

# Home Performance with ENERGY STAR Sponsor Guide and Reference Manual (v1.5)

U.S. Department of Energy  
Building Technologies Office

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## Acknowledgements

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## Preamble

Home Performance with ENERGY STAR is a public-private partnership designed to engage consumers in the highest form of home improvement: making homes safe, healthy, and energy efficient. DOE works with diverse industry stakeholders to advance the unique market transformation platform that is HPwES: it defines a process for translating complicated building science principles into solutions for homeowners seeking to improve not only home energy efficiency, comfort, and health, but durability as well.

Home Performance with ENERGY STAR challenges the traditional approach to home improvement because it evaluates the entire house including its systems and their interactivity to identify solutions that satisfy homeowners. HPwES offers homeowners qualified contractors who have been trained to evaluate the entire home and offer tested solutions that have improved hundreds of thousands of homes.

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<sup>1</sup> [https://www1.eere.energy.gov/communicationstandards/guide.html#energy\\_star](https://www1.eere.energy.gov/communicationstandards/guide.html#energy_star)

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## Introduction

Home Performance with ENERGY STAR® (HPwES) is a public-private voluntary partnership program designed 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 enhance home performance for healthier and more comfortable living environments, enhanced durability of the homes' structures and systems, and improved energy savings for the homeowners.

Home Performance with ENERGY STAR, like all ENERGY STAR programs, facilitates market transformation by increasing the availability and adoption of energy efficient goods and services. HPwES is based on the nationally recognized ENERGY STAR brand and is grounded in a building science driven approach to home improvement 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 HPwES projects and related services.

Organizations that typically sponsor HPwES include utilities, states, municipalities, and nonprofit 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 characteristics into their program's design:

1. **Be Customer Friendly:** Deploy products and services that address homeowner needs, improve comfort and safety, and reduce wasted energy
2. **Offer Streamlined Business Protocols:** Employ administrative procedures that minimize the burden of participation for contractors and homeowners
3. **Be Business Friendly:** Support contractor services that can effectively engage customers, allow their businesses to sustain profitability, and deliver quality work that meets DOE's minimum HPwES Program requirements.

## How to Use the Sponsor Guide and Reference Manual

The *Sponsor Guide and Reference Manual (v1.5)* (*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 to provide guidance and resources, which may be used to meet these requirements. The *Sponsor Guide* is divided into seven sections, each covering a specific requirement of the HPwES Program:

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

Each section includes the following elements:

- **Checklist of Minimum Requirements** specific to each section’s topic
- **Minimum Requirements** in narrative, with specifications for compliance
- **Recommended Approaches**—with 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 Worksheet
- B. Home Performance with ENERGY STAR Partnership Agreement
- C. Home Performance with ENERGY STAR Implementation Plan Template
- D. The Guidelines for Home Energy Professionals
- E. Energy Savings Calculations
- F. Quality Management System (QMS) Based Quality Assurance Overview

In addition to the *Sponsor Guide and Reference Manual (v1.5)*, DOE offers Sponsors and their networks a set of online tools and resources. Visit the [Sponsor Resources](#)<sup>i</sup> section of the HPwES website to access these materials.

## Guide Updates

The *Sponsor Guide* will be maintained and updated over time. Policy 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 online 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 (v1.5)*. These sections of the *Sponsor Guide and Reference Manual (v1.5)* are intended to help support Program Sponsors by highlighting promising and industry-proven practices and resources.

## Compliance and Enforcement

As a public-private partnership, Sponsors and their partners, participating contractors, and the federal government are joined in an effort to protect the value and enhance the visibility of HPwES. As the administrator of the national Program, DOE is required to maintain the integrity of the Home Performance with ENERGY STAR name and marks. This includes ensuring that Sponsors and their partnering organizations are in compliance with the requirements described in the *Sponsor Guide*.

DOE and EPA will actively pursue resolution of non-compliance 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 protect public confidence in ENERGY STAR.

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## Connecting with Home Performance with ENERGY STAR

In addition to the *Sponsor Guide*, DOE offers a variety of online tools and resources for Program Sponsors, their participating contractors, and partners. Visit the [Sponsor Resources](#)<sup>ii</sup> section of the HPwES website to access these materials. Each Sponsor is assigned an Account Manager who is available to assist in answering questions and providing guidance through the start-up and implementation process. The HPwES Account Manager can assist with:

- Access to the Home Performance with ENERGY STAR mark, templates, tools, and other resources covering the development, execution and marketing of HPwES programs
- Networking and information exchange via regional program collaboration, webinars, the Better Buildings Residential Network, and the quarterly HPwES e-newsletter
- Recognition for Sponsors and successful participating contractors, including opportunities to be honored with the ENERGY STAR Partner of the Year, HPwES Century Club Contractor Awards, or DOE’s Housing Innovation Award
- Links from the HPwES Web pages such as the searchable “Find a Program” map, success stories, and other highlights on Sponsors
- Collaboration opportunities with DOE to explore new opportunities, streamlined approaches, cost-cutting measures, and other innovations to help scale the home performance market.

For additional information and support for developing and implementing a HPwES program, email [HomePerformance@EnergyStar.gov](mailto:HomePerformance@EnergyStar.gov).

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

### Minimum Home Performance with ENERGY STAR Program Requirements Checklist:

*Use and Management of the Home Performance with ENERGY STAR Mark*

- 1.1 Comply with current *ENERGY STAR Brand Book*
- 1.2 Maintain a list of authorized representatives, including participating contractors, who may use the brand and mark in compliance with the *ENERGY STAR Brand Book*
- 1.3 Use the Home Performance with ENERGY STAR name and mark to inform homeowners that services being rendered by participating contractors under the Sponsor's program follow the HPwES approach
- 1.4 Establish a process to ensure your business partners and participating contractors comply with the *ENERGY STAR Brand Book*
- 1.5 Send marketing materials, including web designs, to your HPwES Account Manager for compliance review; HPwES Account Managers require a minimum of five business days to review materials
- 1.6 Provide training about the value and minimum requirements of HPwES to all employees who provide customer service
- 1.7 Notify your HPwES Account Manager of any change in the designated responsible party or contacts for the Sponsor's 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 and symbol. As partners with ENERGY STAR, HPwES Program Sponsors have the privilege and responsibility to use both the ENERGY STAR Partner mark and the Home Performance with ENERGY STAR mark.

Sponsors should be familiar with the [\*ENERGY STAR Brand Book\*](#)<sup>iii</sup>, beyond the requirements listed below, and ensure their participating contractors and partners also understand how they may use the Home Performance with ENERGY STAR mark. Only participating contractors and business partners with direct Sponsor partnerships may have access to the Home Performance with ENERGY STAR mark. This access is transferable only through HPwES Sponsors with active ENERGY STAR partnership agreements.

### Minimum Requirements

Sponsors shall use the Home Performance with ENERGY STAR name and mark to promote home performance services in accordance with 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 (v1.5)*
3. The *ENERGY STAR Brand Book*.

As detailed in the *ENERGY STAR Brand Book*, the Home Performance with ENERGY STAR 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 home systems. Sponsors may choose to co-brand Home Performance with ENERGY STAR 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 represents HPwES. Sponsors play a vital role in establishing the value of the HPwES program by increasing the visibility of the Home Performance with ENERGY STAR name and mark. Incorporating the name and mark into program marketing materials instills consumer confidence about the backing of the DOE and EPA and helps the program continue to reinforce national consumer awareness of the brand.

## Managing Use of the Home Performance with ENERGY STAR Mark

- 1.1 Comply with the current *ENERGY STAR Brand Book*, which describes 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 mark used by participating contractors.
- 1.2 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.
- 1.3 Establish a process to ensure your business partners and participating contractors comply with the *ENERGY STAR Brand Book*.
- 1.4 Use the Home Performance with ENERGY STAR name and mark to inform homeowners that services being rendered by participating contractors under the Sponsor’s program follow the HPwES approach. For instance, Sponsors are encouraged to use the Home Performance with ENERGY STAR name and mark on Sponsors’ program websites and in other promotional materials, particularly those that target homeowners. To link to the Sponsor on the ENERGY STAR website, a Sponsor must first comply with the [ENERGY STAR Web Linking Policy](#)<sup>iv</sup> found on the ENERGY STAR website.
- 1.5 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 with a demonstrated track record for appropriate use of the mark and Home Performance with ENERGY STAR name may be given more latitude regarding this requirement at DOE’s discretion. As mentioned in steps 2 and 3 above, Sponsors are responsible for review and monitoring of their contractor and partner network’s use of the Home Performance with ENERGY STAR mark. Participating contractors that are in a “probationary” status may continue to use the mark in any on-going marketing but cannot create new materials or initiate new campaigns using the mark until their status returns to “active.”
- 1.6 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.
- 1.7 Notify your HPwES Account Manager within 30 days of a change in the designated responsible party or contacts for this agreement.

As the ENERGY STAR brand manager, EPA actively monitors proper use of the ENERGY STAR name and marks. DOE and EPA will actively pursue resolution of any non-compliance related to the use of the ENERGY STAR marks.

## Recommended Approaches

### Managing the Use of the Mark

HPwES Sponsors are responsible for communicating and enforcing the *ENERGY STAR Brand Book* 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 Brand Book* in partnership documents and contractor participation agreements. The HPwES Team recommends referencing section 5.8 for specific guidance on use of the Home Performance with ENERGY STAR mark.

In administering the national HPwES platform, DOE seeks to minimize market confusion. Existing and new Sponsors are encouraged to coordinate on marketing their HPwES program in overlapping or neighboring markets.<sup>2</sup> A useful way to manage the proper use of the Home Performance with ENERGY STAR mark is with a cooperative advertising model. An effective means of sharing the costs of creating and placing local advertisements, cooperative advertising allows Sponsors and participating contractors to expand their reach. 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 they advertise.

### General Use of the Home Performance with ENERGY STAR Name and Mark

The Home Performance with ENERGY STAR name and mark are useful symbols to promote the process of home performance. Access to the Home Performance with ENERGY STAR name and mark is an important feature of the HPwES Program because of the opportunity to leverage brand recognition and build greater consumer confidence in the home performance programs Sponsors and their participating contractors are offering. Sponsors and their partner and contractor networks should use the Home Performance with ENERGY STAR name and mark in all consumer-facing promotional and educational material, websites, and social media channels. Use of the mark may also include t-shirts and hats; letterheads, business cards, and other stationery; company-owned or leased cars and vans; and other collateral materials.

In administering the HPwES Program, DOE recommends consistent use of certain terms and phrases when explaining HPwES, conducting home performance sales, and completing projects. 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, and to promote consistency in messaging, DOE recommends Sponsors use the following terms:

Preferred Terms	Why
<p><b>Whole house</b></p> <p><b>Or</b></p> <p><b>House-as-a-system</b></p>	<p>HPwES considers the entire house (including occupants) when assessing opportunities for performance improvements.</p> <p>Describing the HPwES approach as the house- as-a-system is a straightforward way to convey the holistic nature of the approach.</p> <p>These terms are suggested as an alternative to the term “comprehensive” which can imply that every possible thing in the home is being inspected and/or that the homeowner must purchase all recommended improvements.</p>
<p><b>Assessment</b></p>	<p>“Assessment” is an accurate description of the activities performed by a technician when evaluating the home for potential improvement opportunities. This is suggested as an alternative to the term “audit” which can be perceived negatively.</p>
<p><b>Energy upgrade or improvement</b></p> <p><b>Or</b></p> <p><b>Home performance upgrade</b></p>	<p>“Upgrade” and “improvement” are positive terms offering an accurate description of the work performed by home performance contractors. This is suggested as an alternative to the term “retrofit” which can have negative connotations and may not be readily understood by consumers.</p>

<sup>2</sup> In addition to coordinating on marketing with a consistent message, Sponsors in overlapping markets are encouraged to, when feasible, align program procedures, contractor participation agreements, application forms, incentive structures and the like – so as to minimize confusion for participating contractors and homeowners.

