing energy saving measures and customer preferences for specific materials or applications. Program Sponsors using fixed or capped pricing strategies should consider including provisions allowing customers to incur additional costs at their own discretion and for contractors to upsell variations on approved measures resulting in similar energy savings.

Developing a Local HPwES Marketing Plan

Program Sponsors play a very important role in educating consumers about the process and benefits of HPwES. The Program Sponsor's public reputation and credibility are very valuable in persuading homeowners to consider making whole-house energy efficiency improvements.

Successful HPwES programs include marketing and media plans that explain how the Program Sponsor will promote the program to local homeowners. The plans should be informed by market research that segments the local market by criteria such as housing stock, income, community interests, and other defining features. Market segmentation is a valuable method to better target program strategies and messaging.

Even when contractors are responsible for marketing their company and selling renovations, a Program Sponsor should promote the program and the value of a home performance approach using a variety of tactics including advertising, public relations campaigns, social media, bill inserts, websites, media interviews, community partnerships, and special promotional events. The plan should include specific examples of how HPwES will be used in sales and marketing materials and websites.

ENERGY STAR provides marketing materials such as brochures and a marketing toolkit to help program Sponsors and participating contractors educate homeowners about Home Performance with ENERGY STAR. Sponsors, their participating contractors and partnering organizations may access these resources through the password protected ["My Energy Star Account" \(MESA\)](#) on [energystar.gov](#).

Additional Program Design Resources

Additionally, Sponsors and home performance stakeholders can find more information in the [Better Buildings Residential Program Solution Center](#), designed in 2013 as a repository for key lessons, resources, and knowledge collected from residential program efforts. The Better Buildings Residential Program Solution Center is intended to help energy efficiency program teams and their partners plan, implement, manage, and evaluate residential energy upgrade programs.

Development of this resource is underway with a planned release of fall 2013, following technical expert peer review and beta user testing. (Note: this paragraph and link will be updated based on Better Buildings Residential Program project status for final document.)

Kick starting a local program:

After evaluating the market conditions, consider selecting one pilot location for the initial launch of the program. Some pilots set a goal to improve a small number of homes (e.g. 50-100). Selecting a pilot location to launch the program can help focus available resources, allow for testing of ideas and refining the program's design and delivery, and increase the overall likelihood of program success. Once the program has demonstrated success in the pilot phase, consider how to increase the scale of the program and expand to additional markets.

ENERGY STAR Recognition

On an annual basis, DOE and EPA recognize select Sponsors who demonstrate leadership and best practices in implementing HPwES. Recipients of awards distinguish themselves through their use of ENERGY STAR tools, strategies and resources as an effective approach to delivering near-term program results while also effectively overcoming market barriers. Interested Sponsors should visit energystar.gov/awards for more information.

Additionally, DOE annually recognizes the leaders among the HPwES participating contractors with the Century Club Award. Award-winning contractors must complete at least 100 HPwES projects per year, be current and in good standing with their Sponsors. To enhance the value of this annual award, DOE created a [Century Club Award web button](#) which may be displayed on the winning contractors' websites.

Continuous Improvement

Effective programs embrace a philosophy of continuous improvement: planning, implementing, measuring, and evaluating. In planning to improve, programs can address problem areas and accelerate success. Sponsors should design programs with tracking and evaluation in mind. Evaluating progress includes a review of program results and participant experiences.

Key components to examine are

- Pre-and-post- energy savings
- Effectiveness of program procedures and operations
- Customer satisfaction
- Status of workforce development
- Market impact and awareness

Evaluation results and information gathered during a formal review process is used by many Sponsors to create new implementation plans, identify best practices, and set new performance goals.



Section 3: Developing and Supporting a HPwES Workforce

Minimum HPwES Program Requirements

Workforce Development

- ☐ Develop a contractor recruitment plan
- ☐ Establish minimum qualifying criteria for participating contractors including:
 - Training and credentialing requirements
 - Capacity and resources to provide program related services
 - Compliance with local registration and licensing requirements
 - Access to qualified installation crews and/or sub-contractors
- ☐ Provide a program orientation for participating contractors
- ☐ Ensure availability in the local market of home performance skills training (technical, software, sales, business development, installations, etc.) for participating contractors
- ☐ Provide technical support for participating contractors and energy advisors.
- ☐ Provide training on basic principles of building science and the house as a system approach to all employees who provide customer service

When designing and launching a home performance program, there is often a limited supply of qualified contractors. Even if a qualified consultant provides improvement recommendations, homeowners typically do not know who is qualified to make the improvements. Developing a strong network of professionals, skilled in customer engagement, the whole-house assessment, diagnostic testing and reasoning, and installation best practices, is essential to a successful HPwES program. Successful Program Sponsors have developed contractor recruitment strategies and qualification criteria to identify and enroll highly motivated and successful contractors to participate in the program. The enrollment process may include training, certification, mentoring and other qualifying criteria such as maintaining specific types of insurance and completing a program orientation session. Once enrolled in the program, Sponsors are responsible for ensuring that adequate technical support is available to the contractor network to provide mentoring, technical assistance, and on-going skills development.

Minimum Requirements

Contractor Recruitment Plan

The Sponsor shall establish a contractor recruitment plan which includes clearly defined qualification criteria and the means by which those criteria can be satisfied. The Sponsor is not required to submit this plan to DOE for review, but Sponsors shall describe the policies and procedures contained within the plan as part of the initial Implementation Plan submitted when establishing sponsorship. Sponsors shall provide a description of any updates when responding to DOE's annual data call (described in **Section 7**) The recruitment plan shall clearly define the credentialing requirements including which credentialing program(s) are acceptable, which certification(s) are required and by whom within the participating contracting firm. The plan shall also include a description of how training and testing services will be accessed and who is responsible for incurring the costs associated with those activities. The plan shall include a review of the local market to determine the capacity of home improvement contractors to provide HPwES services and to identify potential early adopters. Additionally, the Sponsor shall provide a description of any specific organizations they

will engage or other strategies and tactics that will be used to assist in identifying and contacting contractor prospects. Upon request by DOE or its designated agents, the Program Sponsor shall make the plan available for review.

The recruitment plan shall also include a description of the enrollment process, including all steps required for contractors to qualify for participation in the program. At a minimum, the enrollment process must include:

1. Orientation covering the program's technical and administrative requirements and contractor responsibilities,
2. Identification of certification or other alternative credentialing requirements demonstrating the skills and knowledge required for home performance work,
3. Contractor procurement of (or demonstrated access to) the minimum required diagnostic equipment and software tools needed to complete home performance work, and
4. Execution of a participation agreement between the contractor and the Sponsor.

Participating Contractor Minimum Qualifying Criteria

Contractors participating in the HPwES Program are expected to meet or exceed the following criteria:

1. Credentialing of designated personnel sufficient to oversee the work completed through the HPwES program including a minimum of one site visit per HPwES project by appropriately credentialed personnel. The credentialing process shall be at least as rigorous as those employed by nationally recognized certification bodies¹. If an alternative process is used, it shall be overseen by the Sponsor and approved by DOE to ensure it meets or exceeds the level of rigor required by nationally recognized certification programs².
2. Through training and credentialing, the Contractor's staff (or sub-contractors) shall be proficient in the knowledge, skills and abilities needed to conduct whole-house assessments, building performance diagnostics and reasoning, and to calculate (or model using a software tool) estimated energy savings from improvement installations.
3. The contractor must demonstrate adequate capacity and resources (in house or through the support of the program or other allied third parties) to engage customers, conduct whole-house assessments, building performance diagnostics and reasoning, and fulfillment of all program data collection and reporting requirements. This includes having access to adequate diagnostic equipment, tools, qualified staff, data systems and software, and administrative support.
4. The contractor must be current and in good standing with all local registration and licensing requirements for their specific region and trade(s). *(Note: The Sponsor is not responsible for maintaining records of contractor licenses and registrations but must require the contractor to take responsibility by including this requirement within the terms and conditions of the contractor participation agreement. Failure to comply with this requirement may be cause for a contractor's suspension or dismissal from the program by the Sponsor.)*
5. The contractor must employ or sub-contract to companies with workers who are qualified to install and/or physically oversee the installation of home performance improvement measures in compliance with local building codes and industry accepted protocols. Qualifying criteria for workers may include training, experience, licensing, certification, or other requirements specified by the Sponsor.

¹ Most current Sponsors have adopted the Building Performance Institute (BPI) Building Analyst and/or RESNET Home Energy Rating System Rater certifications as part of their minimum qualifying criteria for participating contractors.

² Under the [Guidelines for Home Energy Professionals](#) initiative DOE has created a Job Task Analysis for each of four job designations which may be used as the basis for both training and technical certifications suitable for use in HPwES programs.

Program Orientation

The Sponsor shall provide an orientation for prospective participating contractors which includes an overview of the program and its goals, a review of the procedures and rules for participation including technical and administrative (e.g. paperwork and data reporting) requirements, and a review of the contractor qualification criteria and enrollment process. The program orientation shall also include a review of the program's quality assurance (QA) procedures and the contractor's role in the QA process including corrective actions and disciplinary policies and procedures.

Home Performance Skills Training

Home performance training shall be made available to the contractor community. Trainings covering the principles of building science, whole-house diagnostics, energy assessments, measure installation requirements and techniques, elements of a successful home performance contracting business and effective customer engagement techniques including marketing, sales, and customer feedback, will help to build and support an infrastructure of qualified contractors. Program Sponsors often need not spend resources developing technical, business development, customer engagement, and sales training, since many local, regional and national organizations already offer training appropriate for home performance work. However, the Sponsor shall have a plan in place describing how contractors can access the training needed to prepare for home performance work.

Technical Support

The technical training required to initially become certified is only a starting point for newly practicing home performance contractors. The skills and knowledge needed to efficiently complete a home performance assessment, accurately diagnose building performance problems, prioritize improvement recommendations, troubleshoot unexpected findings, and installation practices needed to implement work identified through the assessment process, are developed over time with experience. Additionally, home performance work often includes measure specifications and installation techniques which may be new to the local contracting community. For this reason, Sponsors are often the best resource for ensuring that participating contractors have access to on-going technical support and shall be responsible for facilitating access for Participating Contractors to obtain appropriate training and technical resources over time.

Table 3 lists the required elements to be included in local Contractor Participation Agreement.

Table 3: Contractor Participation Agreement	
Section	Required Elements
Explanation of Agreement	<input type="checkbox"/> Terms and Conditions: sets out terms and conditions under which contractors shall participate in the Sponsor's Program.
Participating Contractor Commitments	<input type="checkbox"/> Project Reporting: lays out the administrative procedures and requirements the participating contractor must follow to document (and often be compensated for) a completed HPwES project. <input type="checkbox"/> Field Inspections: describes the terms and conditions under which the participating contractor shall allow access for the Sponsor or its designee to conduct in-process and post-installation field inspections. This section also describes the parameters for participating contractors to address any non-conformities. <input type="checkbox"/> Sub-contracting: the allowed conditions for the participating contractor to enter into sub-contract arrangement(s) for completion of project work scopes.

Marketing and Advertising	<input type="checkbox"/> Use of the Home Performance with ENERGY STAR name and mark: describes the compliance requirements for participating contractor's access to use of the HPwES name and mark. This section should specifically reference the current <i>ENERGY STAR Identity Guidelines</i> , which describe how the HPwES mark and name may be used. Additionally, Sponsors should describe procedures for addressing any noncompliance related to the use of the ENERGY STAR marks.
Business Practices	<input type="checkbox"/> General Business Practices: lays out the obligations for licensures, permits, liability insurance, certifications, training, and other requirements deemed necessary by state law and the Sponsor's Program policies and guidelines. This section also includes reference to all relevant documentation pertaining to the installation of efficiency measures.
Whole-House Credentials	<input type="checkbox"/> Credentials/skills: describes the Sponsor's requirements for certification or other accepted third-party verification of knowledge, skills and abilities needed to conduct whole-house assessments, building performance diagnostics, and to calculate estimated energy savings from improvement installations. <input type="checkbox"/> Equipment: lays out the required access to adequate diagnostic equipment, tools, qualified staff, data systems and software, and administrative support.
Termination	<input type="checkbox"/> Right to Terminate: outlines the terms and conditions under which the Sponsor may terminate the Contractor Participation Agreement.

Recommended Approaches

Contractor Participation Agreement

In addition to the Contractor Participation Agreement required elements listed in **Table 3**, the Sponsor should seek professional counsel to create terms and conditions which satisfy the Sponsor's particular needs. Counsel related to legal issues; licensing, registration, and permitting requirements; and insurance requirements should, at a minimum, be considered.

Recruitment

Successful Program Sponsors have developed contractor recruitment strategies that identify and recruit highly motivated and successful contractors to participate in the program. Activities may include speaking at local trade association chapter meetings, cold calling reputable contractors, or hosting a "Profit from Home Performance" workshop to introduce the business opportunity for participating contractors.

Networking with utility, state, municipal, distributor, and contractor stakeholders can also help identify and recruit likely candidates.

Some Program Sponsors offer contractors incentives to participate such as discounted trainings or financing to purchase equipment. These mid-stream incentives serve the purpose of reducing the cost of entry into the market for the contractors and expediting a more rapid deployment of a qualified workforce to support the program. To ensure that program investments reap returns, subsidized training, testing, or equipment should be contingent on the contractor completing specific milestones, such as passing certification tests or completing a certain number of projects in the program.

Sometimes tiered incentives or caps may be appropriate to reach contractors of a variety of sizes and business models. In some markets these incentives may not be necessary to spur contractor participation and interest in the program. Program Sponsors should evaluate their market and survey contractors before designing their incentive offerings. It is also a good idea to re-evaluate mid-stream incentive offers periodically to ensure that they are still working to help the program meet its goals. Once there is an existing infrastructure of experienced home performance contractors doing work in an established program, it may not be necessary to continue to subsidize trainings or other home performance startup costs.