In addition to the terms noted above, many other building science and industry terms are well understood by the credentialed home performance community but not necessarily by homeowners. For more tips and recommendations on the use of home performance terms, visit the online [tools and resources](#)<sup>v</sup>.

## Use of Certificates to Document HPwES Projects

Homeowners who choose to invest in upgrading their homes' performance are often interested in receiving a "Certificate" that documents the improvements made and references the organizations and companies involved in the home performance project. Certificates can provide the homeowner proof that energy improvements have been made to the home – which can prove valuable in future financing or sales transactions.

In September 2013, the Building Performance Institute (BPI) published [BPI- 2101-S-2013: Standard Requirements for a Certificate of Completion for Whole-House Energy Efficiency Upgrades](#). This Standard provides guidance to generate a Certificate of Efficiency Improvements and a Certificate of Performance. The provisions in BPI-2101 are designed to standardize the elements included in a Certificate to document efficiency improvements in existing homes.

When developing and issuing a Certificate that utilizes the Home Performance with ENERGY STAR name and mark, Sponsors should comply with the guidance in BPI-2101-S-2013. HPwES provides a template Certificate for Sponsors, which can be accessed via the password-protected "[My ENERGY STAR Account](#)" (MESA)<sup>vi</sup> on [energystar.gov](#).

When issuing a **Home Performance with ENERGY STAR Certificate of Efficiency Improvements** it should include the following elements:

- The Home Performance with ENERGY STAR mark and statement explaining the HPwES approach
- Program Sponsor logo and information about your mission as applicable
- Signature block for a third-party representative (e.g., the Program Sponsor or an independent third-party quality assurance program<sup>3</sup>)
- Address of home where improvements were completed

<sup>3</sup> Reflects organizations offering specialized services providing quality assurance (QA) at the contractor level. Examples include BPI's Contractor Accreditation, RESNET's EnergySmart Contractor, and ACCA's Quality Assured program.

## Greening the Multiple Listing Service

Studies indicate that homeowners and buyers are increasingly recognizing a value in energy efficient homes. According to the National Association of Realtors (NAR), trends for "going green" during real estate purchases in the existing homes market are on the rise. The National Association of Home Buyers' new study, [What Home Buyers Really Want](#), details that "91 percent want an ENERGY STAR rating for the whole home." As a result, there is an opportunity to document the value of home performance improvements as a part of highlighting a home's green features to real estate agents, appraisers and potential buyers. There is a burgeoning effort to "Green the Multiple Listing Service (MLS)" – with the intent of standardizing the inclusion of green data entry fields in local MLS systems. For more information see these resources:

- The Appraisal Institute's Form 820.04: Residential Green and Energy Efficient Addendum, <http://www.appraisalinstitute.org/education/downloads/ai-reports/AI-82004-res-green-energy-eff-addendum.pdf>.
- The Green REsource Council's Green MLS Implementation Guide, <http://www.greenresourcecouncil.org>.
- *Unlocking the Value of an Energy Efficient Home: A Blueprint to Make Energy Efficiency Improvements Visible in the Real Estate Market*, CNT Energy and National Performance Rating Council, August 2013, [http://www.cntenergy.org/media/Unlocking\\_Value\\_2013.pdf](http://www.cntenergy.org/media/Unlocking_Value_2013.pdf).
- *The Value of Green Labels in the California Housing Market: An Economic Analysis of the Impact of Green Labeling on the Sales and Price of a Home*, Kok and Kahn, July 2012, [http://www.usgbc.org/sites/default/files/ValueofGreenHomeLabelsStudy\\_July2012.pdf](http://www.usgbc.org/sites/default/files/ValueofGreenHomeLabelsStudy_July2012.pdf).

- Names of companies performing and verifying improvements
- HPwES Project completion<sup>4</sup> date
- Specific home improvement measures completed, including their location, measurement, and efficiency levels (e.g., R-values, etc.).

**Home Performance with ENERGY STAR Certificates of Performance** should include the items listed above for the Home Performance with ENERGY STAR Certificate of Efficiency Improvements AND the estimated energy savings or home performance results achieved (e.g., Home Energy Score, Home Energy Rating System (HERS<sup>®</sup>)Index, Energy Performance Score, deemed savings, or energy modeling software estimations).

As per minimum requirements, Sponsors should consult with their HPwES Account Manager to ensure the proposed Certificates comply with the *ENERGY STAR Brand Book* and are consistent with the ENERGY STAR message.

## Recognition Opportunities

### **ENERGY STAR<sup>vii</sup>**:

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](http://energystar.gov/awards) for more information.

### **U.S. DOE Housing Innovation Awards<sup>viii</sup>**:

In 2013, DOE announced winners of the first-ever Housing Innovation Awards, recognizing the very best in innovation and achievements in Customer Relations, Energy Savings, Market Leadership and Sales & Marketing. The Housing Innovation Awards recognize leading builders, contractors, researchers, national laboratories, and building science organizations who are helping communities across the country save money and energy and are leading the way to affordable, comfortable, zero-net-energy-ready homes.

### **Home Performance with ENERGY STAR Century Club Contractor Awards<sup>ix</sup>**:

DOE annually recognizes the leaders among the HPwES participating contractors with the Century Club Contractor Award. Award winning contractors must complete at least 100 HPwES projects per year, and be current and in good standing with their Sponsors. To help winners highlight their status, DOE created a Century Club Contractor Award web button which may be displayed on the winning contractors' websites.

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<sup>4</sup> 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.

## Section 2: Program Design and Development

### Minimum Home Performance with ENERGY STAR Program Requirements Checklist: *Program Design and Development*

- 2.1 Review and sign a Home Performance with ENERGY STAR Partnership Agreement
- 2.2 Complete and annually update a Home Performance with ENERGY STAR Implementation Plan
- 2.3 Provide quarterly and annual data on the status of Home Performance with ENERGY STAR Program implementation

This section describes the minimum requirements for becoming a Home Performance with ENERGY STAR (HPwES) Program Sponsor and recommendations to design an effective 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 sustainable funding sources 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 markets for home performance services following the HPwES approach. In establishing HPwES programs, Sponsors can forge a path to achieve both near-term energy savings as well as long-term outcomes – such as a thriving home performance industry. 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 HPwES programs include utilities, state energy offices, municipal governments, nonprofit organizations, 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

HPwES Sponsors must meet three minimum requirements for Program Design and Development.

#### 2.1 Review and sign a Home Performance with ENERGY STAR Partnership Agreement

To join HPwES, potential sponsoring organizations must agree to the terms defined in the [Home Performance with ENERGY STAR Partnership Agreement](#)<sup>x</sup>. The terms are as follows:

- a) Adhere to the *ENERGY STAR Brand Book*;
- b) Design and implement initiatives that support the tenets of the HPwES approach as described in this *Sponsor Guide*; and
- c) Meet quarterly and annual tracking and reporting requirements to document the results of program efforts.

The Home Performance with ENERGY STAR 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 home performance market.

## **2.2 Complete and annually update a Home Performance with ENERGY STAR Implementation Plan**

Sponsors shall develop a Home Performance with ENERGY STAR 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. A Sponsor's Implementation Plan should include provisions for long-term operations and production growth projections, along with a business plan that includes metrics and an approach to effectively meet goals. Each year, DOE will issue an Annual Report template to Sponsors to facilitate the required update to their Implementation Plans. See [Section 7: Tracking and Reporting](#) for more details on Annual Reporting requirements.

## **2.3 Provide quarterly and annual Home Performance with ENERGY STAR 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:

- 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
- 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.

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:

- 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.

To streamline reporting, DOE will offer report templates to facilitate data collection and tracking. See [Section 7: Tracking and Reporting](#) for more details on tracking and reporting requirements, recommended approaches, and references to templates and tools.

## Recommended Approaches

Since the Program's launch more than a decade ago, the HPwES community has gleaned insights and observed trends on programs' evolutions. In recent years, DOE has supported hundreds of communities working to promote energy efficiency upgrades in homes and other buildings through programs such as the Better Buildings Neighborhood Program. Typically programs need two to three years of infrastructure development and ramp-up time before gaining sufficient traction to generate larger volumes 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. Setting realistic goals to manage the expectations of funders and participants, especially in early years of program development, is important to long-term success. Below are strategies and tactics Sponsors may consider as they 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 and contractors.

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

### Understanding the Opportunities for the Home Performance Market

In 2013, the National Home Performance Council (NHPC) issued a white paper, *Bringing on the Boom and Beating the Bust: A Framework for Developing a Roadmap to a Successful Home Performance Industry* ([http://www.nhpci.org/publications/NHPC\\_White-paper-Bringing-on-the-boom\\_20130430.pdf](http://www.nhpci.org/publications/NHPC_White-paper-Bringing-on-the-boom_20130430.pdf)), outlining the challenges and opportunities for advancing the market for home performance services. Sponsors may find this document a useful reference for engaging decision makers and legislators, as well as a resource when designing an effective local program.

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, HPwES offers a home improvement service that combines energy efficiency with a wide range of benefits to both the customer and the broader market. By setting a baseline for the quality installation of measures and building consumer confidence by offering customized solutions to each home's unique problems, the value of HPwES extends far beyond the direct energy savings that can be claimed. Some of these additional benefits are listed below:

- Profitability and sustainability of local contractor infrastructure
- Meeting statutory environmental or energy savings goals
- Improved durability of the homes served
- Increased customer retention and satisfaction for utilities and contractors
- Support for local economic and workforce development
- Recognition of improved property values among the real estate community.

## Program Administration and Costs

Sponsoring a HPwES program 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 partner utilities, financial institutions, local government, colleges, manufacturers, distributors, retailers, nonprofit clean energy programs, and large employers. By working with these entities, not only can Program Sponsors leverage funding and skills while designing programs to fill gaps in HPwES program administration needs, but they also build bases from which to generate leads with co-branding opportunities. Sponsors are encouraged to find ways to help establish the HPwES related services of these partner organizations, for instance by funding their start-up costs or subsidizing their services to the HPwES market. This support should be designed to taper off once the program is up and running, to allow the market to support these service providers and

program funds to be used elsewhere. Direct financial support can be replaced by other types of support such as inclusion on a list of preferred/qualified vendors designed to drive customers to these businesses.

## 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 across a program or portfolio of programs. While it may be of interest to the individual customer to know exactly how much energy savings can be expected per installed measure in each individual home, such granular data may be too difficult or costly to collect.

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. For example, a utility may need to achieve a certain level of energy savings 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 achieved. These aggregate results can be used to determine total program cost-effectiveness and to estimate future demand. This process serves as one method to validate the value of the program and demonstrate responsible use of public funds.

### Measuring Project-Level Cost and Savings

Costs and savings reported at the measure and project-level can be useful both for customers and for programs. While it is not necessarily advisable to require cost-effectiveness screening at the measure level for program purposes, it can be worthwhile to provide the customer with a snapshot of their own value proposition for a HPwES project in terms of a return on investment (ROI) or savings to investment ratio (SIR) from the customer's perspective. Some programs require that each HPwES project meet a minimum customer-facing cost-effectiveness threshold using this type of metric as a consumer protection to ensure the program is supporting the installation of measures that will have real impact at reasonable cost. Programs can also benefit from tracking cost, savings, and measure installation data on a measure-by-measure basis to better understand patterns in the recommendation and installation practices across service territories, housing types, or contractors. For example, analysis of measure level data can be used to identify potential areas of improvement for the program and track seasonal patterns for future marketing, outreach, or incentive initiatives.

For more information visit the online tools and resources in the [Sponsor Resources](#) section of the website: [http://www.energystar.gov/hpwes\\_sponsors](http://www.energystar.gov/hpwes_sponsors).

The [International Performance Measurement and Verification Protocol](#)<sup>xi</sup> (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](#)<sup>xii</sup> (UMP) is an initiative intended 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 practice guidance for evaluation, measurement and verification (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<sup>5</sup>. As a result, home performance industry leaders are recommending various improvements to cost-effectiveness calculations to better align them with modern program designs. Among these is a recommendation that these tests be applied on a program-wide, or portfolio-wide level – and not on a project or measure level.

Consensus within the home performance industry, as well as the broader EM&V community, 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 to sell additional measures because the overall cost-effectiveness of the project will appear lower as the total invoice cost increases, thereby inhibiting the achievement of deeper energy savings. Many contractors and Sponsors are frustrated by this calculation because homeowner 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 E. 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.<sup>xiii</sup>
- *[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 American Council for an Energy Efficient Economy (ACEEE) Summer Study on Energy Efficiency in Buildings.<sup>xiv</sup>
- *[Measure it Right: Best Practices in the Selection and Implementation of Cost-Effectiveness Tests](#)*, Robin LeBaron, National Home Performance Rating Council, June 2012.<sup>xv</sup>
- *[Valuing Energy Efficiency: The Search for a Better Yardstick](#)*, Public Utilities Fortnightly, July 2013, p. 28.<sup>xvi</sup>

### Understanding the Value of Investments in Home Performance

DOE is interested in supporting on-going industry efforts to assemble and analyze energy consumption data sets which may be used to verify energy savings and program performance, inform future predictive models, define investment pools, or other applications related to cost-effectiveness and validating results. With the introduction of smart meters, easily accessible online consumption data, and improved technologies for managing big data sets, there is an opportunity to better understand the value of both public and private investments in home performance. Sponsors with access to energy consumption data are encouraged to join industry efforts to populate these data sets and develop analytical tools needed to make this vision a reality. Visit DOE's Building Performance Database for more information (<http://energy.gov/eere/buildings/buildings-performance-database>).

<sup>5</sup> The most commonly used reference for cost-effectiveness tests is the [California Standard Practice Manual](#) (CSPM), created by the California Public Utilities Commission in 2001. The CSPM pre-dates the creation of home performance, and as noted in the text above, several industry stakeholders have voiced concerns that these calculation methodologies need to be updated to maintain pace with the changes in energy efficiency program implementation models of the past decade.

- [\*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.<sup>xvii</sup>

## Performance and Prescriptive Approaches

Approaches to HPwES program designs typically rely on either a performance-based or prescriptive-based implementation model. While some programs use a hybrid approach, most often one model or the other dominates. Any of these approaches are acceptable methods for designing a program's procedures and requirements, but each comes with its own challenges and limitations and offers a distinct set of benefits.

A performance-based approach is typically considered a process where calculated energy savings predictions for customized packages of measures are determined on a project-by-project basis. Key benefits of a performance-based approach are that it allows a program administrator to define project-level energy savings targets or goals without necessarily limiting the pool of possible measures; it also makes possible trade-offs whereby important measures that might not be cost-effective independently can be packaged with more cost-effective measures. The performance-based approach can be helpful in meeting statutory mandates to achieve a targeted percent energy savings and to promote deeper energy savings for both the program and the customer.

A prescriptive-based approach is a process where project incentives 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 typically required using a prescriptive-based approach, which can streamline the energy assessment process.

Some Sponsors use a hybrid approach including elements from both the performance and prescriptive approaches. With a hybrid approach, there is flexibility in how Sponsors achieve goals, comply with cost-effectiveness tests, or meet 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.

Whatever approach is selected, consideration should be given to the interaction of energy savings when measures are combined in a single project. Energy savings from bundled measures are not necessarily directly additive, particularly when combining measures that reduce the heating and cooling load of the building (like insulation and air sealing) with measures that improve the efficiency of the mechanical systems (like heating or cooling system replacement). Most whole building energy simulation software programs have built in algorithms to account for this interactivity of energy savings. Sponsors using a prescriptive method to determine energy savings and measure eligibility must find other means to account for this interaction to prevent over predicting savings.

## Features of Performance-Based and Prescriptive-Based Approaches for HPwES

Feature	Performance-Based Approach	Prescriptive-Based Approach
<b>Energy Savings Predictions</b>	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"> <li>• Site-specific physical characteristics of the building</li> <li>• Site-specific operational characteristics</li> <li>• Local weather conditions</li> <li>• Historic site-specific utility and fuel data.</li> </ul>	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.
<b>Eligible Measures</b>	The pool of eligible measures which may be considered is largely unrestricted with the potential for custom measures to be included. (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.
<b>Interactivity of Savings</b>	Calculated energy savings take interactivity of combined measures into account.	Energy savings interactivity of combined measures is limited to predetermined measure “bundles” or may not be accounted for at all.
<b>Cost-Effectiveness Tests</b>	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.
<b>Packaging of Measures</b>	The customer receives a customized proposal for a package of measures that is specific to the home.	The customer receives a proposal that is customized to the home based on the available eligible measures.
<b>Metrics</b>	Goals may be established based on an average or minimum threshold for energy savings per project. This could be in the form of Btu’s or kWh saved, or a percentage savings based on baseline heating and cooling energy usage, or whole house energy usage.	Goals are typically defined and tracked based on deemed savings calculations and number of installed measures.

### Delivery Models

Regardless of a prescriptive, performance or hybrid approach, in designing a HPwES program, Sponsors should also consider which contractor delivery model will best support goals, given the Sponsor’s specific conditions and limitations. Some Sponsors’ goals are tied to market-based solutions for developing a local home improvement workforce and some may be working with limited budgets that cannot support long-term consumer incentives. In these cases, an open market delivery model that focuses on building an independently sustainable home performance market will help support those objectives. Regardless of whether a Sponsor uses an open market or captive market approach to engaging companies to provide home performance services, most HPwES Sponsors employ in some form two primary tactical approaches to service delivery: the contractor model and the consultant model.

- **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.

- Consultant Delivery Model:** features an “energy advisor” who acts as the homeowner’s representative throughout the HPwES process. Energy advisors are responsible for the assessment but typically do not provide installation services. Instead, 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 over the long-term.

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 which are usually 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, but 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 prescreened 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.

## Developing a Home Performance with ENERGY STAR Marketing Plan

Program Sponsors play a very important role in educating consumers about the process and benefits of Home Performance with ENERGY STAR. The Program Sponsor’s public reputation and credibility are valuable in persuading homeowners to consider making whole house energy efficiency improvements.

Successful HPwES programs include marketing and media plans that explain how the Sponsor will promote the program to 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. As Sponsors define their target market, gathering homeowner input on marketing messages and tactics can help in designing effective marketing strategies that will generate project leads. Sponsors and their participating contractors should remember that each house has different kinds of opportunities, so being open to a variety of approaches will enable the HPwES program to address homeowner needs.

Even when contractors are responsible for marketing their own company and services, a Program Sponsor should promote the program itself and the value of a home performance approach using a variety of tactics including advertising, public

**Tip:** Successful HPwES Programs include active discussions and input from participating contractor networks, local stakeholders and even the customers. By engaging these groups in the design and evolution of a program, Sponsors are able to improve their implementation approaches and more effectively meet their goals.

See [Section 3: Workforce Development and Support](#) on Workforce Development and Support for more details on minimum requirements for ensuring a qualified group of contractors are available to deliver home performance services.

relations campaigns, social media, bill inserts, websites, media interviews, community partnerships, and special promotional events. The plan should include specific examples of how the Home Performance with ENERGY STAR name and mark will be used in sales and marketing materials and websites. It is also recommended that the plan include how the Sponsor will monitor results and make adjustments to the approach as appropriate.

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)<sup>xviii</sup> on energystar.gov.

## Considerations for Incentive Design

After more than a decade of implementation, HPwES Sponsors have developed a greater understanding of the right mix and design for incentives to encourage investment in home performance upgrades. These practices are central to successful residential energy efficiency incentive design:

- **Do the Research:** Understanding the target markets is critical. What are the characteristics of this market? What are the market actors’ decision-making processes? What barriers or challenges do they face in making the choice to invest in home performance? Messaging and tactics that work in one market may not work in another, even within the same state, so be prepared to customize the marketing plan by region as needed.
- **Gather Input:** Coordinate and seek feedback from participating contractor networks and industry stakeholders. Trade ally observations on offering incentives can improve a program’s project conversions. Gather this feedback regularly, either formally or informally.
- **Incentivize for the Desired Outcome:** If energy savings are the desired outcome, then structure the incentives to produce the greatest level of energy savings possible over the entire HPwES program. Also consider structuring the incentives so that they strengthen the opportunities for contractor success with home performance, thereby supporting development of the home performance workforce. If volume of sales of a certain product is the desired outcome, structure the incentive so that customers are motivated to include that product in a home performance project.
- **Make it Easy:** Focus on methods to support trade ally and homeowner participation. Sponsors are encouraged to work with other market actors to ensure clarity and consistency in incentive processes and messaging. This is particularly important where Sponsors may have overlapping markets.
- **Take Notes:** Tracking and evaluating program implementation of incentives enables continuous program improvement. Many successful HPwES Sponsors fine-tune and adjust incentive levels, design, and processes on a regular basis. And as noted above, Sponsors are encouraged to seek input from trade allies to assist in this step of the evolution of program design and implementation.

### Kick starting a 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.

For more information on effective design of incentives, Sponsors should review the following resources:

- The Better Buildings Residential Program Solution Center.

- [\*Customer Incentives for Energy Efficiency Through Program Offerings: A Resources of the National Action Plan for Energy Efficiency\*](#), Leadership Group of the National Action Plan for Energy Efficiency, February 2010.<sup>xix</sup>
- [\*Technical Assistance Program Residential Retrofit Program Design\*](#), Oak Ridge National Laboratory, May 2011.<sup>xx</sup>

### Tips on Incentives

- **Financing:** Look for ways to raise, secure and leverage capital for financing energy efficient loans and use programs such as Federal Housing Authority (FHA) PowerSaver, the National Association of State Energy Offices (NASEO) Warehouse for Energy Efficient Loans (WHEEL) and others. Visit DOE's Solution Center (<http://www1.eere.energy.gov/wip/solutioncenter/financing.html>): Financing for Energy Efficiency and Renewable Energy, a website with helpful resources, including financing overview content, webcasts, FAQs, case studies, and more.
- **Tiered incentives:** Allow for a range of incentives to enable homeowner options for seeking greater energy savings from their HPwES project.
- **Mid-stream incentives:** Provide incentives to participating contractor networks, such as training, certifications, equipment, and/or direct cash incentives, to boost participation rates and help build the home performance delivery infrastructure in early years.