Sponsors should also consider the long-term costs to contractors to maintain their eligibility to work within the program and determine if incentives are needed to assist currently participating contractors with recurring and variable costs such as maintaining certifications and software licenses; training and certifying personnel when turnover occurs; and on-going technical, business development, and programmatic trainings.

On-Going Training and Technical Support

While Sponsors are not required to offer or subsidize training programs on behalf of the program, many Sponsors find this to be a good investment and an effective strategy in developing a qualified workforce. Further, as contractors experience employee turnover, their staff will need to be re-trained periodically and successful Program Sponsors often provide refresher courses. A continuing education requirement passed through to the contractor is one way to reinforce training as a business expense.

Mentoring contractors on-the-job through the HPA, home improvements and test-out has become a common and valuable addition to training. Mentoring reinforces training, helps to verify the contractor is proficient and provides an opportunity to suggest ways to streamline the process to make quality assurance inspections efficient and productive. For example, some Sponsors require mentoring on at least three of the first five home performance projects a contractor completes.

Sharing training and mentoring costs with participating contractors is recommended. Sponsors who offer free training do not help to establish a sustainable training infrastructure. Instead, they reinforce a belief that training is not a necessary business expense and set an expectation that will be difficult to change in the future.

Some Program Sponsors may decide to sub-contract training, mentoring, and quality assurance services. This is common, but Program Sponsors should avoid situations where quality assurance activities are performed by the same person that delivers training and/or mentoring. Sponsors should also take care to ensure proper qualification of quality assurance professionals. Inspectors should have relevant field experience and advanced certification as well as specialized training in how to perform QC inspections.

Through the Workforce Guidelines Project, DOE has created resources which may be helpful to Sponsors developing a training and technical support system for their participating contractor network. Many of the Weatherization Assistance Program Training Centers offer training programs in building science based approaches, diagnostics, and installation techniques that may be available to private market contractors. The International Renewable Energy Council (IREC) offers accreditation of training centers providing home performance and weatherization training programs. And, for those who are developing training curricula, there are Job Task Analysis references available for several of the worker types commonly employed in both weatherization and home performance.

Additional resources for training can be found in the Tools and Resources listed in **Appendix C**.

Credentialing of Participating Contractors and Workers

There are various credentialing programs available for Sponsor's to choose from when designing their program requirements for contractor qualifications. Many Sponsors find it useful to combine more than one training and/or certification program to address both national standards and regional variations in technical needs and requirements. Some examples are included in the following list:

1. Nationally available worker certification programs targeting home performance and weatherization contractors have been developed by the Building Performance Institute (BPI) and the Residential Energy Services Network (RESNET).
2. DOE's Guidelines for Home Energy Professionals project provides job task analyses for four worker job designations which may be used as a basis for both training and certification programs.
3. Regional credentialing programs such as California's Independent Whole House Raters, Texas HERO, or other locally focused training programs may be used alone or in concert with other certifications to ensure climate and region-specific needs are met.
4. Trade-specific certifications are also available through organizations such as North American Technician Excellence (NATE), the National Comfort Institute, Comfort Institute, and some other trade associations.

Sponsors may also find it valuable to take advantage of credentialing and recognition programs offered for contracting firms including BPI's Accredited Contractor or RESNET's Energy Smart Contractor programs. These programs offer additional assurance that participating contractors are operating their businesses in compliance with minimum requirements and are subject to third-party quality assurance.

Section 4: The HPwES Assessment

Minimum HPwES Program Requirements

The Assessment

- ❑ Develop and require a Home Performance Assessment (HPA) for each HPwES project, which ensures, at a minimum, that the following tasks occur at some point in the HPA process:
 - Customer interview
 - Review of energy bills, if available
 - Visual inspection of the home, interior and exterior
 - Data collection of building assemblies and mechanical systems
 - Minimum diagnostic tests
- ❑ Develop and require a Home Performance Assessment (HPA) Summary Report for each HPwES project, which includes at a minimum:
 - Prioritized list of recommended improvements (the proposed improvement measures)
 - Savings projections (estimated or calculated)
 - Notice of health and safety related issues

The Home Performance Assessment (HPA) is a critical element of HPwES. However, it is important to note that the primary goal of HPwES is to facilitate the installation of quality home performance improvements. The assessment is the first step in this process and should be designed and implemented in such a way as to promote and encourage the installation of home performance improvement measures in the homes being evaluated.

The HPA may be completed using a variety of approaches. Fundamentally, it should be designed to capture as much information as necessary to generate a list of recommended home performance improvement measures that will address the customer's needs, and improve the energy efficiency and comfort of the homes served. The level of detail needed to achieve these goals will vary based on the customer, the housing type and condition, climate, fuels used within the home, and other factors.

When designing the HPA for a local program, the following **Guiding Principles** should apply:

1. **Customer Engagement:** Notwithstanding the need for a basis in building science, particularly health and safety, the HPA should be designed to engage the customer and motivate them to action. The Program is not successful unless recommendations are turned into installed measures.
2. **Basis in Building Science:** The HPA must include an evaluation of the home's enclosure and energy-related systems that is based on the fundamental physics of energy, airflow, and moisture in buildings.
3. **House as a System Approach:** When evaluating the energy related performance of the home and determining recommended improvements, the assessment must consider the interactive effects of all energy-related systems in the home using a systems-based approach.
4. **Inspect and Measure as Needed:** As each home presents a unique set of physical and operational characteristics and attributes, the assessment shall include inspections, measurements, and diagnostic tests which are sufficient to provide the data needed to evaluate the performance of the energy-related systems within the home both individually and in combination.

5. **Document, Analyze, and Report Findings:** The assessment shall include an analysis and diagnosis based on observed and measured data which results in a list of prioritized recommended improvements and a prediction of the improved performance of the home including estimated energy savings.

It is not required that all elements of the HPA be completed in a single visit to the home. While many programs operate this way, some find a value in a multi-step approach. Screening visits and walk-through assessments may be used to collect preliminary information about the home and customer to determine if they are good candidates for the HPwES program before investing in additional elements of the HPA. Preliminary screening through data collection over the phone or through an application process can also assist programs in directing customers to the appropriate program and/or level of service to provide more efficient and effective services. Likewise, there should be sufficient latitude built into the HPA process to allow contractors to experiment with different ways of delivering the HPA in order to increase customer engagement.

Minimum Requirements

The HPA shall include an interview with the homeowner, a review of energy consumption history, inspection of the home, diagnostic testing as necessary to evaluate conditions which are not readily observable, a review of the data collected, and analysis of that data to produce a HPA Report. The HPA Report shall include a prioritized list of recommended improvements including projected energy savings estimates associated with those improvements and notification of health, safety, and durability issues identified during the HPA.

Home Performance Assessment

The HPA includes specific activities (i.e. inspections, tests, etc.) that are completed to evaluate a home's existing condition, and prepare a proposed energy efficiency improvement package to the homeowner. Program Sponsors shall have policies and procedures describing the minimum requirements of the HPA and the minimum qualification criteria for the person performing the assessment. The required elements of the HPA do not have to be completed in a single visit to the home but must be completed prior to or concurrent with the commencement of improvement installations under the HPwES program.

The HPA shall include, at a minimum, the following elements as described below:

- **Customer Interview:** At some point before, during, or after the physical inspection of the property, the participating contractor shall interview one of the primary occupants of the home to determine if there are any specific issues the customer is seeking to have addressed by the HPwES program and to identify typical occupant behavioral patterns as they relate to the performance of the home.
- **Review of Energy Bills:** The participating contractor shall also request historical energy bill data be provided by the customer as part of the HPA. While useable, detailed historical bill data may not be available in all cases, it is important for the contractor to ask for whatever information is available to be used as a reality check against projected savings estimates. A review of energy consumption data is critical to determining how the homeowner uses energy and not having this information limits the effectiveness of the HPA. When historical fuel-use data is available, the participating contractor shall review that data to identify patterns that will inform the prioritization of recommended measures and confirm that projected energy savings estimates are realistic.

At a minimum, the participating contractor shall review customer-reported annual or monthly energy costs and use it as a benchmark against estimated cost savings predictions.

- **Combustion Appliance Safety Evaluation:** When combustion appliances and/or space heating equipment are present in the home, a combustion appliance safety evaluation shall be completed following industry-accepted protocols. At a minimum, this evaluation shall include a check for fuel leaks, carbon monoxide, and confirmation that flue gases are exiting the building as required by the equipment manufacturers' specifications. If original manufacturer performance data is unavailable, industry-accepted standards such as DOE's Guidelines for Home Energy Professionals: Standard Work Specifications for Single-Family Home Energy Upgrades (Sections 2.0111.4-2.0301.2) shall be used.³
- **Visual Home Inspection:** A comprehensive visual inspection shall be completed of the home's exterior, interior, thermal envelope and enclosure, and all mechanical systems (including equipment, distribution systems, and controls.)
- **Diagnostic Tests:** Instrumented diagnostic testing shall be completed as part of the HPA process as required to effectively assess the home's energy performance, produce energy savings estimates, and develop an accurate list of recommended improvement measures. The specific required diagnostic tests may vary based on a variety of factors including: local program requirements, the customer's needs and desires, climate, housing stock, mechanical system types, and existing conditions within the home.
- **Data Collection:** Observed and measured data shall be recorded during the HPA including: documentation of the home's physical geometry, features, and measurements; identification and performance data for space heating, cooling, ventilation, and domestic hot water equipment and systems; existing type, quantity, and condition of thermal elements of the building enclosure; evaluation of envelope air leakage paths, and information about existing lighting and household appliances which may be used to inform customers of opportunities for improvements.

Relative to certain kinds of housing stock, mechanical system types, climate zones, or other conditions, it may be necessary to require additional diagnostic testing as part of the core assessment. It is the Sponsor's responsibility to ensure that the minimum requirements for their own programs satisfy the intent of all of the aforementioned guiding principles.

The Home Performance Assessment Report

Upon completion of the HPA, participating contractors shall present an HPA Summary Report to the homeowner. The HPA Summary Report will enumerate the improvement recommendations identified during the assessment. The participating contractor is required to communicate inspection findings and present a set of recommended improvement measures to the homeowner.

At a minimum, the elements included in **Table 4** are required to be included in an HPA Summary Report and provided to the homeowner after the completed HPA. This table represents the minimum data required for a HPwES compliant HPA Summary Report that may be provided as a stand-alone report or concurrent with a contract and agreed upon Scope of

³ Alternative acceptable methods include, but are not limited to BPI's Technical Standards for the Building Analyst Professional ("Combustion Safety and Carbon Monoxide Protection" pages 9-15), ANSI/ACCA 12 QH-2011 Existing Home Evaluation and Improvement Standard, Section 3.3, and the RESNET "Interim Guidance for Combustion Appliance Testing and Writing Work Scope"

Work. Sponsors may elect to require additional data collection and documentation for program specific purposes, such as incentive eligibility screenings, cost-effectiveness evaluations, or building energy modeling.

Table 4. Home Performance Assessment Report: Required Elements

	Required Elements	Description
General Information	Participating contractor name	Annotates the company taking <u>primary responsibility</u> for the HPwES project. This is the contractor of record who will be credited with the project in data reported to DOE.
	Contractor contact information	
	Identification of the contractor's qualifying credential(s)	
	Name of technician completing the HPA	
General Information	Customer name	Additional data such as utility account numbers may be required by the Sponsor to uniquely identify the site and qualify the project for program incentives. (Note: Although the information noted should be included in the homeowner report, DOE does not collect any personally identifiable information for HPwES customers.)
	Assessed home's address	
	Date of HPA	The date that the primary assessment site visit was conducted.
Existing Conditions	Building envelope air leakage evaluation	Results of the visual inspection shall be recorded including a preliminary identification of leakage paths to be sealed or general scope of air sealing work to be completed as a recommended improvement measure.
	Thermal barrier condition assessment	Includes all walls, floors, ceilings and other enclosure elements comprising the envelope of the building. The report shall document the general conditions and estimated existing R-value (or U-value) for each unique surface.
	Mechanical systems inventory and condition assessment	Includes identification of all heating, cooling, domestic hot water, and ventilation systems in the home by system and distribution type, fuel type; make and model numbers; rated and/or measured operating efficiencies; and condition evaluation.
	Heating and cooling distribution system condition assessment	Includes a description of the existing heating and/or cooling distribution system by location, insulation condition, leakage assessment, and general condition evaluation including potential design flaws to be considered for improvement.
	Lighting and appliance assessment	Includes a general description of the overall condition, age, and efficiency (if available) of major household appliances in the home as well as a general evaluation of the opportunity for efficiency improvements to the existing lighting. Note: a detailed inventory of all lighting and appliances in the home is not a requirement.

Proposed Improvement Measures	Prioritized list of recommended improvements	Includes home performance improvement measures identified during the assessment. Prioritization shall be determined based on: (1) Resolving health and safety related issues; (2) Satisfying customer needs and desires; (3) Overall cost-benefit to the customer; and (4) programmatic goals. The loading order of recommended improvements shall be consistent with industry-accepted standards and building science principles.
	Specifications for recommended improvement measures	Specifications shall be consistent with Sponsor-defined minimum installation specifications and include descriptions of individual measures to be installed; materials, quantities and sizes, as applicable to ensure performance (e.g. recommended insulation type and density should be listed if a change in the specification might impact the final performance of the measure); and rated post-installation energy performance data (e.g. R-values, AFUE ratings, etc.).
	Specifications for gaining access to areas to be treated, final finished conditions, and test-out requirements.	Includes any special instructions for the customer (e.g. removal of storage from areas to be treated) and descriptions of how access will be obtained if necessary.
Health and Safety	Documentation of moisture-related problems	Includes signs of water intrusion, condensation, mold, and water stains; suspected sources and causes; and recommended repairs.
	Results of combustion appliance evaluation	Includes a general condition assessment based on visual inspection as well as results of diagnostic tests used to evaluate fuel leaks, carbon monoxide, and drafting of flue gases.
	Identification of hazardous conditions and recommended mitigation measures	Includes repairs that must be completed prior to or concurrent with energy-related improvements (e.g. electrical repairs, roof replacements, asbestos removal, etc.).
Energy Savings	Estimated energy savings	Includes a projected site energy savings associated with the recommended improvement package(s). This may be presented in terms of reduced fuel consumption, reduced costs, a percentage improvement over existing conditions, or an improvement on a relative scale or benchmark such as a Home Energy Score, Home Energy Rating, or Energy Performance Score. (Note: Energy simulation software is not a requirement.) Savings estimates shall clearly indicate whether savings are projected for electricity, heating, cooling, or total household energy consumption.

To facilitate the process of developing HPA reports for every home served by HPwES, it is allowable to use generic descriptions as applicable for report elements that are likely to be encountered frequently within the program's service

territory. For instance, it may be helpful to develop “typical language” that can be used in the report to discuss energy efficient lighting or appliance options based on the most likely scenarios the contractor is likely to encounter.

Special Requirements for Multifamily Buildings

Scope of Building Types

Any multi-unit building subject to residential building codes as determined by the local authority having jurisdiction may participate in HPwES.

Reporting Options

HPwES projects may be reported at the building or the dwelling unit level, depending on the building type and the nature of the improvements that were installed.

HPwES Program Participation

In all cases, projects must be overseen by a HPwES Program Sponsor and follow all minimum Program requirements as required for single family detached dwellings. When whole building improvements (e.g. adding insulation to an attic space covering multiple dwelling units) are installed following these guidelines, the Sponsor may count all dwelling units directly improved by those measures toward their reported HPwES completed projects. When buildings are improved unit-by-unit, only those dwelling units that have been improved may be counted. Improvements impacting the energy efficiency of common areas and other non-residential spaces may be included in overall work scopes but only projects directly impacting dwelling units will be recognized by the HPwES Program.

Mechanical System Provisions

Individual Mechanical Systems

Buildings with separate mechanical systems that provide all heating, cooling, domestic hot water (DHW), and ventilation for each dwelling unit individually may be counted as projects in the HPwES Program provided, at a minimum, that all other requirements listed in this section are met. Program Sponsors may adopt more stringent or specific requirements at their own discretion.

Central Mechanical Systems

Buildings using any HVAC-related central mechanical systems including heating, cooling, DHW, and ventilation systems will require DOE review and approval for inclusion in the HPwES program. Sponsors may apply for program-wide authorization to include specific building types in their HPwES portfolio by submitting a summary of the local program’s technical requirements for low-rise multifamily buildings with central systems for consideration by DOE as part of their implementation plan. This requirement is a one-time process review to ensure appropriate provisions are in place in the program’s policies and procedures to address the unique technical challenges of buildings with central mechanical systems servicing multiple dwelling units. Sponsors are not required to obtain project-by-project approvals from DOE for HPwES.

Energy Modeling and Savings Predictions

Energy simulation using modeling software is not required by the HPwES Program for single family homes or for low rise multifamily buildings. However, when energy simulation software is used to predict energy savings and cost-benefit analysis of proposed improvements in multifamily projects, the following guidelines apply:

- Buildings with individual mechanical systems in each dwelling unit may be modeled as a whole building or unit-by-unit at the Sponsor's discretion.
- When individual dwelling units are modeled, the simulation should assume no heat transfer across surfaces separating similarly conditioned spaces following the software developer's recommended method for modeling these surface types.
- Buildings with any central mechanical systems (including heating, cooling, DHW, and ventilation) should be modeled using software designed for whole-building energy simulation. Additional provisions for the determination of predicted dwelling unit savings may be applied at the Sponsor's discretion.

When evaluating a whole building using unit-level modeling, Sponsors may elect to model every apartment in the building or apply one of the following sampling approaches to estimate pre- and post-retrofit energy consumption:

- For each unique unit type (including variations based on size, geometry, mechanical systems, number of bedrooms, and exposed surface configurations) and aggregated to determine the whole building energy consumption.
- Follow sampling protocols in the RESNET Standards⁴ and model worst-case configurations of each unique floorplan.

Recommended Approaches for Single and Multifamily Buildings

Supporting a Whole House Approach

All programs have their own specific goals which will dictate priority areas for HPA's but it is important to make sure the program design allows for sufficient latitude to generate whole-building based SOW's. Many programs do not have the financial resources or regulatory freedom to offer incentives for the full range of improvements that will come up as a result of the HPA. As a result, it is a good practice to design your program to allow for contractors to offer add-on services at market rates to their customers to give them the option to complete comprehensive SOW's even if all measures cannot be funded or incentivized through the program.

To ensure market success and avoid overburdening the contractors and customers, the HPA should not be overly complex. The assessment should go deep enough to produce meaningful recommendations without wasting resources on unnecessary diagnostics, data collection, and calculations that will not be used later.

Strategies for Diagnostic Testing Requirements

The purpose of the HPA is to facilitate the installation of improvements in the home. While it is an important premise of the HPwES Program that the performance of these installations be measured via pre- and post-installation diagnostics

⁴ The sampling protocols referenced here are intended to be applied for purposes of energy assessments and test-in/test-out diagnostics. This is not to be confused with the minimum requirements for QA inspections.

(see also **Section 5**), it is equally important to design the HPA strategically for the most efficient use of program resources (including the contractor's and customer's time.)

Standards and specifications for conducting energy assessments as well as diagnostic testing protocols are available through a variety of industry resources. A few examples include:

- DOE's *Guidelines for Home Energy Professionals: Standard Work Specifications for Single-Family Home Energy Upgrades* provides guidance on specific measure installations and required diagnostic testing and also provides protocols for conducting the tests.
- The Air Conditioning Contractors of America's *Standard 12: Existing Home Evaluation and Performance Improvement* provides guidance on conducting whole house energy assessments, diagnostic testing procedures, and performance tolerances.
- The BPI's *Technical Standard for Building Analyst Professionals* provides guidance on diagnostic testing procedures and performance tolerances and *BPI-1100-T-2012 Home Energy Audit Standard* provides procedures for conducting a home energy audit including selection of appropriate diagnostic tests for given site conditions.

There are many beneficial reasons to perform instrumented diagnostics during the assessment, particularly when assessments are conducted by inexperienced workers. Some of those reasons are listed below:

- Diagnostic equipment like blower doors and infrared cameras can be used effectively to engage the customer during the HPA.
- Measurement of existing conditions in the home can help support accuracy in pricing and savings estimates for certain measures like air sealing and closed cavity insulation.
- Pre-installation diagnostic tests can assist in the prediction of final results so contractors can anticipate possible additional health and safety related measures that may be needed once primary energy saving measures are installed. (For example, it may not be possible predict backdrafting of combustion appliances after air sealing, but a blower door test done during the assessment will improve the accuracy of predicting potential post-improvement failures making it possible to include venting of combustion appliances in the initial proposal based on the projected results.)
- Diagnostic test results can impact the accuracy of modeled energy savings predictions.

Depending on the specific needs and goals of the Sponsor's program, it may be beneficial to include some standard diagnostic tests in the minimum HPA requirement. Using discretion in selecting these requirements to determine if every test is purposeful will help to ensure resources are not wasted on unnecessary tests.

Some Sponsors have developed a tiered approach to address this issue, offering different levels of assessments for different types of customers or at different stages in the process. For example, a walkthrough audit can be useful as a screening tool to identify homes that would benefit from a full diagnostic assessment and filtering out those with little potential for improvement. If workers are already in the home for other reasons, an abbreviated assessment, such as that offered by the Home Energy Score could be a viable option for getting homes with the highest potential into the program pipeline.

Proposed Improvement Measures Review

Some programs may require a review of the assessment data and proposed improvement measures before approving financing or incentives for eligible measures. The review may include any or all of the following: a detailed review of the data collected during the assessment, work-scope details, and results of energy modeling and cost-effectiveness calculations. If pre-approval for incentives or financing is required, be aware it will add an interruption to the customer's decision-making process and can represent an excessive administrative burden on the program and participating contractor, and can potentially damage the customer-contractor relationship. As the program matures and participating contractors improve, reducing or eliminating the requirement will reduce administrative costs to operate the program, expedite the project cycle time, reduce potential attrition points for customers, and give contractors more flexibility to quickly close projects.

Program Sponsors should consider how cost estimates will be generated at the time of the HPA and ensure that program policies and procedures are clearly defined and enforced. In some program models and project scenarios, the person calculating the initial cost estimate may not have final bids or pricing from the installation contractor(s). It is the Program Sponsor's responsibility to provide guidance on allowable methods of cost-estimating.

Additionally, while market-based approaches are encouraged, Sponsors should monitor proposed cost estimates as part of the quality assurance process to protect against price gaming used solely to take advantage of program incentives and/or to artificially drive higher cost measures. For example, if a contractor is found to be artificially inflating the cost of higher payback measures like air sealing to drive the installation of higher cost, lower payback measures like windows, this practice should be addressed directly by the Sponsor to participating contractors to ensure transparency, fairness, accuracy of cost-effectiveness predictions, and program consistency.

Estimating Energy Savings

While HPwES encourages customer engagement based on the needs and desires of the homeowners, the primary driver for DOE and most Sponsors is energy savings. Consequently, HPwES promotes the idea that homeowners can expect to save 20% or more of their total energy bill by installing recommended measures that are identified during home performance assessments. Contractors participating in HPwES need to have clear guidance on what methods are acceptable for estimating the energy savings that will result from installing a package of home improvements.

Fundamentally, estimating energy savings requires predicting future energy use.

$$\text{Percent Energy Savings} = 1 - (\text{Predicted Post-Improvement Energy Use} \div \text{Pre-Improvement Energy Use})$$

Predicting the future is never easy. The baseline energy use (pre-improvement) can be estimated or based on historical energy bills. Using a historical baseline is preferred, but there is no way to avoid predicting the estimated future energy use after improvements.

HPwES Sponsors use many different methods to estimate the expected energy savings associated with a package of improvements. Each of these methods has advantages and disadvantages. In order to evaluate which method may be appropriate for individual Sponsors, it is important to understand how estimation of energy savings serves a variety of different stakeholder needs. To ensure consistency at the local level, Sponsors should define guidelines describing

which methodologies are acceptable for use in the local program to analyze existing consumption data and to predict future energy savings.

Appendix F includes discussion of the various approaches used to estimate savings and cost-effectiveness.

Whatever method is used to predict energy savings, it is important that these projections are “trued up” or calibrated to the historical fuel usage of the home whenever that data is available. When computer modeling is used to simulate the energy consumption of the home before and after improvements, a calibration procedure such as the BPI’s *Standard 2400-S-2012 Standard Practice for Standardized Qualification of Whole-House Energy Savings Predictions by Calibration to Energy Use History* should be used to ensure savings predictions are consistent with the home’s actual performance patterns. When other methods are used to predict energy savings, the energy consumption and/or cost data should still be used to provide a reality check against savings projections.

Water Savings

While not required by the HPwES Program, water savings represents a significant opportunity for contractors, consumers, and potentially Program Sponsors. Some municipalities have water and sewer rates resulting in water bills rivaling homeowners’ energy bills. From an overall home performance perspective, water savings should be considered during the HPA, particularly when water usage consumes significant energy due to hot water production and/or electricity used for pumping or represents a significant portion of the household’s operating costs.

Section 5: The HPwES Project Installation

Minimum HPwES Program Requirements

The Installation

- ❑ Develop and require measure installation specifications, which include at a minimum:
 - Installation of measures, including the sequence of installation shall be consistent with the contracted Scope of Work (SOW), as agreed upon between the participating contractor and the customer
 - Installations shall be compliant with local building codes and permitting procedures, industry-accepted standards, and manufacturer’s specifications for the materials and equipment being installed
 - Installations shall be completed by qualified workers
- ❑ Develop and require, test-out procedures, which include at a minimum:
 - Visual inspection of installed measures as specified in the SOW, review of commissioning reports, and diagnostic tests as necessary to confirm that manufacturers’ specifications and industry-accepted standards have been satisfied
 - Combustion safety checks for all projects where improvements might impact combustion appliance performance
 - Blower door tests when measures impacting infiltration rates are installed
 - System airflow and/or static pressure tests when duct sealing measures are installed

It is the Sponsor’s responsibility to ensure that improvement measures installed under the HPwES Program are installed in accordance with Program specifications. The guiding principles for HPAs (refer to **Section 4**) hold true for the installation of recommended measures. Adhering to these general principles will help prevent the adverse impacts of sub-standard improvement work and ensure that predicted energy savings post-improvement.

One features that distinguishes HPwES projects as a value-added service for residential customers is the series of inspection and instrumented tests the home performance contractor performs after the improvements are made to a home. These tests support the “do-no-harm” principal that is a hallmark of home performance contracting. While there is no guarantee that any home will operate safely under all conditions, the HPwES Program is explicitly concerned about health and safety of the occupants. In addition to addressing health and safety issues that may be directly affected by the home performance work, some of the tests provide valuable information on the effectiveness of certain installed measures and verification that estimated savings objectives have been met and systems are operating with specifications.

Minimum Requirements

The SOW shall serve as the set of measures agreed upon by both the participating contractor and customer after review of the HPA results, recommended improvement measures, the customer’s specific needs and wants, and the Program Sponsor’s requirements. This includes installation specifications as well as appropriate sequencing of measure installations (i.e. loading order) to ensure predicted performance improvements have been achieved. Installation requirements described within this section refer only to the contracted SOW.