## 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, including customer and participating contractor feedback.

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
- Market sustainability.



Many Sponsors use evaluation results and information gathered during a formal review process to create new implementation plans, identify best practices, and set new performance goals.

### Additional Program Design Resources

Sponsors and home performance stakeholders can find more information in the Better Buildings Residential Program Solution Center

([http://www1.eere.energy.gov/buildings/betterbuildings/neighborhoods/pdfs/bbrpsc\\_demo\\_presentation\\_05-16-13.pdf](http://www1.eere.energy.gov/buildings/betterbuildings/neighborhoods/pdfs/bbrpsc_demo_presentation_05-16-13.pdf)), initiated 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 in 2014.

## Section 3: Workforce Development and Support

### Minimum Home Performance with ENERGY STAR Program Requirements Checklist: *Workforce Development and Support*

- 3.1** Develop a contractor engagement plan
  - Assess the market to identify the target contractor base
  - Define required certifications and credentials
  - Enable contractor access to required diagnostic equipment and software tools
- 3.2** Establish minimum qualifying criteria for participating contractors including:
  - Training and credentialing requirements
  - Certification of supervisory staff
  - Capacity and resources to provide program related services
  - Compliance with local registration and licensing requirements
  - Access to qualified installation crews and/or sub-contractors
- 3.3** Provide a program orientation:
  - Conduct contractor training providing an overview of program goals and policies and procedures as they pertain to the participating contractors
  - Provide training on basic principles of building science and the house-as-a-system approach to all employees of the Sponsor, its implementation vendor, and other program staff who interact with customers
- 3.4** Ensure availability in the local market of home performance skills training (technical, software, sales, business development, installations, etc.) for participating contractors
- 3.5** Provide technical support for participating contractors and energy advisors
- 3.6** Develop and execute a Contractor Participation Agreement (CPA) including
  - Explanation of the agreement
  - Participating contractor commitments
  - Marketing and advertising guidelines, particularly with regard to use of the Home Performance with ENERGY STAR name and mark
  - Business Practices
  - Qualifications and credentials
  - Terms and conditions pertaining to termination

When launching a home performance program, Sponsors often find a limited supply of qualified contractors. Homeowners, when given improvement recommendations by a qualified consultant, typically do not have a reliable point of reference to determine who is qualified to make the improvements. Developing a strong network of professionals who are skilled in customer engagement, the whole house assessment, performance testing, diagnostic reasoning, and installation best practices is essential to a successful Home Performance with ENERGY STAR (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

### 3.1 Contractor Engagement Plan

The Sponsor shall establish a contractor engagement plan which includes identification of the targeted contractor base, a strategy for reaching candidate contractors, 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 related policies and procedures as part of the initial Implementation Plan submitted when establishing sponsorship. Sponsors shall provide a description of any updates to the contractor engagement plan when responding to DOE's annual data call (described in [Section 7: Tracking and Reporting](#)). The engagement plan shall clearly define the credentialing requirements for participating contractors including which credentialing program(s) are acceptable, which certification(s) are required and by whom within the participating contractor's team. 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 engagement 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 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 to complete home performance work
4. Execution of a participation agreement between the contractor and the Sponsor.

### 3.2 Participating Contractor Minimum Qualifying Criteria

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

1. Through training and credentialing, the Contractor's staff (and sub-contractors, if applicable) shall be proficient in the knowledge, skills and abilities needed to conduct whole house assessments, building performance diagnostics and reasoning, and estimates of energy savings from improvement installations (via calculations or a modeling software tool).
2. Certification of designated workers to assure the quality of the work completed through the HPwES program including a minimum of one site visit per HPwES project by appropriately credentialed individuals. The credentialing

**Tip:** HPwES Sponsors should anticipate that participating contractors will experience turnover among their credentialed staff over time. Additionally, most worker certifications are subject to periodic renewal (typically every 3-5 years.) As a result, it is important to establish a system for tracking and verifying that participating contractors not only satisfy credentialing requirements included in your contractor engagement plan when they sign up for the program, but also that they maintain those credentials over time.



process shall be at least as rigorous as those employed by nationally recognized certification bodies<sup>6</sup>. 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 programs<sup>7</sup>.

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 testing and diagnostic 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.

### 3.3 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 requirements (e.g. paperwork and data reporting), 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. Additionally, the program shall provide training for all program staff engaged in customer service activities. Training for customer service staff shall cover the fundamentals of what is meant by home performance, building science, and the house-as-a-system approach and the value to the customer.

### 3.4 Home Performance Skills Training

Home performance training shall be made available to the contractor community. Trainings will help to build and support an infrastructure of qualified contractors and should cover 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 relations. 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.

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<sup>6</sup> 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.

<sup>7</sup> 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 in HPwES programs.

### 3.5 Technical Support

The technical training required to initially become certified is only a starting point for newly practicing home performance contractors. The necessary skills and knowledge—to efficiently complete a home performance assessment, accurately diagnose building performance problems, prioritize improvement recommendations, troubleshoot unexpected findings, and use best practices during installation of measures 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 appropriate training and technical resources over time.

### 3.6 Contractor Participation Agreement

The Sponsor shall create a Contractor Participation Agreement (CPA) describing the roles and responsibilities of both the contractor with respect to the Sponsor and vice versa. 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 *ENERGY STAR Brand Book*, to follow standards and specifications of the program, and to report HPwES project data to the Sponsor.

The following table lists the required elements to be included in the Contractor Participation Agreement.

Section	Required Elements
Explanation of Agreement	<ul style="list-style-type: none"> <li>• <b>Terms and Conditions:</b> establishes the terms and conditions under which contractors may participate in the Sponsor’s Program.</li> </ul>
Participating Contractor Commitments	<ul style="list-style-type: none"> <li>• <b>Project Reporting:</b> describes the administrative procedures and requirements the participating contractor must follow to document (and often be compensated for) a completed HPwES project.</li> <li>• <b>Field Inspections:</b> 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 deficiencies identified through the inspection process.</li> <li>• <b>Sub-contracting:</b> articulates conditions under which the participating contractor may enter into sub-contract arrangements for completion of project work scopes.</li> </ul>
Marketing and Advertising	<ul style="list-style-type: none"> <li>• <b>Use of the Home Performance with ENERGY STAR Name and Mark:</b> describes the compliance requirements for a participating contractor’s use of the Home Performance with ENERGY STAR name and mark. This section should specifically reference the current <i>ENERGY STAR Brand Book</i>, which describes how the Home Performance with ENERGY STAR mark and name may be used. Additionally, Sponsors shall describe procedures for addressing any non-compliance related to the use of the ENERGY STAR marks.</li> </ul>
Business Practices	<ul style="list-style-type: none"> <li>• <b>General Business Practices:</b> 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 and specifications pertaining to the installation of efficiency measures.</li> </ul>
Qualifications and Credentials	<ul style="list-style-type: none"> <li>• <b>Credentials/Skills:</b> 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.</li> <li>• <b>Equipment:</b> lays out the required access to adequate diagnostic equipment, tools, qualified staff, data systems and software, and administrative support.</li> </ul>
Termination	<ul style="list-style-type: none"> <li>• <b>Right to Terminate:</b> outlines the terms and conditions under which the Sponsor may terminate the Contractor Participation Agreement.</li> </ul>

## Recommended Approaches

### Contractor Participation Agreement

In addition to the required elements listed in the above table, the Sponsor should seek professional counsel to create terms and conditions for the Contractor Participation Agreement that will satisfy the Sponsor's particular needs. At a minimum, the Sponsor should consider counsel related to legal issues; licensing, registration, and permitting requirements; and insurance requirements.

### Recruitment

Successful Program Sponsors have developed contractor recruitment strategies to 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 defray the cost of establishing and maintaining a home performance business, 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 the 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 own market and survey contractors before designing their incentive offerings. It is also a good idea to reevaluate mid-stream incentive offers periodically to ensure that they are still working to help the program meet its goals. Once an infrastructure of experienced home performance contractors is supporting a program, it may no longer be necessary to subsidize trainings or other home performance start-up 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 workers 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 retrained 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. Many credentialing programs include continuing education requirements for workers to maintain their certification(s) over time. It is recommended that Sponsors be familiar with the requirements for the credentialing program used in their programs and provide support where possible to assist participating contractors in accessing suitable

continuing education opportunities. Additionally, Sponsors and their participating contractor networks should avail themselves of national, regional, and local conferences offered by organizations such as Air Conditioning Contractors of America (ACCA), Affordable Comfort Inc. (ACI), the Environmental and Energy Building Alliance (EEBA), ComfortTech, the National HVACR, Hydronics and Plumbing Seminar and Products Showcase, and RESNET. These events offer training and continuing education credits (CEUs) that can help participating contractors to maintain their credentials.

Mentoring contractors on-the-job through the Home Performance Assessment, home improvement installation, 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 quality control inspections.

Through the Workforce Guidelines Project, DOE has created resources that 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, Job Task Analysis references are available for several of the worker types commonly employed in both weatherization and home performance.

Additional resources for training can be found online. Visit the [Sponsor Resources](#)<sup>xxi</sup> section of the HPwES website to access these materials.

## **Credentialing of Participating Contractors and Workers**

Sponsors may choose from various credentialing programs when designing 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 are offered 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 Home Energy Rating Organization, 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 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, RESNET's Energy Smart Contractor, or ACCA's Quality Assured 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 Assessment

### Minimum Home Performance with ENERGY STAR Program Requirements Checklist:

#### *The Assessment*

- 4.1** Develop and require a Home Performance Assessment (HPA) for each HPwES project, which ensures 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
  - Minimum diagnostic tests
  - Data collection of building assemblies and mechanical systems
- 4.2** Develop and require a Home Performance Assessment (HPA) Summary Report for each HPwES project, which includes at a minimum:
- General information
  - Existing conditions
  - Prioritized list of recommended improvements (the proposed improvement measures)
  - Notice of health and safety related issues
  - Savings projections (estimated, modeled, or calculated)

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

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 home. 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 localized factors.

In addition to conforming to the Minimum Requirements listed in the checklist and described in more detail in the following section, when designing the HPA for a program, Sponsors should also strive to apply the **Guiding Principles** in the text box below.

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 value in a multistep 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. Likewise, Sponsors should build sufficient latitude into the HPA process to allow contractors to experiment with different ways of delivering the HPA in order to increase customer engagement.

## Guiding Principles

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 converted 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 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. In this context, the "performance" of the home is inclusive not only of energy efficiency, but also the comfort, health, and safety of the occupants, and the durability of the building enclosure and its mechanical systems.
4. **Inspection and Measurement 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 home's energy-related systems, including both individual and combined systems.
5. **Documentation, Analysis, and Reporting:** The assessment shall include an analysis and diagnosis based on observed and measured data with a list of prioritized recommended improvements and a prediction of the improved home performance including estimated energy savings.

## Minimum Requirements

The HPA shall include an interview with the homeowner and occupants, and a review of the energy consumption history if the home is occupied. The HPA shall also include an 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 and notification of health, safety, and durability issues identified during the HPA. Each of these requirements is described in greater detail below.

**Tip:** When designing your program's HPA, careful consideration should be given to striking a balance between the technical needs of the program and the effectiveness of the HPA as a sales tool. One issue that is integral to this decision process is the selection and timing of diagnostic tests. The goal should be to gather information during the HPA that is both necessary and sufficient to develop an accurate improvement proposal and to successfully persuade the customer to commit to the improvements. On the other hand, the HPA should not be so lengthy or complicated as to pose an undue burden upon the customer or the program's overhead costs. See the Recommended Approaches for considerations in the selection and sequencing of diagnostic testing.

## 4.1 Home Performance Assessment

The HPA includes specific activities (i.e., inspections and tests) to evaluate a home's existing condition and prepare a proposed energy efficiency improvement package for 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 diagnostic tests that are specific to individual measure installations are not required to be completed in a single visit to the home during the HPA, but must be completed prior to or concurrent with the commencement of improvement installations under the HPwES program. Additional detail describing the minimum requirements for diagnostic tests is included in [Section 5: The Project Installation](#) of the *Sponsor Guide*.

The HPA shall include, at a minimum, the following elements with the understanding that any of these elements may be omitted on a case-by-case basis if it is physically impossible to complete the task (e.g., if the house is unoccupied it may be impossible to complete an occupant interview):

- **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 identify any specific issues the customer is seeking to address through the HPwES program and 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 from 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 as a reality check against projected savings estimates. A review of energy consumption data is critical to determining how the homeowner uses energy; 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 manufacturer's 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* (Section 2.02) shall be used<sup>8</sup>.
- **Visual Home Inspection:** A 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).

<sup>8</sup> 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); and American National Standards Institute (ANSI)/ACCA 12 QH-2011 Existing Home Evaluation and Improvement Standard, Section 3.3.



- **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 but shall remain consistent with the Guiding Principles. Additional guidance on the required diagnostic tests that must be performed during the course of HPwES project is included in Section 5: The Project Installation.
- **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 major household appliances which may be used to inform customers of opportunities for improvements.

For 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 program satisfy the intent of all of the aforementioned Guiding Principles.

## 4.2 The Home Performance Assessment Summary Report

Upon completion of the HPA, participating contractors shall present the homeowner with an HPA Summary Report that communicates inspection findings and enumerates the improvement recommendations identified during the assessment.

At a minimum, the elements included in the following table are required to be included in an HPA Summary Report and may be provided as a stand-alone report or concurrent with a contract and agreed upon Scope of 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.

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.

## Home Performance Assessment Report: Required Elements

	Required Elements	Description
General Information	Participating contractor name Contractor contact information Identification of the contractor's qualifying credential(s) Name of technician completing the HPA	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.
	Customer name Assessed home's address	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.)
	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.
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 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.

## Special Requirements for Multifamily Buildings

### Scope of Building Types

Any multi-unit building subject to residential building codes as determined by the local authority 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 requirements as required for single family detached dwellings. When whole building improvements (e.g., insulation of 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 that all other requirements listed in this section are met. Program Sponsors may adopt more stringent or specific requirements at their discretion.

#### Central Mechanical Systems

Buildings using any heating, ventilation, and air conditioning (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 for DOE consideration a summary of the program's technical requirements for low-rise multifamily buildings with central systems. 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:

- Model the energy consumption for each unique unit type (including variations based on size, geometry, mechanical systems, number of bedrooms, and exposed surface configurations) and then aggregate the results across all units in the building to determine the whole building energy consumption.
- Follow sampling protocols in the RESNET Standards<sup>9</sup> and model worst-case configurations of each unique floor plan.

## Recommended Approaches for Single and Multifamily Buildings

### Supporting a Whole House Approach

While all programs have specific goals which will dictate priority areas for HPAs, the program design should allow for sufficient latitude to generate whole building based scopes of work. Many programs do not have the financial resources or regulatory freedom to offer incentives for the full range of improvements recommended in the HPA. As a result, it is a good practice to design the program to allow for contractors to offer their customers add-on services at market rates to give them the option to complete comprehensive scopes of work 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

Diagnostic tests are required when conducting an HPA to quantify baseline conditions that are not readily observable and/or cannot otherwise be accurately estimated. There are a variety of considerations Sponsors should take into account when establishing the minimum requirements for diagnostic testing during the HPA. A few of the most important issues are described below:

- **Diagnostic Tests are Sales Tools:** The HPA itself is often designed to be a loss leader, whereby the customer does not typically pay for the full market value of the time and expertise that goes into the analysis of their home. Instead, the program and contractor capture benefits and profit through the installation of measures that result from the HPA recommendations. Toward this end, some diagnostic tests are extremely powerful selling tools and

<sup>9</sup> 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.

should be included as part of the standard HPA process for that reason alone. For instance, the blower door gives the customer an opportunity to see and feel the air leakage in their home in a new way, creating a mental anchor that sticks when the proposed improvement package is presented to them. When used effectively, the sale is made while the blower door is still running, not at the kitchen table over a proposed bid for work. The infrared camera is a similarly powerful tool for helping the homeowner visualize problems that the improvement package proposes to fix.

- **Diagnostic Tests Can Help Manage Risk:** Using diagnostic tests to establish a baseline pre-improvement level of performance at the time of the HPA, enables the energy assessor to better predict the final post-improvement test results. While not a perfect predictor, HPA test results can indicate likely need for ventilation or combustion appliance venting improvements resulting from other measures that impact the air movement in the home. This enables the energy assessor to include potentially necessary health and safety related improvements in the original proposal instead of being stuck with change orders that add more work and cost to the project after other measures have been installed.
- **Diagnostic Tests are for Installers:** From a purely technical perspective, most of the instrumented diagnostic tests that are often considered part of the “energy audit” process are designed to give us baseline information that can be compared to post-installation results to quantify the net improvement after work has been completed. Tools like blower doors, infrared cameras, and duct testing devices are invaluable to installers as they help them pinpoint locations to be sealed or insulated and allow them to check their work as the installation progresses to ensure goals are being met. On the other hand, many experienced energy assessors can be very effective at identifying insulation, air sealing, and duct sealing opportunities for the purposes of recommending and pricing improvements without using testing equipment. This would suggest that diagnostic tests might be better left for the installers instead of the HPA.

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 (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 QH-2011: 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 them include:

- 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 to predict backdrafting of combustion appliances after air sealing, but a blower door test during the assessment will improve the accuracy of predicting potential post-improvement failures; this makes 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 avoid the waste of resources on unnecessary tests.

### **Prescreen Customers to Provide a Customized Experience**

Not all homes are ideal candidates for a comprehensive home energy assessment. Use data and information available prior to visiting the home to prescreen and triage customers into appropriate assessment categories. This approach can help programs improve their services and manage costs by customizing the service provided to the home and customer from the first point of contact. Key features of the home such as square footage, vintage, and basic construction characteristics can be obtained over the phone or through online resources such as Zillow.com and bing.com/maps. When energy consumption data is available prior to the site visit, consumption analysis and benchmarking can be used to estimate the home’s potential for energy savings, and tools like Advanced Energy’s “House Characterization” ([http://www.advancedenergy.org/portal/house\\_characterization/](http://www.advancedenergy.org/portal/house_characterization/)) screening can help predict the level of effort needed to conduct an HPA so workers can be deployed appropriately.

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 filter 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, workscope 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). When cost-effectiveness is used to determine measure eligibility, it is the Program Sponsor's responsibility to provide guidance on allowable methods of cost-estimating as well as energy savings estimates.

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 scopes of work by emphasizing measures like air sealing so as to drive the installation of higher cost, lower payback measures like windows, Sponsors should address this directly with the 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.

$$\begin{aligned} & \textit{Percent Energy Savings} \\ & = \\ & 1 - (\textit{Predicted Post-Improvement Energy Use} \div \textit{Pre-Improvement Energy Use}) \end{aligned}$$

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 E](#) 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.

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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.

### **Energy Savings Outside of the Building**

When completing home performance assessments, keep in mind that significant energy consumption can occur outside the home. It is recommended that program Sponsors include in the HPA an evaluation of potential energy savings outside of the home by evaluating potential improvements to exterior lighting and controls, pool pumps and heaters, garage and driveway heaters, or other exterior accessories which might present significant energy saving opportunities.

### **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.

### **Multifamily Operations and Maintenance**

When proposing improvements to multifamily buildings, keep in mind that operations and maintenance (O&M) practices are just as important for energy efficiency as the condition of the building itself and its mechanical systems. Even high efficiency equipment won't save energy or money if not operated and maintained properly. HPwES programs serving multifamily buildings are encouraged to treat operations and maintenance improvements as viable energy efficiency measures by ensuring that O&M is included as part of the building assessment and recommendations for related improvements are included in the proposed list of measures. Additionally, training for multifamily building operators in energy efficient practices is encouraged. Some programs offer discounted training or other incentives to building owners who send their maintenance and management staff members to these trainings.



## Section 5: The Project Installation

### Minimum Home Performance with ENERGY STAR Program Requirements Checklist

#### *The Project Installation*

#### 5.1 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
- Ventilation shall be installed as prescribed by industry-accepted standards whenever the home's air exchange rate is determined to be below the required air exchange rate for good indoor air quality as determined by the referenced standard(s).
- Materials and installation techniques used shall be consistent with a building science-based approach
- Installations shall be completed by qualified workers

#### 5.2 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

It is the Sponsor's responsibility to ensure that improvement measures installed under the Home Performance with ENERGY STAR (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 substandard improvement work and ensure that predicted energy savings are realized post-improvement.

One feature 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 Scope of Work (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. At this stage in the project, loading order of measure installations is determined based on the final contracted SOW and consideration of customer needs and site-specific conditions. Installation requirements described within this section refer only to the contracted SOW.

## 5.1 Scope of Work and Installation Requirements

The improvement measure specifications included in the contracted scope of work shall be consistent with Sponsor-defined minimum installation specifications. It shall include descriptions of individual measures to be installed. Additionally, the scope of work shall include information on the 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 and annual fuel utilization efficiency (AFUE) ratings).

The SOW specifications should also include 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.

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 backdrafting combustion appliances) and maximizes energy savings. (Note: 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).
- Installations shall be compliant with building codes, industry-accepted standards, and manufacturers' installation instructions for the materials and equipment being installed. This requirement does not impose responsibility for code enforcement upon the Sponsor; however, the Sponsor shall take measures to ensure that participating contractors are working within local compliance requirements. These measures may include collecting evidence of current contractor licenses, verifying that permits are pulled where required, reviewing code inspectors' reports, or other appropriate actions. 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*, American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE) 62.2-2013, ACCA Standard 5 QI-2010, NFPA 54-2012, etc.) are to be referenced for HPwES projects.
- If natural air exchange rates are 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. 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 reducing air exchange rates below the minimum requirements for indoor air quality.
- 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 workers.

## 5.2 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: Quality Assurance](#)). 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 tolerances<sup>10</sup> to ensure indoor air quality.