Scope of Work and Installation Requirements

When installing measures for a HPwES project, the following minimum requirements shall be followed:

- ☐ Sequencing of the installation of measures shall be completed in a manner that prevents potential subsequent defects, (such as moisture problems or back-drafting combustion appliances) and maximizes energy savings. (Note: It is assumed that consumer driven preferences and needs are already factored into the prescribed loading order of the contracted SOW during consultation and negotiations resulting from the HPA Report and recommended improvement package are included).
- ☐ Installations shall be compliant with building codes, industry-accepted standards, and manufacturers' installation instructions for the materials and equipment being installed. The Sponsor shall be responsible for identifying which specific industry standards (e.g. DOE's *Guidelines for Home Energy Professionals: Standard Work Specifications for Single-Family Home Energy Upgrades*, BPI's *Technical Standards for Building Analysts*, ASHRAE 62.2-2013, ACCA Standard 5 QI-2010, NFPA 54-2012, etc.) are to be referenced for HPwES projects.
- ☐ Specifications for envelope measures designed to reduce air exchange rates shall be prioritized based on preventing defects (such as interior moisture migration into building cavities), reducing energy consumption in the building, and improving the thermal comfort within the building. Air sealing and insulation measures necessary to address these issues shall not be limited to avoid falling below the minimum air exchange rate requirements for indoor air quality. If natural air exchange rates fall below the rates prescribed by industry-accepted standards, then intentional passive and/or mechanical ventilation system improvements shall be included in the scope of work to satisfy these requirements.
- ☐ Materials and installation techniques used shall be consistent with a building science based approach to achieve projected energy savings, minimize indoor air quality problems, minimize the accumulation of moisture in building assemblies, and ensure materials and equipment installed operate at rated capacities and efficiencies.
- ☐ All measures shall be installed by qualified personnel.

Post-Installation "Test-Out" Procedures

To ensure that the "test-out" is performed properly, Program Sponsors shall adopt "test-out" requirements in their program policies and procedures that meet or exceed the guidance in this document. Participating contractors commonly conduct their own post-testing, but some Sponsors use a third-party for the final test-out. While it may include a similar set of tests and inspections, this process is not the same as inspections that are conducted for quality assurance purposes (see **Section 6**). The test-out process is a standard element of every home performance project. Documentation of test-out results may be used to quantify final energy savings projections as well as verify that systems are performing within specifications.

The following are minimum requirements for HPwES test-out procedures on all projects:

- ☐ Installation of measures as specified in the SOW shall be verified via visual inspection, review of commissioning reports or mechanical system performance testing documentation, and other diagnostic tests as necessary to confirm that the manufacturers' specifications and industry-accepted standards have been satisfied and systems are performing at least as efficiently as specified in the contracted SOW.
- ☐ Combustion safety checks are required for all homes with combustion appliances following industry-accepted protocols. At a minimum, this evaluation shall include a check for fuel leaks, carbon monoxide, and confirmation that flue gases are exiting the building as required by the equipment manufacturers' specifications. If original

manufacturer performance data is unavailable, industry-accepted standards such as DOE’s *Guidelines for Home Energy Professionals: Standard Work Specifications for Single-Family Home Energy Upgrades* (Sections 2.0111.4-2.0301.2) shall be used.

- ❑ Post-installation blower door tests are required when measures impacting the building’s natural air exchange rates are installed. Final air exchange rates (either natural or mechanically driven) must be within industry-accepted tolerances⁵ to ensure indoor air quality.
- ❑ System airflow and/or static pressure tests must be completed when duct sealing measures are installed to verify that systems are operating within the manufacturers’ specified performance ranges.

Special Requirements for Multifamily Buildings

Types of Improvements

Whole Building Improvements

Whole building improvements are defined as measures which impact the energy-related performance of the overall building. Examples include air sealing and insulation of roof or attic spaces covering multiple dwelling units, upgrades to a central heating system serving multiple apartments, or building-wide replacement of windows, etc.

Unit-by-Unit Improvements

Unit-by-unit improvements are defined as measures with impact limited to the energy-related performance of individual dwelling units. Examples include in-unit lighting and appliance upgrades and improvement/replacement of in-unit unitary heating/cooling/DHW equipment, etc.

Performance Testing and Quality Assurance

Test-in and test-out requirements for installed measures are the same for single-family detached buildings described in **Section 4** of this guide with the following modifications. Sampling should follow RESNET Standard (Sections 603.7.1 through 603.7.8 and Section 603.8) or include a minimum of 10% of the total number of dwelling units treated that are fully representative of the variation in exposed surfaces (for envelope measures) and mechanical equipment (for mechanical measures) across the entire population of improved dwelling units.

- Combustion safety testing must be completed for all combustion appliances located within the building that may be impacted by improvements. Sampling protocols may not be applied to combustion safety testing requirements.
- Whole building blower door tests are not required for whole building attic treatments. In-unit blower door testing should be used to verify unit level air exchange rates for ventilation purposes whenever shell-tightening measures are part of the scope of work at the dwelling unit or whole building level. A sampling approach may be used for in-unit blower door tests to determine ventilation rates if there are no other health and safety-related issues.

⁵ For example, ASHRAE Standard 62.2-2013, “Ventilation and Acceptable Indoor Air Quality in Low Rise Buildings”

- A sampling approach may be used for test-in/test-out of in-unit improvements unless they are health and safety related (for the purposes of this provision, blower door tests are exempt from the health and safety related category unless there is a specific health and safety concern unique to the building or project.)
- Guarded blower door tests (i.e. using multiple blower doors simultaneously in adjacent spaces) may be used to isolate leakage paths for diagnostic purposes but are not required.

Minimum required Quality Assurance (QA) inspection sampling rates are the same as for single-family detached dwellings based on the total number of dwelling units improved under the HPwES Program as described in **Section 6** of this guide.

Project Oversight

All HPwES projects and test-out diagnostics must be physically overseen by a qualified technician to complete pre/post diagnostic tests and ensure compliance with all Program rules. A building owner or management company may act as their own contractor if they have the in-house capacity to install HPwES project measures. Local Sponsors may elect to establish their own rules for third-party oversight of HPwES projects.

Recommended Approaches

Installation Specifications and Performance Testing Protocols

DOE's Guidelines for Home Energy Professionals Standard Work Specifications (SWS) (see **Appendix D** for more information) provide a comprehensive resource for installation specifications for home performance improvements. This document describes details for minimum performance, material selection, and installation techniques for a comprehensive set of building construction details and mechanical system types and components. Measure by measure, the work of a home performance crew is broken down into desired outcomes and the minimum specifications that are required to achieve those outcomes. They provide a foundation for training and the development of best practice guides. They also provide a uniform basis for assessing the quality of installed work. HPwES Sponsors are strongly encouraged to use these specifications as a key reference when establishing their own program requirements.

Building America's online Solution Center (*forthcoming*) serves as a clearinghouse for a wide variety of technical documents and references including white papers, research and demonstration project reports, as well as many construction details which may be helpful as references.

Guidance reference documents and test-out templates are offered in Appendix XX (*forthcoming*) to assist Program Sponsors with the development of their "test-out" procedures. When a participating contractor completes home performance improvements for a customer, they will perform the post-installation tests and inspections described in this section, and document the results in a "Post-Installation Tests and Inspections" Form. DOE offers a template form that can be used or modified by Program Sponsors. If any of the tests or inspections show the need for corrective action, the contractor can record the action item(s) in the document or postpone completing the Form (including having the customer sign it) until those corrective actions have been made.

Worker Qualification

It is important to the success of the program and achievement of predicted performance improvements that installation workers are trained in building science and house as a system principles. Furthermore, in addition to being

appropriately experienced and licensed as required by local codes and statutes, these workers should be trained to understand and apply program specific installation requirements.

Job task analyses (JTA's) for certification programs designed for installing technicians are available through DOE's Workforce Guidelines Certifications for Home Energy Professionals. Certifications for Retrofit Installers and Crew Leaders, based on the Workforce Guidelines JTA's, are currently available through the BPI. BPI also offers certification for air sealing and insulation installers. Trade-specific certifications for HVAC workers are also available through organizations such as North American Technician Excellence (NATE), National Comfort Institute (NCI), Comfort Institute, and some other trade associations.

Performance Testing the Installation

Building performance diagnostic tests are often associated with the assessment, post-installation test-out, and inspection stages of a residential retrofit project. However, some of the most successful programs and contractors make it a priority to ensure that installation crews are trained to use these same diagnostic tools in-process during the installation to both guide and verify their work. In process diagnostics provide valuable feedback to installation crews and are the best means by which an installing technician can verify that the project specifications have been satisfied prior to leaving the job. Sponsors are urged to encourage and support program and contractor business models which employ this approach to improve productivity, worker and customer satisfaction, and achieved performance improvement results.

Section 6: HPwES Quality Assurance

Minimum HPwES Program Requirements

Quality Assurance

- Develop and implement a Quality Assurance Plan, which includes all of the following:
 - Execute a signed partnership agreement with all participating contractors including requirements for compliance with the Sponsor's QA system
 - Maintain records on quality control activities relating to the participating contractors including:
 - Inspection sampling rate
 - Inspection findings
 - Corrective actions, including process improvements resulting from QC activities
 - Be prepared for review by request of DOE or its implementation contractor
 - Implement a mechanism for customer feedback
 - Have a conflict resolution procedure in place to address problems identified through QA activities and customer feedback.
 - Implement one of the following two options:
 - **OPTION 1: Meet minimum requirements for Quality Control**
 - **OPTION 2: Implement a Quality Management System [Appendix G]**

Quality Assurance (QA) is an essential component of HPwES and Sponsors are responsible for developing and implementing a Quality Assurance Plan. Quality assurance protects homeowners by providing an independent review of the work performed by participating contractors to ensure that it meets program standards. Quality assurance also protects the reputation of the HPwES Sponsor and provides a feedback mechanism for both customers and participating contractors.

Quality assurance is often confused with quality control. It is important to note that quality assurance deals with *systems that are designed to meet customer expectations*. Quality control is concerned with *a product or service meeting a particular standard*. A product or service may conform to a standard or specification but miss the mark in terms of customer expectations.

A properly designed and executed quality assurance plan eliminates ambiguity by clearly defining and addressing each of the following program elements:

- Overall program goals,
- Customers served and their needs and desired outcomes,
- QA responsibilities of the organization(s) and individuals engaged in program activities,
- Success metrics,
- How success metrics are measured, and
- How overall process improvements are informed by QA activities.

In addition to definitions provided in the Glossary, a primer on the terminology and steps involved in executing the QA processes described in this section is included in Appendix XX (*forthcoming*).

Minimum Requirements

The Sponsor is required to maintain and allow access by DOE, EPA, or their authorized agents to records that demonstrate compliance with the commitments defined in the signed Program Sponsor Partnership Agreement. To verify compliance and maintain the integrity of the program for all Sponsors, DOE and EPA will perform periodic audits and may request records for review. Records may be reviewed by DOE, EPA, or their authorized agents, either remotely or through site visits to the Sponsor's location.

Sponsors are allowed to select one of two paths as their primary means of satisfying the HPwES Program QA requirement. The option selected shall be included in the Sponsor's Implementation Plan (and updated in the Sponsor's Annual Report) with policies and procedures made available to DOE or its designated agents upon request. These options are listed below and described in more detail in the following sections:

- **Option 1: Quality Control (QC)**

The QC option relies primarily on checks and inspections performed by a party which is external to the installing contractor, to verify compliance with program standards and customer satisfaction. Deficiencies identified as a result of the QC process are addressed through feedback to the contractors and enforcement of a clearly defined issue resolution process. Sponsors using the QC-based approach as their primary QA option may also choose to employ some of the strategies described in the QMS-based system (Option 2) to enhance their QA program.

- **Option 2: Quality Management System (QMS)**

The QMS option uses a systems-based approach promoting the integration of quality principles throughout the entire program delivery infrastructure from the Sponsor to its entire staff, vendor, and contractor network. The QMS approach relies on instilling a culture of quality which holds each individual working within the program responsible for delivering quality products and services as defined by a customer-focused set of pre-defined criteria. While QC activities identified in Option 1 may be a part of a QMS program, the long-term burden to the program associated with QC activities can be reduced with the implementation of a successful QMS program.

Table 5 provides a listing of the minimum QA requirements, for which QA approach option the element is required, and whether the described elements are subject to a data/file review or site inspection (or both) by the Sponsor or DOE. DOE will periodically review the Sponsor's activities and records. The Sponsor is responsible for reviewing the activities and records of the participating contractors. *Components subject to both data/file review and site inspection are not necessarily required to receive both types of audit review during a single review period.*

Table 5. Summary of QA Verification Points

QA Option	QA Requirement	Verified by Sponsor	Verified by DOE	
			Desktop	Site Visit
1 & 2	Comply with <i>ENERGY STAR Identity Guidelines</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
1 & 2	Execute signed participation agreements with all participating contractors	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

1 & 2	Implement a system for collecting and responding to customer feedback	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1 & 2	Implement a conflict resolution procedure	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1	Complete a data/file review of all contractor projects	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
1	Ensure completion of on-site inspections of all participating contractors (minimum 5% sample of projects for each contractor)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
1 & 2	Maintain records on quality control inspections including sampling rates, findings, corrective actions taken, and verification of conformance to specifications	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	Comply with self-defined and Department approved QMS elements	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	Maintain records on internal quality control data collected during production including documentation of defects observed, corrective actions taken, and verification of conformance to specifications	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

A detailed discussion comparing Options 1 and 2 and describing the QMS-based approach is included in **Appendix G**. DOE will be working with several sponsors in late 2013 and early 2014 to pilot QMS based QA programs. Sponsors who wish to use Option 2 should contact their Account Manager for assistance.

General Requirements (Both Options 1 and 2)

The following requirements are to be satisfied by all HPwES Sponsors regardless of which QA implementation option path is selected.

Compliance with ENERGY STAR Identity Guidelines

The ENERGY STAR identity is maintained by EPA and DOE and is protected as to its use and application. The requirements for working with *ENERGY STAR Identity Guidelines* are described in detail in **Section 1** of this document. At a minimum, the Sponsor's QA program must include activities to monitor and verify compliance with the following provisions:

- **Adhere to the ENERGY STAR Identity Guidelines:** As agreed to in the Program Sponsor Partnership Agreement for Home Performance with ENERGY STAR, Sponsors will abide by the EPA guideline as it pertains to mark use, marketing materials, brochures, and other uses of the identity mark.
- **Assure compliance of ENERGY STAR marks by participating contractors:** Sponsors must assure, through communications and quality assurance activities with participating contractors, that their participating contractors use the ENERGY STAR mark in accordance to the ENERGY STAR Identity Guidelines.