## 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, and building-wide replacement of windows.

#### 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 replacement of in-unit heating, cooling, and DHW equipment.

### Performance Testing and Quality Assurance

Test-in and test-out requirements for installed measures are the same as for single family detached buildings described in [Section 4: The Assessment](#) and [Section 5: The Project Installation](#) of the *Sponsor 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

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<sup>10</sup> For example, ASHRAE Standard 62.2-2013, "Ventilation and Acceptable Indoor Air Quality in Low Rise Buildings."

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.
- 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: Quality Assurance](#) of the *Sponsor 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. 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](#)<sup>xxii</sup> 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 that may be helpful as references.

The Sponsor Resources section of the HPwES website provided guidance reference documents and test-out templates 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.

### **Ventilation and Air Sealing Go Hand in Hand**

Ventilation requirements are not designed to limit air sealing activities. The idea of establishing a “target” air leakage rate using a minimum ventilation threshold as the stopping point is an incorrect application of ventilation standards like ASHRAE 62.2. Some programs in the past have adopted “building tightness limits” in a well-intentioned but misguided attempt to maintain the cost-effectiveness of air sealing work. Ideally, air sealing specifications should be driven by the location and type of holes and air leakage paths present in the building and should not be governed by the ventilation standards. The details of where and how much to seal should be determined based on a combination of factors including prevention of moisture migration into unconditioned spaces, accessibility, energy savings potential, and the impact on comfort. The blower door test will provide the data needed to determine if additional ventilation is needed based on the ventilation standards, but should not dictate a stopping point for air sealing.

### **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 (JTAs) 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 JTAs, are currently available through BPI. BPI also offers certification for air sealing and insulation installers. Trade-specific certifications for HVAC workers are available through organizations such as North American Technician Excellence (NATE), National Comfort Institute (NCI), Comfort Institute, and 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 that employ this approach to improve productivity, worker and customer satisfaction, and performance results.

## Special Considerations for Ducted Heating and Cooling Systems

Sealing of leaky heating and cooling ductwork can have a significant impact on both the energy consumption and the delivery of comfort in the home. Duct sealing is a common improvement offered by many HPwES program Sponsors and carries with it some special considerations. The following issues should be considered when duct sealing is recommended:

- System airflow and/or static pressure tests should be completed when duct sealing measures are installed to verify that systems are operating within the manufacturers' specified performance ranges. Proper airflow and static pressure help ensure that both heating and cooling systems are operating at optimal efficiency and help protect the equipment against premature failure. When systems are found with low airflow and/or high static pressures before or after sealing, measures should be taken to bring the system into the manufacturer's recommended operating ranges. This practice will help ensure that systems operate at their rated efficiency and reduce the occurrence of common performance issues like icing of refrigerant coils and short cycling.
- Some newer residential HVAC systems use variable speed fans and intelligent controls with on board diagnostics that can monitor airflow and static pressure conditions and automatically adjust the fan speed to the current conditions. Additional testing of systems with these types of advanced controls is often unnecessary and may not produce meaningful results if the technician is unfamiliar with the specific type of control system. It is important for technicians to be aware of these types of systems and understand when testing should not be done as well as when it is necessary.
- Not all duct sealing is equal in terms of energy benefits. For example, sealing of central AC duct work located in an attic can be a high impact energy savings measure, but if that ductwork is located in an unconditioned basement the energy savings could be lower. It is recommended that programs consider both the location and type of leaks sealed (supply vs. return) when estimating the energy savings from duct sealing.

Duct leakage testing provides important feedback for installers. In addition to providing a means of quantifying the net impact of duct sealing, pre- and post-installation leakage testing during the installation can help guide installers so they know if the work they have completed has been effective. New installers, especially, can benefit from measuring the results of their own work. It is not uncommon for new installers to miss sealing important leaks or to apply mastic too sparingly and fail to produce an effective seal. By testing leakage during the installation, these errors can be corrected while the job is still in process.

### Documentation of Results

If the Sponsor offers a **Certificate of Efficiency Improvements** to participating homeowners, the certificate should include a listing of the measures installed with sufficient detail to document the final post-installation condition for each measure listed. For example, if insulation is added to an attic, the certificate should indicate the location in the home where the insulation was installed (e.g., the attic above the master bedroom), the number of inches of insulation, the type of insulation, its square footage, and the resulting R-value of the attic surface. If a **Certificate of Performance** is offered, this information should be supplemented with the designated rating or scoring system and the achieved level of performance within that scoring system. In addition to the basic requirements described in the preceding sections, the post-installation test-out process should include provisions requiring the workers to document the results as needed to complete these certificates. See [Section 1: Use and Management of the Home Performance with ENERGY STAR Mark](#) for more on recommended approaches for use of certificates.

## Section 6: Quality Assurance

### Minimum Home Performance with ENERGY STAR Program Requirements Checklist: Quality Assurance

- 6.1** Ensure program and contractor compliance with the ENERGY STAR Brand Book
- 6.2** Ensure that a signed contractor participation agreement (CPA) includes requirements for compliance with the Sponsor's QA system
- 6.3** Implement a mechanism for customer feedback
- 6.4** Institute a conflict resolution procedure to address problems identified through Quality Assurance/Quality Control (QA/QC) activities and customer feedback.
- 6.5** Implement on-site inspection procedures and maintain records on quality control activities relating to the participating contractors including:
  - Inspection sampling rate
  - Inspection findings
  - Corrective actions, including process improvements resulting from Quality Control activities
  - Be prepared for review by request of DOE or its implementation contractor
- 6.6** Establish and implement procedures for due process and remedial actions
- 6.7** Implement one of the following two options:
  - 6.7.1** OPTION 1: Meet minimum requirements for Quality Control
  - 6.7.2** OPTION 2: Implement a Quality Management System

Quality Assurance (QA) is an essential component of Home Performance with ENERGY STAR that helps protect the integrity of the ENERGY STAR brand, and ensure that federal and local objectives are being achieved through energy savings, improved living environments, and a thriving home performance industry. Sponsors are responsible for developing and implementing a Quality Assurance/Quality Control (QA/QC) program to achieve these goals. Quality assurance protects homeowners by providing independent oversight 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 participating contractor, and provides a feedback mechanism for both customers and participating contractors to support continuous improvement.

Quality assurance is often confused with quality control. 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 meet quality control requirements by conforming to a standard or specification but miss the mark in terms of quality assurance if the customer's expectations are not satisfied.

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

- Overall program goals
- Identification of the various types of customers served and their associated needs and desired outcomes
- QA responsibilities of the organization(s) and individuals engaged in program activities
- Success metrics
- How success metrics are measured
- How overall process improvements are informed by QA/QC activities.

There are several general quality requirements for Sponsors included in the following section, in addition, Sponsors are required to select one of two possible paths to fulfill the quality assurance requirement for HPwES, as described below:

- Option 1: Quality Control (QC)**  
 The QC option relies primarily on checks and inspections performed by a party that is external to the installing contractor (e.g. program staff, dedicated QC vendors hired by the program, or other independent third parties) 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/QC 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.

Definitions for key terms associated with quality assurance systems are provided in the [Glossary](#) of Terms Used in the Sponsor Guide. An overview of QMS for HPwES and a comparison of the traditional QC-based approach vs. the QMS approach are included in [Appendix F](#).

## Minimum Requirements

The Sponsor is required to maintain records and permit access to those records by DOE, EPA, and their authorized agents to 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, and their authorized agents, either remotely via electronic document and data review, or through site visits to the Sponsor's location.

Sponsors are allowed to select one of the two options described above 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.

The following table lists the minimum QA/QC requirements, the associated QA/QC Option 1 or 2 for each required element, and the primary verification activity (data/file review, site inspection, or both) to be used by the Sponsor or DOE to ascertain compliance with the requirement. DOE will periodically review the Sponsor's activities and records. The Sponsor, in turn, 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.*



## 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 Brand Book</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"/>

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 (Options 1 and 2)

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

### 6.1 Compliance with ENERGY STAR Brand Book

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 Brand Book* 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 Brand Book*:** 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 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 Brand Book*.

### 6.2 Executed Contractor Participation Agreement

A signed Contractor Participation Agreement shall be executed by all participating contractors in the program as described in Section 3 of the *Sponsor Guide*. At a minimum, the Sponsor's QA program must include activities to monitor and verify compliance with participating contractor commitments, marketing and advertising guidance, required business practices, and verification and enforcement of qualifications and credentialing requirements.

### 6.3 Customer Feedback System

A HPwES Program quality assurance plan shall include a process for program and process review, identification of systemic 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 or its agents upon requested.

### 6.4 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.

### 6.5 On-Site Inspections

Regardless of which approach a Sponsor chooses for their QA process, some level of physical inspection of project sites will be required. At a minimum, these inspections shall be performed by technically qualified workers 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).

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. Technical skills qualification criteria for inspectors shall be established by the Sponsor to ensure that inspectors possess the knowledge, skills, and abilities to accurately evaluate the work being inspected. This criteria may include training, credentialing, licensure, documented experience, or other means of demonstrating competency as defined by the Sponsor.

### 6.6 Remedial Actions and Due Process

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 that 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:

## 6.7 QA/QC Plan (Option 1 or 2)

A QA/QC plan should describe the basic management functions for the delivery of the set of products and services provided and is designed to meet the expectations of a targeted customer.

### 6.7.1 Option 1: QC-Based Quality Plan

The HPwES Sponsor's QC-Based Quality 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 and/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 use this data review process to determine if:
  - the HPA was implemented in accordance with the requirements in Section 4 of the *Sponsor Guide*
  - the findings and recommendations from the HPA were provided to the homeowner (including costs and estimated savings)
  - the recommended improvement measures were consistent with the Guiding Principles and minimum requirements of the HPA
  - the contracted scope of work was specified using industry best practices
  - 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.

### 6.7.2 Option 2: QMS-Based Quality Assurance Plan

Sponsors using the QMS option must describe and implement a Quality Assurance Plan (QA Plan) which includes all of the eight features listed below. 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 obtain DOE approval of the summary of this plan via the Home Performance with ENERGY STAR Implementation Plan process and/or via the Annual Report process. Periodic QA Audits conducted by DOE or its agents will be used to confirm that the Sponsor is successfully implementing and conforming to its approved QA Plan.

#### Required Elements of a QMS-Based Quality Assurance Plan

1. **Customer Needs Assessment:** Identify all customers in the HPwES program's supply chain and their associated needs targeted by the program. (For example, homeowners and utility commissioners might be two customer types identified by a Sponsor, each with differing needs.)
2. **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.

3. **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 once identified, describe their impact and responsibility as it relates to quality.
4. **Product (Service) Specifications:** Define the technical specifications and metrics required to satisfy the customers' needs and meet quality objectives. Reference industry standards for home performance assessments and energy improvement installation as needed to fulfill this QA Plan element.
5. **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.
6. **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.
7. **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 record 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 process to ensure checks occur at critical stages throughout the supply chain.
8. **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.

### QA Plan Example:

The following example is provided to illustrate how a QA Plan might be developed for a HPwES Program. The descriptions listed are by no means exhaustive but should provide a basis from which a Sponsor may begin the process of defining its QA Plan.

*Note that this example describes how a program might design a QA Plan based on the obvious end user, the homeowner, but there are other customer groups that should be considered in this process as well. For instance, your program may be subject to rules and expectations set by a public utility commission or other governmental body. Mid-stream actors such as the contractors who deliver home performance services might also be considered customers of the program. For your program to be successful, it must satisfy the needs of those customers as well as the end users (i.e. homeowners and occupants.)*

QA Plan Element	Example Description
<p><b>1. Customer Needs Assessment</b></p> <p><i>Tip: Remember to consider needs from the customer's perspective, not the program's perspective.</i></p>	<p>One of our customer groups is homeowners. Homeowners needs include: a comfortable, safe, durable home, affordable energy bills, improvements completed within budget, timely service, and a trouble-free program experience.</p>
<p><b>2. Quality Objectives</b></p> <p><i>Tip: Quality objectives must be measureable and should be indicative of the goal you want to strive for, not your tolerance for failure.</i></p>	<p>In order for our program to successfully meet homeowners' needs our objectives are to deliver:</p> <ul style="list-style-type: none"> <li>• Zero-defect installation of measures</li> <li>• A documented net improvement in home performance as measured by test-in/test-out procedures for every home participating in the program</li> <li>• 100% customer satisfaction (zero complaints)</li> <li>• Excellent customer satisfaction ratings based on survey results</li> </ul>
<p><b>3. Roles and Responsibilities</b></p> <p><i>Tip: List how each department or person in the supply chain has a potential to impact the customer and design this list in terms of each person or group taking personal responsibility for meeting the Quality Objectives. Remember that some are less obvious than others.</i></p>	<p>The departments and people within our program who impact the homeowner's experience include all of the following. <i>[A few examples of each party's associated responsibilities are also listed.]</i></p> <ul style="list-style-type: none"> <li>• <u>Marketing</u>: sets the tone for the program, messaging must resonate with customers in a positive way, tactics must be effective...</li> <li>• <u>Customer service</u>: be polite and helpful, efficiently triage customer inquiries, accommodate scheduling needs of customer and contractors...</li> <li>• <u>Energy assessors and installation contractors</u>: make a good impression in terms of appearance, communication, punctuality, and behavior in the customer's home; conduct assessments efficiently; address both the customer's needs and desires; possess technical skills; ensure predicted results are achieved...</li> <li>• <u>Technical support</u>: ensure assessors and contractors are properly trained and equipped to carry out work, define technical requirements to meet both the customer's needs and the program's...</li> <li>• <u>IT</u>: provide systems that allow for seamless customer management, ensure uninterrupted phone and internet communications...</li> <li>• <u>Program management</u>: promote and support culture of self-directed accountability, ensure that program operations support quality objectives</li> </ul>
<p><b>4. Product Specifications</b></p> <p><i>Tip: Product specifications for HPwES programs will primarily cover measure installation specifications but could also include criteria related to customer service, documentation and reporting, or other program-related activities.</i></p>	<p>Industry standards such as DOE's Standard Work Specifications for Energy Professionals or BPI's technical standards may provide a basis for product specifications. Programs should develop their own customer service, energy assessment, and installation requirements with detailed specifications that can be used to verify compliance. <i>[A couple of examples follow.]</i></p> <ul style="list-style-type: none"> <li>• <u>Venting of Bathroom Exhaust Fans</u>: Prior to the installation of insulation in an attic space, all bathroom exhaust fans connected to the attic space shall be vented to outside via continuous, insulated metal or flex duct. This installation shall conform to the requirements set forth in the Workforce Guidelines for Energy Professionals Standard Work Specifications Sections 6.6002, 6.6003.1d, and 6.6003.1e.</li> <li>• <u>Customer Service In-Field</u>: The technician shall wear clean disposable booties over his or her shoes at all times when working in the occupied space of the home. Booties shall be removed prior to entering attics, basements, crawlspaces or other unfinished spaces of the building and when outside.</li> </ul>
<p><b>5. Operations and Implementation Process</b></p> <p><i>Tip: This is where it all starts to come together. You are building your QA Plan using the elements developed in the first 4 steps.</i></p>	<p>Describe the process and flow of work beginning with the first touch with the customer (QA Plan Element 1) and resulting in the final product. This is the supply chain. For each stage in the supply chain, identify who is responsible (QA Plan Element 3) and how the quality objectives (QA Plan Element 2) are being met using the criteria contained within the product specifications (QA Plan Element 4.)</p>

## 6. Quality Validation and Documentation

*Tip: Validation procedures occur in-process, during production, and should include not only measurement of outcomes but also validation that the product specifications were met throughout the process. If all of the technical specifications were met but the workers failed to put booties on making the customer unhappy, then the quality objectives have not been met.*

Using the operations and implementation process (QA Plan Element 5) describe the procedures that are to be used to verify compliance with the product specifications at each stage in the supply chain. [An example is below.]

A worker is required to measure air sealing results using a blower door and document not only the measured leakage rate, but also that the testing procedure was compliant with the product specifications (e.g. configuring the house, recording pressures and flows, etc.) and that the projected goal has been met. If the goal is not met (the house is leakier than predicted) it is the worker's responsibility to identify the cause and remedy the situation before completing the job (find the hole that was missed and seal it.) If the predicted leakage rate cannot be achieved after all other criteria for an air sealing job have been satisfied (all the holes have been sealed,) the worker is responsible for documenting the situation so it can be evaluated in terms of the complete process to determine the cause and develop a different kind of remedy (correct the methodology used to predict air leakage reduction from air sealing or retrain the energy assessors.)

## 7. Inspection and Testing

*Tip: The inspection and testing process is distinct from the quality validation process in that the people checking the data and work are third-parties to the work itself. These checks may occur in-process while work is being done, or post-installation. Use of automated data error detection and other analytics may also serve this function.*

Establish protocols for conducting quality control checks that are external to the regular production process. These protocols should include validity checks based on the criteria described in the product specifications (QA Plan Element 4) and be consistent with the quality validation procedures (QA Plan Element 6). Define who is responsible for conducting these inspections and tests, sampling rates, and frequency. Tests may include automated data checks, manual data reviews, and physical inspections. Documentation of errors and defects should be consistent with the quality validation procedures (QA Plan Element 6).

## 8. Feedback System

*Tip: This is a continuous improvement process.*

Establish procedures for reporting of results (from QA Plan Elements 6 and 7) back to the program; processing of non-conformities, errors, and defects to identify the root causes; and procedures for implementing and documenting solutions.

## 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 F](#).

## Contractor Feedback

Inspection results should be made available to the contractor(s) responsible for the work that was performed on the home. Feedback, both positive and negative, is a critical element of a successful quality assurance strategy to both document results and support continuous improvement for the individual contractors and the program overall. Additionally, many programs have successfully implemented merit-based reward systems for contractors demonstrating excellence in service, quality, and reporting. Reward systems include preferential listing in program materials or websites, preferred access to program generated leads, eligibility to by-pass third-party project approvals, or other means deemed appropriate and effective by the Sponsor.

### **Who's to Blame when Systems Fail?**

The purpose of a good quality assurance system is to ensure the program's success in meeting goals through a continuous review and improvement process. Product defects, deficiencies in service, failure to meet goals, and other non-conformities are most often caused by system failures, not individual failures. For a quality system to be effective, it is imperative that a feedback loop focused on root cause identification is in place. To make this work, all parties must feel that they can safely report errors (including their own) without fear of adverse repercussions. Error reporting should be considered a responsibility and part of the overall team effort to achieve zero-defect results. Zero-defect does not mean that problems never occur, it means they are detected before the final product is delivered to the customer, so when non-conformities are identified during production, they not only need to be resolved but also reported into the feedback system. This enables the program's QA team to identify the root cause in the system that led to the problem in production and fix it before it occurs again. While remedial and punitive actions are sometimes necessary, they should be reserved only for egregious and/or willful failure to comply with the program requirements. By establishing a blame-free work environment, programs can help ensure that systemic failures will be detected, reported, and remedied as quickly as possible.

### **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.

### **Metered Results**

Monitoring of metered energy consumption data is the only way to verify actual energy savings. Most programs have historically been limited in their ability to use this data across large residential customer populations. However, with the introduction of smart meters, easily accessible online consumption data, and improved technologies for managing big data sets, the landscape is rapidly changing. Actual pre/post-improvement billing data is currently used on a sampling basis in many evaluation, monitoring, and validation activities. With improved mechanisms for data capture and analysis over time, this type of monitoring is no longer limited only to small samples of customers. Sponsors with access to this type of data are encouraged to integrate actual metered data into their quality assurance processes to verify that predicted energy savings have been realized and to inform process improvements.

### **Third-Party QA Providers**

Some sponsors choose to employ independent third-party quality assurance providers directly or indirectly to satisfy DOE's QA requirement or to supplement sponsor-provided quality assurance. Third-party providers support regional or national networks to verify contractor compliance with program standards and report results to the Sponsor. While the fees associated with these services are typically incurred by the participating contractor, Sponsors may provide direct funding or incentives to offset this expense.

## Section 7: Tracking and Reporting

### Minimum Home Performance with ENERGY STAR Program Requirements Checklist: *Tracking and Reporting*

- 7.1** 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
- 7.2** 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 Home Performance with ENERGY STAR (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, inform enhancements to online tools and resources, and recognize achievements (e.g., ENERGY STAR Awards and Century Club Contractors). Furthermore, analysis of these data enable DOE to understand with better clarity the residential energy, improvement, and real estate markets so that it can provide timely and independent feedback back to those markets. 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

#### 7.1 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:** encompasses the complete work cycle in which HPwES services are provided to a customer for a specific household. For purposes of reporting data to DOE, 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:** A fully participating contractor that is enrolled and eligible to produce projects in the program; these participating contractors are eligible to have access to use of the Home Performance with ENERGY STAR mark and tools on My ENERGY STAR Account (MESA)
- **Inactive:** A participating contractor that is no longer participating in a local program. Inactive contractors may self-withdraw from participation and/or may become ineligible to participate due to non-compliance with program requirements or any other delisting at the Sponsor's discretion; inactive contractors are not eligible to use of the Home Performance with ENERGY STAR mark and tools on MESA.
- **Probation:** any interim status where a contractor may be in between Active and Inactive; a contractor under a probationary status may be producing work in the program but is not fully enrolled or is under observation.

The Quarterly Report Template is a simple and easy to use Microsoft Excel workbook. Retroactive adjustments are allowed only for the two preceding quarters. If it is necessary to make changes to older data, the Sponsors should contact their Account Manager.

## 7.2 Annual Report Requirements

Sponsors shall report to DOE no later than first quarter of each calendar year, or as requested by their Account Manager, whichever is earlier. 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

**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

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 detailed in [Section 2](#), submittal of Annual Reports will meet requirements for annual updates to a Sponsor's Implementation Plan. 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 HPwES program. There are commercially available tools for customer relationship management (CRM) and project tracking that can help Sponsors efficiently maintain data. In November 2013, BPI published the [BPI-2100-S-2013: Standard for Home Performance Related Data Transfer \(HPXML\) and BPI-2200-S-2013: Standard for Home Performance Related Data Collection](#). DOE encourages Sponsors and their contractor networks to review these documents and begin planning to integrate HPXML into their data exchanges with their local and national HP audiences. DOE expects compliance with these standards to reduce costs associated with data collection and transfer. As DOE continues to enhance the Program's reporting tools and templates, these standards will be referenced as appropriate.