Contractor Participation Agreement

A signed Participation Agreement shall be executed by all participating contractors in the program. It is the Sponsor's responsibility to ensure this is completed as part of the contractor enrollment process. Every contractor working within

a Sponsor's HPwES program must have signed a Participation Agreement indicating an understanding and intent to abide by the *EPA ENERGY STAR Identity Guidelines*, to follow standards and specifications of the program, and to report HPwES project data to the Sponsor. Guidance for the content to be included in a HPwES contractor participation agreement is provided in the Recommended Approaches included in **Section 3** of the Sponsor Guide and Manual.

Customer Feedback System

A HPwES Program quality assurance plan shall include a process for program and process review, identification of system lapses or weakness, and development of actions designed to strengthen the delivery of the product to the client. Customers participating in a Sponsor's HPwES program shall have access to a system that enables them to report concerns and issues directly to the Sponsor. Sponsors shall be responsible for communicating customer feedback to the affected contractors. All feedback from customers shall be documented and evaluated to inform decisions related to program operations and future program designs. Any negative feedback shall be addressed and records relating to the contractor feedback, response, and final resolution shall be maintained and made available for review by DOE if requested.

Conflict Resolution Procedure

HPwES Sponsors shall develop and implement a process for responding to conflicts, complaints, or other issues identified through the customer feedback process and/or other QA activities. This process shall be in writing and include protocols for timely response, identification of responsible parties, documentation of corrective actions, results, and implementation of systemic improvements resulting from these issues.

On-Site Inspections

Regardless of which approach a Sponsor chooses for their Quality Assurance Plan, some level of physical inspection of project sites will be required. At a minimum, these inspections shall be performed by technically qualified personnel who have been trained on the program's quality assurance policies and procedures and inspection protocols. Site inspections shall, at a minimum include:

- A visual inspection of the site and work conditions
- Verification that the installed measures match the contracted SOW and any change orders have been appropriately documented
- Verification that diagnostic test results are accurate (may be directly observed if the inspector is present at the time of testing or repeated by the inspector)

Remedial Actions and Due Process (Both Options 1 and 2)

When deficiencies are detected through the inspection and testing process using either the QC-based or QMS-based approach, the Sponsor shall ensure that these results are communicated to the responsible party and any remedial or punitive actions taken follow a pre-defined set of protocols (due process). The Sponsor shall develop due process policies and procedures which shall be included in the QA Plan.

In addition to the items described above, the Sponsor shall select one of the following approaches for implementation of a Quality Assurance Plan:

Quality Assurance Plan

In general, a Quality Assurance Plan should describe the basic management functions for the delivery of the product or service provided and is designed to meet the expectations of a targeted customer.⁶

QC-Based Quality Assurance Plan (Option 1)

The HPwES Sponsor's QC-Based Quality Assurance Plan shall include, at a minimum, the following elements as described below:

- **Data/file review of reported HPwES projects:** The Sponsor shall establish and implement a system of reviewing project data submittals in paper or electronic form to ensure participating contractors' projects are in compliance with HPwES minimum requirements and the policies and procedures established by the Sponsor for the program. In particular, the Sponsor shall determine whether the HPA was implemented, the findings and recommendations from the HPA were provided to the homeowner (including costs and estimated savings), if the recommended improvement measures were consistent with the guiding principles and minimum requirements of the HPA, if the contracted scope of work was fully installed using industry best-practices, and if post-installation testing was performed to verify installed-measure performance and health and safety conditions of the home post-installation. Findings shall be recorded and maintained including documentation of corrective actions and verification of compliance with program requirements.
- **On-site inspections:** The Sponsor shall conduct physical, on-site inspections for a minimum of 5% of all HPwES projects completed by each participating contractor. On-site inspections conducted to satisfy this requirement may occur at varying stages of the HPwES project including assessment, installation, test-out, and post-completion inspections, provided a minimum of 50% of all inspections reported for each contractor represent post-installation inspections. Findings for each contractor shall be recorded and maintained including documentation of corrective actions and verification of compliance with program requirements.
- **Inspection records control:** Inspection activities, including processes, rate of inspections, findings for data review and on-site visits, corrective actions, customer feedback, and customer response shall be maintained by the Sponsor and be made available to DOE or its agents upon request.

Qualification of QA Inspectors

The Sponsor shall ensure that personnel providing technical inspections of Contractors' work are sufficiently trained and qualified to oversee this work. Inspectors shall have relevant field experience and advanced certification as well as specialized training in how to perform QC inspections.

Recommended Approaches

A number of resources are available to assist organizations with the development of quality assurance plans and the use of associated quality control tools and strategies. It is important to note, however, that templates, checklists, and guides that don't fit well into a Sponsor's existing operations (or the operations can't be altered without great effort) have little likelihood of adoption and use. References that may be useful for planning and implementing a quality assurance program are provided in **Appendix G**.

⁶ A primer is being developed by DOE to further assist Sponsors in developing effective QA plans. This document should be available in late 2013 or early 2014.

Tiered Inspection Rates

Whichever QA option is selected by the program Sponsor, a tiered approach to inspection sampling rates based on contractor experience and recent performance can be an effective means of keeping program administrative costs down and rewarding contractors with excellent quality management. Using a tiered approach, a Sponsor might require a higher sampling rate of inspections to be conducted for newly enrolled contractors and reduce that rate over time as the contractor becomes more familiar with the program requirements and more proficient at working within program specifications.

Section 7: HPwES Tracking and Reporting

Minimum HPwES Program Requirements

Tracking and Reporting

- ❑ Collect data and report results to DOE using Quarterly Data Reporting template provided, including:
 - Verified and updated list of participating contractors including status (active, probation, inactive) and the contractor's primary point of contact for accessing marketing materials
 - Number of projects completed by each contractor within the reporting period
 - Number of field inspections completed for each contractor within the reporting period, including at which point during the project the inspection was completed (assessment, measure installation, test-out, or post installation)
 - Number of projects completed by the program within the reporting period disaggregated by project type: single family vs. multifamily, and an indication of how many reported projects included only program subsidized direct-install measures
- ❑ Collect data and report results to DOE using Annual Data Reporting template provided, including:
 - Verified and updated contact information
 - Verified and updated program URL and description for HPwES website
 - Updated program implementation plan elements
 - Summary results of preceding program year
 - Summary goals for upcoming program year

Tracking and reporting on progress in developing and implementing local HPwES programs is a requirement for Sponsors. Data Sponsors provide allows DOE to review and analyze movement towards goals, trends, and lessons in implementation of HPwES. Collection of quarterly and annual reports is part of DOE's quality assurance for the national implementation of HPwES. The process also informs DOE's deployment strategy by identifying where and how best to support Sponsors and industry. Reports enable DOE to track program success, identify inactive partners, enable access to tools and resources – such as the HPwES mark, videos, and house graphics, – and recognize achievements (e.g., ENERGY STAR Awards and Century Club Contractors). The data reported by Sponsors will be aggregated and used in publishing information on the HPwES Program's progress on the energystar.gov website, HPwES newsletter and other program reports.

Minimum Requirements

Quarterly Report Requirements

Sponsors are responsible for tracking program activity and reporting results to DOE on a quarterly basis. Sponsors shall provide this data using templates provided by DOE. Data reported on a quarterly basis includes a listing of participating contractors, their current status in the program (active, inactive, probation), and a designated point of contact for accessing marketing materials. Once a Sponsor has completed this data reporting process the first time, DOE will provide pre-populated templates for subsequent reporting periods. The pre-populated forms require that Sponsors simply verify and update existing data rather than recreate it with each reporting period. Quarterly data submittals are

based on the calendar year and are due thirty days following the close of the reporting period and include all of the following:

- ☐ Verified and updated list of participating contractors including status (active, probation, inactive) and a primary point of contact for accessing marketing materials
- ☐ Number of **projects completed** by each contractor within the reporting period
- ☐ Number of **field inspections** completed for each contractor within the reporting period, including at which point during the project the inspection was completed (assessment, measure installation, test-out, or post installation)
- ☐ Number of projects completed by the program within the reporting period disaggregated by project type: single family vs. multifamily, and an indication of how many reported projects included only program subsidized direct-install measures

Key Reporting Terms:

Completed HPwES Project: A completed project may be counted for each independent contract executed between the homeowner and a qualified participating contractor or other signatory designated by the Sponsor, which meets all program requirements including documentation of test-in and test-out results related to the scope of work completed under that contract.

Field Inspection: A field visit by an independent inspector to assess compliance with program standards. The visit could be at any stage during the HPwES project but the sample set should include some post-improvement inspections (refer to **Section 6** on Quality Assurance).

Contractor Status:

- **Active:** enrolled and eligible to produce projects in the program
- **Inactive:** withdrawn or ineligible to participate in the program
- **Probation:** any interim status where a contractor may be producing work in the program but is not fully enrolled or is under observation due to performance issues

The Quarterly Report Template is a simple and easy to use excel workbook. Retroactive adjustments are allowed only for the two preceding quarters. While the template will show previously reported numbers for 3 prior quarters but only the current and immediately prior quarters will be editable. If it is necessary to make changes to older data, the Sponsors should contact their Account Manager.

A reminder for quarterly reports will be issued one month after the close of a quarter. Sponsors should provide their quarterly reports following this schedule:

Q1	Jan.-March	April 30th
Q2	April-June	July 30th
Q3	July-Sept.	October 30th
Q4	Oct.-Dec.	January 30th

Annual Report Requirements

Sponsors shall report to DOE no later than March 1st each year. An Annual Report Template will be provided to all Sponsors at the beginning of each calendar year. Annual data is based on the calendar year and includes all of the following:

- ☐ Verified and updated contact information
- ☐ Verified and updated program URL and description for HPwES website
- ☐ Updated program implementation plan elements
- ☐ Summary results of preceding program year
- ☐ Summary goals for upcoming program year

DOE is interested in gathering information on the previous year's results, as well as plans for the upcoming year. The Annual Report questions are designed to coincide as much as possible with the data Sponsors normally collect and information that is readily accessible to the Sponsor's implementation team. As Sponsors and their implementation team complete the Annual Report, any questions can be directed to their Account Manager.

Recommended Approaches

In 2013, DOE initiated enhanced data collection and reporting to enable greater understanding of results and trends. DOE's goal is to minimize the response burden for Sponsors and their stakeholders. As a result, a Quarterly Report Template and PDF-writeable Annual Report template form are offered to Sponsors to facilitate data collection.

DOE encourages Sponsors to use software tracking tools to assist in the collection and management of data related to implementing a local HPwES program. There are commercially available tools for customer relationship management (CRM) and project tracking that can help Sponsors efficiently maintain data. As industry protocols, such as HPXML, for standard data collection schema and transfer protocols become available, DOE will integrate HPwES tracking and reporting as appropriate.

Special Requirements for Multifamily Buildings

*In fall 2013, DOE will pilot data collection on HPwES projects completed in multi-family buildings. The reporting requirements for multi-family buildings will be the same as for single-family detached dwellings on a unit-by-unit basis as described in **Sections 4 and 5** of this guide. Additionally, whole building projects must report the number of dwelling units impacted by the project.*

Glossary of Terms Used in this Guide

The following definitions are intended to clarify the intent of the content of this guide. These definitions are not intended to re-define any specific terms within any other context.

Contractor – any company or individual worker representing a company providing HPwES related services to the customer including home performance assessments, installation of measures, energy consulting, or other related services. In the context of this document, this term is inclusive of Participating Contractors, sub-contractors, consultants, and other service providers falling within this definition.

Consultant – in the context of a HPwES project, a consultant may be an independent auditor who provides home performance assessment services without directly installing measures or providing any construction services. Consultants may also act as a project manager, the customer’s representative throughout the construction process, and/or take responsibility for the final test-out and submission of documentation for the completed project to the Sponsor. Consultants may also be referred to by other names such as “energy advisor” or “independent auditor.”

Cooperative Advertising (or Co-op Advertising) – a form of cost sharing where the total cost of advertising is shared by more than one party who may benefit from the advertising. HPwES co-op advertising costs are typically shared between the Sponsor and the Participating Contractor. Cost sharing may extend to design fees, collateral production, and traditional media placements as well as more non-traditional initiatives such as participation in trade shows, lawn signs, or other tactics.

Customer Contracted Work – a sales transaction between the contractor and the homeowner resulting in improvement measures paid for primarily by the homeowner. Customer contracted work may be eligible for incentives but is distinguished from direct-install work in that the homeowner typically has a choice of contractors and greater flexibility to customize the scope of work based on their own needs or wants.

Demand – the amount of electricity being consumed at any given time expressed in kilowatts (kW). Peak demand drives electric utilities’ capacity needs and reducing peak demand is often a goal or metric associated with energy efficiency programs.

Direct-install – improvement measures that are paid for or significantly subsidized by the program **and** are installed in the home through an agent under contract with the Sponsor or program administrator rather than the homeowner directly. Direct-install measures are typically restricted to a specific set of pre-qualified eligible measures and/or may be subject to caps or other restrictions to meet the program’s cost-effectiveness guidelines or other criteria. This is in contrast to “customer contracted work” (see definition).

Home Performance Assessment (HPA) – the set of inspections, diagnostics, data collection, analyses, and reporting, as defined in this guide (**Section 4**), needed to initiate a HPwES project with a customer resulting in an HPA Report including a proposed improvement package.

HPwES Implementation Plan – the Sponsor’s documented plan for start-up and on-going implementation of a HPwES program including documentation of the required program design elements as described in this guide (**Section 2**).

Prospective Sponsors are required to submit an Implementation Plan for DOE review and determination of eligibility for sponsorship.

HPwES project – encompasses the complete work cycle in which HPwES services are provided to a customer for a specific household. A completed HPwES project includes an HPA, installation of improvement measures, and a final test-out.

Implementation Vendor – the lead vendor(s) is hired by the HPwES Sponsor to assist in delivering a HPwES program. Implementation vendors typically provide administrative support for the program, managing components such as training, tracking and reporting, marketing etc. Some Sponsor programs may also use implementation vendors in a fulfillment capacity, conducting HPAs, direct installation of measures, serving as an “energy advisor” to the homeowner, and quality assurance inspections. Implementation vendors are typically paid directly by the Sponsor for the completion of HPwES related work in the home under a pre-determined fee structure.

Industry accepted protocol or standard – any published technical standard or protocol which has successfully been vetted through a public consensus process and/or is generally accepted practice within the relevant trade that will meet or exceed the standard of care of a reasonably prudent professional within such trade.

Installation specifications – detailed descriptions of improvement measures to be installed based on the SOW including identification of locations, quantities, materials, equipment selection, installation techniques, loading order, or other work details as required to fully describe the work to the customer and installation contractors.

Loading order – the prescribed order in which improvement measures should be installed in the home based on the package of measures included as part of the installation specifications within the contracted SOW. The loading order included in the SOW is driven by building science principles to maximize energy savings and avoid potentially undesirable outcomes.

Major household appliances –energy consuming appliances (i.e. “white goods”) other than electronics or heating and cooling equipment typically found in dwellings including but not limited to: refrigerators, freezers, dishwashers, clothes washers, clothes dryers, and dehumidifiers.

Modeling (or Energy Modeling) – the process of calculating a building’s energy loads and predicting energy consumption for that building based on known data such as the physical characteristics of the building and operating conditions. This process is usually completed using computer software but may also be calculated using manual algorithms. Modeling includes whole building simulations as well as less complex measure-specific calculations.

Participating Contractor – the organization that signs a Contractor Participation Agreement with the HPwES Sponsor to offer home performance services in their market. Participating Contractors can include consultants, energy auditors, home performance contractors, and/or trades contractors who engage directly with homeowners to market, sell, and install HPwES improvements. Participating Contractors are typically paid directly by the homeowner for their HPwES services unless the customer gives permission to the program to make incentive and/or loan payments directly to the contractor.

Peak Demand – the maximum amount of electricity being consumed over a specified period of time. See also, Demand.

Proposed improvement package (or Recommended improvement package) – the prioritized set of recommended measures presented to the customer as a result of the HPA.

Qualified personnel (or qualified staff or workers) – people who have sufficient knowledge, skills, and abilities to carry out the designated work activities. Qualification may be determined based on training, experience, certification, licensing, or other appropriate criteria.

Quality – characteristic of products or services that meet the customers' expectations and comply with the specifications and criteria

Quality Assurance (QA) – The planned and systematic activities implemented in a quality system so that quality requirements for a product or service will be fulfilled.

Quality Control (QC) – The observation techniques and activities used to fulfill requirements for quality.

Quality Management System (QMS) – a process based approach to fulfill the requirements for quality with emphasis on continual improvement and zero defect production.

Scope of Work (SOW) – the detailed listing of improvement measures, including installation specifications resulting from the sales transaction between the contractor and the homeowner.

Sponsor (or HPwES Sponsor) – the organization or entity with primary responsibility for meeting all the requirements outlined in the Sponsor Guide. Organizations that typically sponsor local HPwES programs include utilities, state energy offices, municipal governments, non-profit organizations that promote energy efficiency, and financial institutions; however, other types of organizations with sufficient resources to manage the day-to-day operations of a HPwES program are encouraged to join.

Test-out – the post-installation diagnostic tests and inspections performed to verify the final conditions of the home and/or systems within the home after improvements.

Acronyms and Abbreviations

ACCA	Air Conditioning Contractors of America
ACEEE	American Council for an Energy Efficient Economy
ACI	Affordable Comfort, Inc.
AFUE	annual fuel utilization efficiency
AHRI	Air Conditioning, Heating, and Refrigeration Institute
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc.
ASTM	American Society for Testing and Materials
BBNP	Better Buildings Neighborhoods Program
BPI	Building Performance Institute
CAZ	combustion appliance zone
CFL	compact fluorescent lamp
CO	carbon monoxide
CRM	customer relationship management
DEER	California Database for Energy Efficiency Resources
DHW	domestic hot water
DSM	demand-side management
EER	energy efficiency ratio
EF	energy factor
EPA	U.S. Environmental Protection Agency
HPA	Home Performance Assessment
HPwES	Home Performance with ENERGY STAR
HPXML	home performance extensible markup language
HVAC	heating, ventilation, and air conditioning

IPMVP	International Performance Measurement and Verification Protocol
LIUNA	Laborers' International Union of North America
MESA	My Energy Star Account
NAHB	National Association of Homebuilders
NAPEE	National Action Plan for Energy Efficiency's
NARI	National Association of the Remodeling Industry
NATE	North American Technician Excellence
NEAT	National Energy Audit Tool
NFPA	National Fire Protection Association
NHPC	National Home Performance Council
QA	quality assurance
QC	quality control
RESNET	Residential Energy Services Network
SEER	seasonal energy efficiency ratio
SSE	steady state efficiency
WAP	Weatherization Assistance Program

Appendices

- A. Minimum Requirements Checklist Reference**
- B. HPwES Partnership Agreement**
- C. HPwES Implementation Plan**
- D. Tools and Resources Matrix**
- E. DOE’s Guidelines for Home Energy Professionals**
- F. Energy Savings and Cost Effectiveness**
- G. Quality Management System Overview**

Appendix A – Minimum Requirements Checklist Reference

Minimum HPwES Program Requirements	
Use and Management of the HPwES Mark	<ul style="list-style-type: none"> <input type="checkbox"/> Comply with current <i>ENERGY STAR Identity Guidelines</i> <input type="checkbox"/> Maintain a list of authorized representatives, including participating contractors, to ensure their compliance with the <i>ENERGY STAR Identity Guidelines</i> <input type="checkbox"/> Feature the HPwES name and mark on the Sponsor's website and in other promotional materials <input type="checkbox"/> Establish a process to ensure your business partners and participating contractors comply with the <i>ENERGY STAR Identity Guidelines</i> <input type="checkbox"/> Send marketing materials, including web designs, to your HPwES Account Manager for review of compliance with the <i>ENERGY STAR Identity Guidelines</i> <input type="checkbox"/> Provide training about the value of and minimum requirements of HPwES to all employees who provide customer service <input type="checkbox"/> Notify your HPwES Account Manager of any change in the designated responsible party or contacts for the Sponsor's local program
Program Design	<ul style="list-style-type: none"> <input type="checkbox"/> Review and sign a HPwES Partnership Agreement <input type="checkbox"/> Complete and annually update a HPwES Implementation Plan <input type="checkbox"/> Provide quarterly and annual data on the status of HPwES Program implementation
Workforce Development	<ul style="list-style-type: none"> <input type="checkbox"/> Develop a contractor recruitment plan <input type="checkbox"/> Establish minimum qualifying criteria for participating contractors including: <ul style="list-style-type: none"> ○ Training and credentialing requirements ○ Capacity and resources to provide program related services ○ Compliance with local registration and licensing requirements ○ Access to qualified installation crews and/or sub-contractors <input type="checkbox"/> Provide a program orientation for participating contractors <input type="checkbox"/> Ensure availability in the local market of home performance skills training (technical, software, sales, business development, installations, etc.) for participating contractors <input type="checkbox"/> Provide technical support for participating contractors and energy advisors. <input type="checkbox"/> Provide training on basic principles of building science and the house as a system approach to all employees who provide customer service
The Assessment	<ul style="list-style-type: none"> <input type="checkbox"/> Develop and require a Home Performance Assessment (HPA) for each HPwES project, which ensures, at a minimum, that the following tasks occur at some point in the HPA process: <ul style="list-style-type: none"> ○ Customer interview ○ Review of energy bills, if available ○ Visual inspection of the home, interior and exterior ○ Data collection of building assemblies and mechanical systems ○ Minimum diagnostic tests <input type="checkbox"/> Develop and require a Home Performance Assessment (HPA) Summary Report for each HPwES project, which includes at a minimum: <ul style="list-style-type: none"> ○ Prioritized list of recommended improvements (the proposed improvement measures) ○ Savings projections (estimated or calculated) ○ Notice of health and safety related issues

The Installation	<ul style="list-style-type: none"> ❑ Develop and require measure installation specifications, which include at a minimum: <ul style="list-style-type: none"> ○ Installation of measures, including the sequence of installation shall be consistent with the contracted Scope of Work (SOW), as agreed upon between the participating contractor and the customer ○ Installations shall be compliant with local building codes and permitting procedures, industry-accepted standards, and manufacturer’s specifications for the materials and equipment being installed ○ Installations shall be completed by qualified workers ❑ Develop and require, test-out procedures, which include at a minimum: <ul style="list-style-type: none"> ○ Visual inspection of installed measures as specified in the SOW, review of commissioning reports, and diagnostic tests as necessary to confirm that manufacturers’ specifications and industry-accepted standards have been satisfied ○ Combustion safety checks for all projects where improvements might impact combustion appliance performance ○ Blower door tests when measures impacting infiltration rates are installed ○ System airflow and/or static pressure tests when duct sealing measures are installed
Quality Assurance	<ul style="list-style-type: none"> ❑ Develop and implement a Quality Assurance Plan, which includes all of the following: <ul style="list-style-type: none"> ○ Execute a signed partnership agreement with all participating contractors including requirements for compliance with the Sponsor’s QA system ○ Maintain records on quality control activities relating to the participating contractors including: <ul style="list-style-type: none"> ▪ Inspection sampling rate ▪ Inspection findings ▪ Corrective actions, including process improvements resulting from QC activities ▪ Be prepared for review by request of DOE or its implementation contractor ○ Implement a mechanism for customer feedback ○ Have a conflict resolution procedure in place to address problems identified through QA activities and customer feedback. ○ Implement one of the following two options: <ul style="list-style-type: none"> ▪ OPTION 1: Meet minimum requirements for Quality Control ▪ OPTION 2: Implement a Quality Management System [Appendix G]
Tracking and Reporting	<ul style="list-style-type: none"> ❑ Collect data and report results to DOE using Quarterly Data Reporting template provided, including: <ul style="list-style-type: none"> ○ Verified and updated list of participating contractors including status (active, probation, inactive) and the contractor’s primary point of contact for accessing marketing materials ○ Number of projects completed by each contractor within the reporting period ○ Number of field inspections completed for each contractor within the reporting period, including at which point during the project the inspection was completed (assessment, measure installation, test-out, or post installation) ○ Number of projects completed by the program within the reporting period disaggregated by project type: single family vs. multifamily, and an indication of how many reported projects included only program subsidized direct-install measures ❑ Collect data and report results to DOE using Annual Data Reporting template provided, including: <ul style="list-style-type: none"> ○ Verified and updated contact information ○ Verified and updated program URL and description for HPwES website ○ Updated program implementation plan elements ○ Summary results of preceding program year ○ Summary goals for upcoming program year

Appendix B – HPwES Partnership Agreement

[HPwES Partnership Agreement](#)

(Note: in the final version of the Guide, this link will be replaced with the actual text/form)

Appendix C – HPwES Implementation Plan

[Implementation Plan](#)

(Note: in the final version of the Guide, this link will be replaced with the actual text/form)

Appendix D – Tools and Resources Matrix

Tools and Resources

Below is a sample of the kinds of tools and resources DOE anticipates highlighting in the final version of the HPwES Sponsor Guide and Reference Manual. If Sponsors, participating contractors or other home performance stakeholders have suggestions for this section, please email homeperformance@energystar.gov

Resource Links

ACCA standards
Building America Solution Center
Building America Quality Assurance Roadmap for High Performance Residential Buildings
BPI resources, including standards, certifications, accreditation information
California Center for Sustainable Energy's HVAC Contractor Blueprint for Home Performance
DOE Guidelines for Home Energy Professionals: Standard Work Specifications for Single-Family Home Energy Upgrades
DOE Building Energy Software Tools Directory;
DOE Standard Workforce Specifications Tool
DOE Technical Assistance Program Residential Retrofit Program Design Guide
ENERGY STAR Identity Guidelines
ENERGY STAR Web Linking Policy
EPA Quality System, quality management tools
Home Performance Resource Center's Best Practices for Home Performance Programs
HPwES Annual Report Template
HPwES Century Club Contractor web button and plaque
HPwES House Graphics
HPwES Implementation Plan Template
HPwES Marks
HPwES Partnership Agreement
HPwES Quarterly Report Template
HPwES Video Series
Mortgage Industry National Home Energy Rating standards
NAHB-Toolbase.org
NATE certifications
Pro Forma HP Contracting Business Financial Planning Tool
RESNET EnergySmart Contractor Guidelines
RESNET resources, including standards, certifications, accreditation information
Weatherization Assistance Program Technical Assistance Center

Resources in Development

Better Buildings Residential Program Solution Center
HPwES Marketing Toolkit
HPwES Workforce Management Toolkit
HPwES QMS Primer (To be developed/revised as pilots continue)

Templates in Development

Template Certificate of Completion

HPA Data Collection Template

HPA Report Outline/Template

Resource Examples Being Collected

Sample Coop Guidelines

Sample Contractor Participation Agreement

HPwES Marketing Examples

Appendix E – DOE’s Guidelines for Home Energy Professionals

The Guidelines for Home Energy Professionals

The Guidelines for Home Energy Professionals is a suite of resources developed by DOE of Energy’s Weatherization Assistance Program and the National Renewable Energy Laboratory in collaboration with the home performance industry. The resources include work quality specifications, training program accreditation, job task analyses and worker certifications.

Overview

The Guidelines effort is about achieving quality in any given home energy upgrade task. To do that, the Guidelines take a three pronged approach in alignment of nationally recognized needs:

1. Define the Work:

The Standard Work Specifications for Home Energy Upgrades (SWS)

The SWS are intended to define the minimum acceptable outcomes for any weatherization or home performance task to be effective, durable and safe.

2. Validate the Training:

Job Task Analyses and Training Program Accreditation

The Guidelines provides the industry with a uniform way to ensure that all workers are trained and have knowledge skills and abilities to do the work right. The Job Task Analyses (JTA) for the four major energy upgrade job classifications define what a worker needs to know and do. The accreditation of energy efficiency training programs verifies that organizations training workers in the industry are qualified to teach to those JTAs.

3. Certify the Worker:

The National Home Energy Professional Certifications

With definitions of work quality and Job Task Analyses delineating the expectations of the workforce, it is important to also provide employers a mechanism for ensuring that employees are capable of meeting the expectations of a national industry. Four new Home Energy Professional worker certifications are part of and aligned with the other Guidelines efforts and target a worker’s capacity to demonstrate practical ability to perform the work of the industry.

The Details

The Standard Work Specifications

Taken at its most basic level, a home energy upgrade job is a collection of individual measures (such as air sealing of the envelope, tuning of the HVAC system, attic insulation, etc.) aimed at increasing the energy efficiency of a particular system in a building. These individual measures are the focus of the SWS. Measure by measure, the work of an energy

efficiency retrofit crew is broken down into desired outcomes and the minimum specifications that are required to achieve those outcomes. This definition of the work and the specifications for producing that work are a major step in establishing residential energy upgrade work as a true national industry. They provide a foundation for training and the development of best practice guides. They also provide a uniform basis for assessing the quality of installed work. The SWS provide a common yardstick against which consumers, financiers and policy makers can measure the performance of their service providers.

For further information, please visit:

http://www1.eere.energy.gov/wip/guidelines_sws.html

The SWS are available via an online tool at:

<https://sws.nrel.gov/>

The Job Task Analyses

A Job Task Analysis (JTA) is a formal process, overseen by a professional psychometrician, which brings together a group of industry professionals to draft a document that clearly and concisely lists the required tasks and the associated knowledge, skills and abilities for a particular occupation. For the Guidelines project, four JTAs were developed for the residential energy upgrade industry:

- Installer/Technician: Performs the actual installation of the work.
- Crew Leader: Directs and supervises the work of the Installers.
- Energy Auditor: Assesses the home before the work begins for energy savings opportunities and writes a scope of work for the crew.
- Quality Control Inspector: Inspects the quality of the installed work.

For each job classification, there is now a document that clearly delineates what is required of a professional performing the job. These four JTAs are now the basis for a new third party accreditation of energy efficiency training programs and a suite of national worker certifications.

To view and download the Home Energy Professional JTA's, please visit:

http://www1.eere.energy.gov/wip/guidelines_accredited_training.html

Training Program Accreditation

The WAP commissioned the Interstate Renewable Energy Council (IREC) to develop and administer an accreditation program for energy efficiency training programs. IREC's Institute for Sustainable Power (ISP) Quality standard is an internationally recognized standard for the accreditation of renewable energy and energy efficiency training programs. The IREC ISPQ International Standard 01022: 2011 specifies requirements for competency, quality systems, resources, and qualification of a curriculum against which trainers and training programs can be evaluated. The four WAP developed Job Task Analyses are the basis upon which IREC accredits energy efficiency training programs. Training

programs must demonstrate that they have the capacity, in curriculum, staff and facilities to adequately train workers in all of the skills listed in the JTA.

For further information, please visit: http://www1.eere.energy.gov/wip/guidelines_accredited_training.html

The National Home Energy Professional Certifications

The four new Home Energy Professional certifications are job oriented and require a fully trained or experienced professional to demonstrate the knowledge, skills, and abilities to successfully perform in a specific role. These professional certifications, which are based on the WAP JTAs, are intended to build upon each other and provide a career ladder in the home energy upgrade industry.

The Building Performance Institute (BPI) was selected through a competitive solicitation to deliver the four new professional certifications first to the weatherization network and then to the greater home performance marketplace. The certification blueprints are available to other qualified certifying bodies.

For further information, please visit:

<http://www1.eere.energy.gov/wip/certifications.html>

Training the Industry

Weatherization Training Centers (WTCs) are specialized training organizations that teach whole-house building science to an on-the-ground workforce. WTCs receive constant feedback from employers and workers in the field and are able to continually improve training effectiveness. The WTCs are always on the cutting edge of what works in real homes, and how to effectively communicate this to the workforce. The curriculum taught in the WTCs is rooted in the knowledge, skills and abilities outlined in the national WAP Job Task Analyses for Energy Efficiency workers. Many WTCs have received IREC accreditation, validating the quality of their training.

The WTCs are available at:

<http://waptac.org/Training-Resources.aspx>

Appendix F – Energy Savings and Cost Effectiveness

Energy Savings Calculations and Cost-Effectiveness

Home Specific Energy Savings – Project Level

Homeowners are motivated to improve their homes for a variety of reasons. Energy savings is only one possible motivating factor. The HPWES Program creates the opportunity to leverage other motivators like improved comfort, durability of the home and its systems, and healthier living environments to promote choices that result in energy savings.

Homeowners and contractors need be able to assess the impact of energy efficiency measures on a project-specific level. This is particularly critical when program incentives are tied to a specific level of energy savings as is the case with performance-based incentive structures and some on-bill financing programs. A variety of energy estimating methods and tools are available to calculate the predicted energy savings on a project-by-project basis as described in the following section.

Methods to Calculate Energy Savings

Predicting future energy use is typically achieved through mathematical models - from measure-by-measure algorithms using physics-based calculations or empirical data, to complex customized whole building simulation models.

- Some programs use energy modeling software or custom algorithms to create deemed savings databases. These deemed savings will generally be appropriate for most measures on average but are not intended to predict specific savings of any measure or package of improvements for a specific house.
- Other programs allow (or require) contractors to use energy modeling software to calculate predicted energy savings that are specific to each home and project.

Under both approaches, engineering calculations or software is used to model estimated savings – the difference is whether the calculations are being used by the program to develop a deemed savings database, or by the contractor to create a customized analysis that is specific to each home or project.

Deemed Savings

The Department of Energy⁷ has defined deemed savings as:

Deemed Savings. An estimate of an energy or demand savings for a single unit of an installed energy-efficiency measure that (1) has been developed from data sources and analytical methods that are widely considered acceptable for the measure and purpose, and (2) is applicable to the situation being evaluated. Individual parameters or calculation methods can also be deemed; also called *stipulated savings value*.

Deemed savings databases have historically been built using existing data obtained through program evaluations, measurement and verification (EM&V) data. One example is the California Database for Energy Efficiency Resources

⁷ “Energy Efficiency Program Impact Evaluation Guide,” SEE Action Evaluation, Measurement, and Verification Working Group, December 2012, http://www1.eere.energy.gov/seeaction/pdfs/emv_ee_program_impact_guide.pdf

(DEER). Local sponsors have tailored these existing databases to adjust for their climate, retrofit techniques, housing stock, and typical energy consumption in their jurisdictions. For example, Michigan has used data from Wisconsin and other states to create its own comprehensive database. New Hampshire has done the same using deemed savings data from nearby New England states.

Advantages of Deemed Savings:

Once created, deemed savings can provide a simplified means to quickly estimate energy savings and incentive levels using simple calculations or reference tables. This simplicity can allow:

- Contractors to quickly identify eligible measures and sell a package of improvements knowing the total incentive levels available
- Utilities and other entities to have clear “rules of the game”
- A perceived level playing field for a public service commission (or other oversight entity) to evaluate the impacts of different utility programs
- For electric companies seeking to track demand savings (kW) as well as energy savings (kWh), a deemed savings approach can also be applied to estimate the demand reduction associated with specific measure installations.

Disadvantages of Deemed Savings:

- Can require a significant investment of time and effort to create
- Often requires a continual process of refinement and on-going maintenance
- Estimated savings are applicable only on average or in aggregate, so individual customers cannot be provided with project-specific predicted savings
- Can result in perverse incentives whereby prescribed incentive levels tied to specific measures may make little or no impact on actual energy savings, based upon an individual home’s characteristics and unique needs
- Deemed savings are often based upon an assumption that a single measure will be installed in a home. However, when multiple measures are installed (e.g. air sealing and HVAC replacement), the total energy savings is often less than the sum of the parts. If not accounted for, this interactivity of savings for measure packages can result in overestimating actual energy savings.
- May encourage program designs that maximize energy savings based upon the features and limitations of the deemed savings database - not building science or best practices. For example, one proposed program’s deemed savings data projected greater energy savings associated with a leave-behind DIY kit of light bulbs and hot water measures than it did with actual installed air sealing.
- “Pick lists” based on deemed savings tend to only identify and incentivize the most cost-effective measures, but do not encourage deeper energy retrofits. This approach also can have the unintended effect of discouraging bundling of measures that should go hand-in-hand (e.g. certain types of air sealing and insulation.) By ignoring the cost of the lost opportunity to install multiple measures in a single transaction, programs reliant on deemed savings may create situations where return visits to a home are needed to install future measures that were not initially identified as cost-effective. The commensurate overhead and transaction costs associated with future visits are ignored.

Energy Modeling

Many programs rely on contractors using energy modeling software to quantify predicted savings and identify cost-effective recommendations. In most software applications, participating contractors collect a variety of data points about the home's thermal envelope, mechanical equipment, geometry, location, and occupants.

There are a variety of software programs in the market, although most sponsors have traditionally relied upon software that has been approved by some authoritative body, such as software approved by DOE for weatherization work, or software determined acceptable by the mortgage industry in the new home marketplace. The Building Energy Software Tools Directory, is a list of available software tools published by DOE covering a wide variety of applications and can be found at: http://apps1.eere.energy.gov/buildings/tools_directory/subjects_sub.cfm

The advantages and disadvantages of using energy modeling software are varied. Each individual software tool has its own unique set of strengths and limitations. Finding a suitable tool for use in your particular program will require some research and may also be dependent on key program design details (e.g. will your program require models to be “trued up” to coincide with the actual utility consumption history?)

Some important considerations that Sponsors should take into account when selecting modeling software include:

- Ease of use to train new users
- Ease of use to enter home data into the program
- Ability of contractor to collect the required data
- Accessibility of data (e.g. SEER rating)
- Volume of data
- Cost and who pays (will contractors be required to purchase software or will the program provide it for them?)
- Licensing requirements and who takes responsibility for the licenses (the program or the contractors?)
- Quality of customer reports and flexibility to customize reports
- Quality and limitations of energy savings calculations (e.g. some software tools are better than others at handling specific technologies like heat pumps, water heating, and renewable energy systems)
- Ability to analyze historical energy usage data for the specific home
- Applicability of simulation approach to regional housing stock and climate conditions
- Will the models be calibrated or “trued up” to the home's actual energy usage history?
- Data transfer and reporting capabilities
- Potential for integration with existing data systems and customer relationship management (CRM) tools

Statistical Predictive Models

In regions where significant historical data is available describing past performance of energy retrofit programs, some programs are starting to adopt a statistical approach to predicting energy savings in current projects. Using predictive models based on past experience and empirical data, the home energy assessment process can be streamlined to require only those data points necessary to accurately populate modeling tools that are much simpler than traditional whole building energy simulation models.

Limitations of All Methods of Energy Savings Estimations

Various factors will impact the actual energy savings and how well these results align with predicted savings. Program evaluations may attempt to quantify some of these effects.

- Home-owner “take-back” – for example, some homeowners may decide that they can turn up their thermostat in the winter because they can now afford to do so
- Replacement vs. retirement – for example, an old refrigerator that was replaced by an energy efficient model may be moved to the basement resulting in increased energy consumption.
- Homeowners may interpret a 20% reduction in total energy use to equate to a 20% reduction in the bills. However, the fluctuating price of energy may impact those results.
- Year-to-year weather variations
- Changes in household composition or occupant behaviors (e.g., new occupants)
- Equipment maintenance issues (e.g. filter replacement in HVACs)
- The simple fact that no model fully captures reality. For example assumptions must be made related to occupant behavior. Calibration of the modeled energy savings to the actual utility billing data can help mitigate this problem.

Homeowner behavior and education remains an absolutely essential topic to address when trying to lower energy usage. It is also beyond the scope of this section of the Sponsor Guide.

Actual Energy Usage

While this discussion is focused on estimating energy savings, attention should be paid to actual energy use after improvements are made. Post-improvement data can be used to calibrate deemed savings tables as well as energy modeling outputs. However, Sponsors may also want to investigate how actual energy usage (post-installation) could be used to motivate homeowners. Creative strategies may be pursued using advanced metering, online utility data tracking (Green Button or other third-party service), on-bill financing, etc.

Appendix G – Quality Management System Overview

QMS-Based Quality Assurance Overview

The following overview is provided to introduce Sponsors to the QMS based approach to Quality Assurance. A more detailed primer on covering how to apply these methods to HPwES program implementation is forthcoming and will be updated as regional pilot initiatives gain experience using this approach.

For comparison purposes, **Figures G.1** and **G.2** illustrate the process and flow of information that occurs using each of the two QA approaches. **Table G.1** describes the basic components of the QA approaches and compares how each approach applies these components to manage quality.

Option 1: (QC-Based Approach)

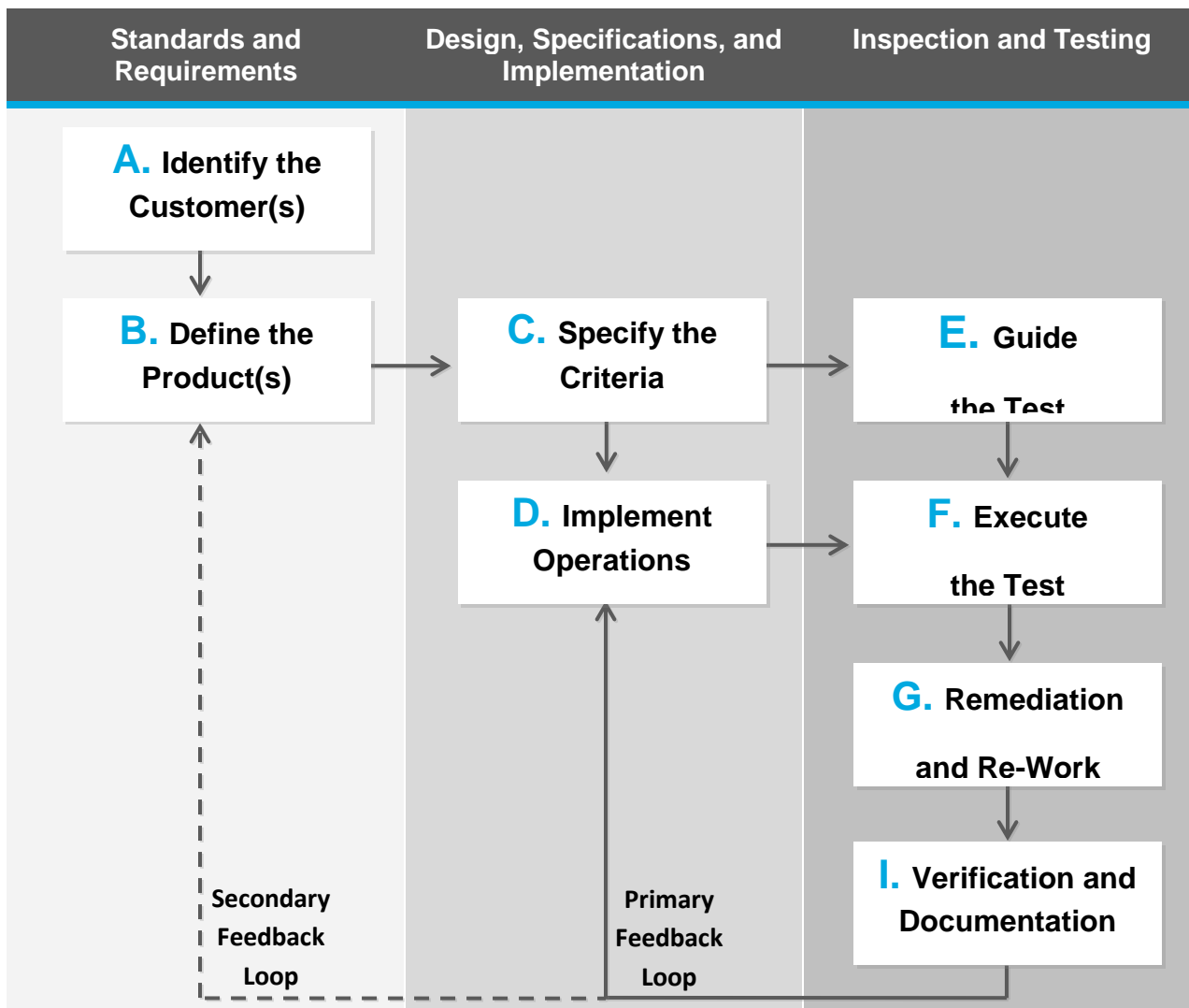
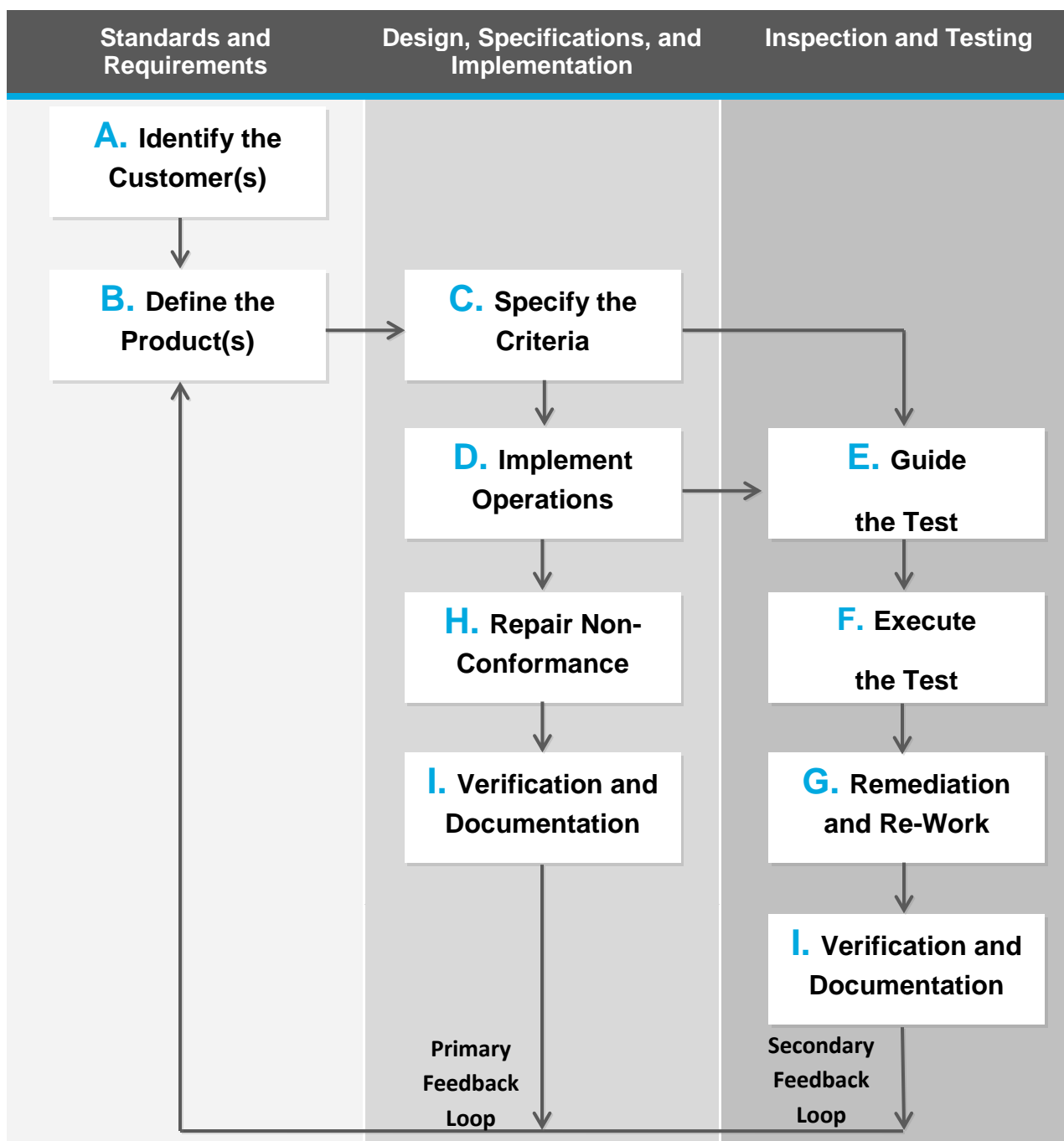


Figure G.1 – Typical QA Process Diagram (QC-based Approach)

Option 2: (QMS-Based Approach)*Figure G.2 – Typical QA Process Diagram (QMS Approach)*

	QA Activity	Description	QC vs. QMS Approach
A	Define the Customer(s)	All end-users or recipients of products and services being delivered	Addressed similarly in both approaches.
B	Define the Product(s)	All products and services delivered through the program's supply chain	Starts out the same in both approaches but must be subject to feedback-driven continuous improvement in QMS-based approach which may not always occur in QC-based approach.
C	Specify the Criteria	Specifications and metrics needed to meet customers' needs	Addressed similarly in both approaches. Specifications inform validation criteria, which in turn informs the design of the test protocols (E).
D	Implement Operations	All activities completed for production resulting in delivery of products and services to the customer	The QMS-based approach requires that quality checks are embedded in the routine work at all levels of production. The QC-based approach relies primarily on external inspections and management oversight to ensure quality in production.
E	Guide the Test	Inspection protocols including data review and physical inspections	The testing protocols are informed by the specifications (C) in both approaches. In addition, the QMS-based approach uses a direct link to implementation and operations (D) to further inform the design of the testing protocols. Tests may also include verification that internal management systems are working properly.
F	Execute the Test	Inspection activities including data review and physical inspections conducted by parties other than the workers themselves	The QC-based approach relies primarily on inspections to ensure quality. The QMS focuses on production-based quality validation, using inspections strategically to supplement and spot-check results.
G	Remediation and Re-Work (post-production)	Repairs and remedial actions resulting from deficiencies identified through a testing process that is external to the production process.	Post-production repairs and remedial actions including re-training and punitive actions are the primary mechanism for feedback in the QC-based approach. The QMS-based system seeks to minimize the occurrence of these types of failures by capturing deficiencies earlier in the production process (I) and prioritizing process improvements to avoid repetitive deficiencies.
H	Repair Non-Conformance (in process)	Repairs completed in production resulting from routine checks for compliance with specifications	Primary line of defense for achieving zero defect goal of QMS-based approach. All workers are responsible for identifying non-conformities and repairing them <i>prior to closing out a project</i> . While this may occur in practice under a QC-based system, it is not typically emphasized or documented.
I	Verification and Documentation	Routine checks or post-repair validation for compliance with specifications and documentation of results	Non-conformities identified through either system must be documented including repairs completed to meet specifications. Documentation provides critical feedback to inform overall process improvements in the QMS-based approach. In the QC-based approach, this feedback is often limited to operations (D) resulting in less impact on long-term quality improvements.

Table G.1 -- QA System Components Comparison Chart

QMS-Based Quality Assurance Plan (Option 2)

Sponsors using the QMS option must describe and implement a Quality Assurance Plan which includes all of the following key features. Note that Sponsors using a QMS-based approach are required to develop a complete quality assurance plan including all of these elements for their own internal policies and procedures. Sponsors are required to submit this plan to DOE for approval and will be required to demonstrate that these procedures exist and are being followed when audited by DOE or its agents.

Elements of a QMS-Based Quality Assurance Plan

- **Customer Identification and Needs Assessment:** Identify all customers and their associated needs targeted by the HPwES Program. (For example, homeowners and a utility commission might be two customers identified by a Sponsor, each with differing needs.)
- **Quality Objectives:** Describe the overarching goals the QA process is seeking to accomplish. These objectives shall relate to how the service or product meets the needs of the targeted customer and must be measurable.
- **Roles and Responsibilities:** List of organizations and staff by category and/or title, their roles, and associated responsibilities of each individual worker type or entity acting within the supply chain and describe their impact as it relates to quality.
- **Product Specifications:** Define the technical specifications and metrics required to satisfy the customers' needs and meet quality objectives. (Industry standards for home performance assessments and energy improvement installation may be referenced as a part of this component.)
- **Operations and Implementation Processes:** Describe the activities formally adopted by the HPwES program to deliver the product or service to the targeted customer(s). The implementation process will detail stages in the production and supply chain where quality objectives are measured and verified and who is responsible.
- **Quality Validation and Documentation:** Using Quality Objectives and Product Specifications developed for the QA Plan as a basis, product and service characteristics shall be identified which can be measured to ascertain whether customer needs have been satisfied. The plan shall include procedures for validating compliance with the specifications during production and documentation of non-conformances that are identified and repaired via this process. Each worker in the supply chain shall be responsible for validating compliance with the specifications prior to closing out his or her stage of the work.
- **Inspection and Testing:** Data reviews and physical inspections conducted by outside parties and/or management shall be used to supplement production-based quality checks. Sampling rates shall be determined based on the program's specific needs and its track record for managing quality within the production process. Inspection rates may also be adjusted based on individual contractor's track records as well. Inspection and testing protocols shall be designed to ensure defined Quality Objectives and Product Specifications have been achieved and shall be further informed by the Operations and Implementation profile to ensure checks occur at critical stages throughout the supply chain.
- **Feedback Systems:** A system of tracking and interpreting the results of production-based quality checks as well as external quality checks shall be created in order to use the data for meaningful improvements to the system. The feedback system shall be designed to inform overall process improvements targeting zero defect production.

Comparison of QC-based and QMS-based Approaches

Fundamentally, the QC-based approach is limited in its ability to promote sustainable quality. The process loop shown in **Figure G.1** leading from box “I” to box “D” illustrates a key weakness of this system. QA resources become bogged down in the loop with operations, focusing on remedial work and punitive actions with deficient contractors. This diverts resources away from looping back to box “B” where overall process improvements can be made to address the underlying causes and eliminate the root problem. As a result, the QC-based system ends up more focused on identifying and fixing deficiencies instead of preventing them in the first place.

While the QMS-based approach promises better overall quality and possible long-term savings to the program, there are many reasons that programs may choose to start up or stick with a QC-based system. For example, the program’s existing infrastructure may not currently be well-suited to adopt a QMS-based approach, or the program may be under an external mandate to meet a specific inspection rate. However, it may be possible to adopt certain elements of the QMS-based system while still operating under a QC-based mandate and incrementally make the move toward prevention and zero-defect goals.

To assist HPWES Sponsors in selecting a QA system, **Table G.2** summarizes some of the critical features and pros and cons of the two allowable options.

Option	Pro’s	Con’s
QC-Based	<ul style="list-style-type: none"> • Typical of what most programs are doing now • The majority of supply chain actors are minimally impacted so transition period is short once inspection staff is up and running • Fixed costs to the program are more easily compartmentalized and predictable 	<ul style="list-style-type: none"> • Potentially high startup costs in planning, systems development, and training • Potentially high long-term fixed and variable costs in implementation, re-work, re-training, and remedial and punitive actions • Responsibility for quality lies primarily with the Program Sponsor. Pass through to contractors is mostly limited to remedial and punitive actions. • Remediation and re-work become ingrained in the program culture which can negatively impact morale
QMS-Based	<ul style="list-style-type: none"> • Responsibility for quality is shared by all actors in the supply chain • Focus on prevention helps avoid customer exposure to defects • Zero-defect approach minimizes or eliminates the need for post-work remediation and re-work, resulting in reduced variable costs to the program in the long term • Offers a systematic approach to continuous improvement that becomes ingrained within the program culture 	<ul style="list-style-type: none"> • Represents a paradigm shift for most programs • Potentially high startup costs in planning, systems development, and training • Requires buy-in at all levels of the supply chain from executive management to workers • Potentially long transition period

Table G.2 – Pros and Cons of QA System Components