### Special Requirements for Multifamily Buildings

In 2014, DOE will pilot data collection on HPwES projects completed in multifamily buildings. The reporting requirements for multifamily 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 the *Sponsor Guide*. Additionally, whole building projects must report the number of dwelling units impacted by the project.

Several initiatives related to the collection, aggregation, and analysis of energy efficiency program and project data on a national level are underway within DOE. These projects will help make building performance more visible to enable improved operations and efficient energy management and drive rational investment through increased confidence in energy savings results achieved through energy efficiency actions.

Three DOE initiatives to standardize building energy efficiency data management include:

- **Building Energy Data Exchange Specification (BEDES):** a commercial and residential building energy performance data specification that provides a common data format, definitions, and an exchange protocol for building characteristics, efficiency measures and energy use.
- **Standard Energy Efficiency Data (SEED):** a software tool that provides a standardized format for collecting, storing and analyzing large portfolios of building energy performance information. The platform provides an

easy, flexible, and cost-effective method to analyze data about large portfolios of buildings and demonstrate the economic and environmental benefits of energy efficiency.

- **Buildings Performance Database (BPD):** a platform that enables users to perform statistical analysis on large anonymous dataset of commercial and residential buildings from across the country. Users can compare performance trends among similar buildings to identify and prioritize cost-saving energy efficiency improvements and assess the range of likely savings.

Industry stakeholders are currently exploring methods of using data for a wide variety of potential end uses including: validation of energy savings predictive models, program performance benchmarking, contractor performance evaluation, and providing a basis for energy savings guarantees.

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## Glossary of Terms Used in the Sponsor Guide

*The following definitions are intended to clarify the intent of the content of the Sponsor Guide. These definitions are not intended to redefine any specific terms within any other context.*

**Certificates** – Documents the improvements, as well as the organizations and companies involved in the home performance project offered by the HPwES Sponsor. Certificates can offer the homeowner proof that energy improvements have been made to their home – which may contribute to improving the house’s future re-sale value.

**Contractor** – any an organization or 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 might 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 time rate of energy flow. It is the requirement for energy consumption of energy source(s) by an energy using system at a given instant or averaged over any designated interval of time. Demand usually refers to the amount of electric energy used by a customer or piece of equipment at a specific time, expressed in kilowatts (kW equals kWh/h) but can also refer to natural gas use at a point in time, usually as Btu/hr, kBtu/hr, therms/day, or cubic feet per day (ccf/day). (Source: [SEE Action Energy Impact Evaluation Guide](#)<sup>xxiii</sup>).

**Direct install** – Improvement measures installed under an energy efficiency program design strategy involving the direct installation of measures in customer premises by a contractor hired by the program at no cost to the customer. 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).

**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: Quality Assurance).

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

**Home Performance with ENERGY STAR Implementation Plan** – the Sponsor’s documented plan for start-up and on-going implementation of a Home Performance with ENERGY STAR program including documentation of the required program design elements as described in the *Sponsor Guide* ([Section 2: Program Design and Development](#)). 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. For purposes of reporting data to DOE, 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.

**HPXML** – The industry term for [BPI-2100-S-2013 Standard for Home Performance –Related Data Transfer](#)<sup>xxiv</sup>. BPI-2100 is designed to facilitate communication and the exchange of information and data among all actors in the home performance industry by providing an extensible markup language (XML) standard for transferring information related to whole house energy efficiency upgrades. The standard is informally known as Home Performance XML, or HPXML.

**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.

**Independent third-party QA program** – a quality assurance program that is external to the HPwES program and the Sponsor. Sponsors might pay for independent third-party QA services but do not influence the QA process implemented by the QA provider. Examples are organizations offering QA specialized services at the contractor level, including BPI’s Contractor Accreditation, RESNET’s EnergySmart Contractor, and ACCA’s Quality Assured programs.

**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.

**Participating Contractor Status** – A drop-down menu on the Quarterly Report Template with the following options for Sponsors to indicate each quarter:

- **Active:** A fully participating contractor that is enrolled and eligible to produce projects in the program; these participating contractors are eligible to have access to use of the Home Performance with ENERGY STAR mark and tools on My ENERGY STAR Account (MESA).
- **Inactive:** A participating contractor that is no longer participating in a local program. Inactive contractors may self-withdraw from participation and/or may become ineligible to participate due to non-compliance with program requirements or any other delisting at the Sponsor’s discretion; inactive contractors are not eligible to use of the Home Performance with ENERGY STAR mark and tools on MESA.
- **Probation:** any interim status where a contractor may be in between Active and Inactive; a contractor under a probationary status may be producing work in the program but is not fully enrolled or is under observation.

**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 Workers (or qualified staff)** – 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 detect and verify 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 HPwES programs include utilities, state energy offices, municipal governments, nonprofit 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.

**Tiered Inspection Rates** – When Sponsors 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.

## 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
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc.
BEDES	Building Energy Data Exchange Specification
BPD	Building Performance Database
BPI	Building Performance Institute
CEUs	continuing education credits
CPA	Contractor Participation Agreement
CRM	customer relationship management system
CSPM	California Standard Practice Manual
DHW	domestic hot water
DIY	Do-it-yourself
DOE	U.S. Department of Energy
DSM	demand side management
EEBA	Environmental and Energy Building Alliance
EM&V	evaluation, measurement and verification
EPA	U.S. Environmental Protection Agency
FHA	Federal Housing Authority
HERS	Home Energy Rating System
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
IREC	International Renewable Energy Council
ISP	Institute for Sustainable Power
JTAs	job task analyses
MESA	My Energy Star Account
MLS	Multiple Listing Service
NAR	National Association of Realtors
NASEO	National Association of State Energy Offices
NATE	North American Technician Excellence
NCI	National Comfort Institute
NEEP	Northeast Energy Efficiency Partnerships
NHPC	National Home Performance Council
O&M	operations and maintenance



QA	quality assurance
QA/QC	quality assurance/quality control
QC	quality control
RESNET	Residential Energy Services Network
ROI	return on investment
SEED	Standard Energy Efficiency Data
SEER	seasonal energy efficiency ratio
SIR	savings to investment ratio
SOW	scope of work
SWS	Standard Workforce Specifications
TRC	total resource cost
UMP	Uniform Methods Project
WAP	Weatherization Assistance Program
WHEEL	Warehouse for Energy Efficient Loans
WTC	Weatherization Training Centers
XML	extensible markup language

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# Appendices

- A. **Minimum Requirements Checklist Worksheet - Normative**
- B. **Home Performance with ENERGY STAR Partner Agreement - Normative**
- C. **Home Performance with ENERGY STAR Implementation Plan Template - Normative**
- D. **The Guidelines for Home Energy Professionals - Informative**
- E. **Energy Savings Calculations - Informative**
- F. **Quality Management System (QMS) Based Quality Assurance Overview - Informative**

# Appendix A

## Minimum Requirements Checklist Worksheet – Normative

### Minimum Home Performance with ENERGY STAR Program Requirements Checklist: Use and Management of the Home Performance with ENERGY STAR Mark

1.1 Comply with current *ENERGY STAR Brand Book*

Status:  Yes  
 No

Notes:

1.2 Maintain a list of authorized representatives, including participating contractors, who may use the brand and mark in compliance with the *ENERGY STAR Brand Book*

Status:  Yes  
 No

Notes:

1.3 Use the Home Performance with ENERGY STAR name and mark to inform homeowners that services being rendered by participating contractors under the Sponsor’s program follow the HPwES approach

Status:  Yes  
 No

Notes:

1.4 Establish a process to ensure your business partners and participating contractors comply with the *ENERGY STAR Brand Book*

Status:  Yes  
 No

Notes:

1.5 Send marketing materials, including web designs, to your HPwES Account Manager for compliance review; HPwES Account Managers require a minimum of five business days to review materials

Status:  Yes  
 No

Notes:

1.6 Provide training about the value and minimum requirements of HPwES to all employees who provide customer service

Status:  Yes  
 No

Notes:

**1.7** Notify your HPwES Account Manager of any change in the designated responsible party or contacts for the Sponsor's program

**Status:**  *Yes*  
 *No*

**Notes:**

**Minimum Home Performance with ENERGY STAR Program Requirements Checklist:**  
*Program Design and Development*

**2.1** Review and sign a Home Performance with ENERGY STAR Partnership Agreement

**Status:**  *Yes*  
 *No*

**Notes:**

**2.2** Complete and annually update a Home Performance with ENERGY STAR Implementation Plan

**Status:**  *Yes*  
 *No*

**Notes:**

**2.3** Provide quarterly and annual data on the status of Home Performance with ENERGY STAR Program implementation

**Status:**  *Yes*  
 *No*

**Notes:**

**Minimum Home Performance with ENERGY STAR Program Requirements Checklist:**  
*Workforce Development and Support*

**3.1** Develop a contractor engagement plan

- Assess the market to identify the target contractor base
- Define required certifications and credentials
- Enable contractor access to required diagnostic equipment and software tools

**Status:**  *Yes*  
 *No*

**Notes:**

**3.2 Establish minimum qualifying criteria for participating contractors including:**

- Training and credentialing requirements
- Certification of supervisory staff
- Capacity and resources to provide program related services
- Compliance with local registration and licensing requirements
- Access to qualified installation crews and/or sub-contractors

**Status:**  **Yes**  
 **No**

**Notes:**

**3.3 Provide a program orientation:**

- Conduct contractor training providing an overview of program goals and policies and procedures as they pertain to the participating contractors
- Provide training on basic principles of building science and the house-as-a-system approach to all employees of the Sponsor, its implementation vendor, and other program staff who interact with customers

**Status:**  **Yes**  
 **No**

**Notes:**

**3.4 Ensure availability in the local market of home performance skills training (technical, software, sales, business development, installations, etc.) for participating contractors**

**Status:**  **Yes**  
 **No**

**Notes:**

**3.5 Provide technical support for participating contractors and energy advisors**

**Status:**  **Yes**  
 **No**

**Notes:**

**3.6 Develop and execute a Contractor Participation Agreement (CPA) including:**

- Explanation of the agreement
- Participating contractor commitments
- Marketing and advertising guidelines, particularly with regard to use of the Home Performance with ENERGY STAR name and mark
- Business Practices
- Qualifications and credentials
- Terms and conditions pertaining to termination

**Status:**  **Yes**  
 **No**

**Notes:**

## Minimum Home Performance with ENERGY STAR Program Requirements Checklist:

### The Assessment

**4.1** Develop and require a Home Performance Assessment (HPA) for each HPwES project, which ensures 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
- Minimum diagnostic tests
- Data collection of building assemblies and mechanical systems

**Status:**  **Yes**

**Notes:**

**No**

**4.2** Develop and require a Home Performance Assessment (HPA) Summary Report for each HPwES project, which includes at a minimum:

- General information
- Existing conditions
- Prioritized list of recommended improvements (the proposed improvement measures)
- Notice of health and safety related issues
- Savings projections (estimated, modeled, or calculated)

**Status:**  **Yes**

**Notes:**

**No**

## Minimum Home Performance with ENERGY STAR Program Requirements Checklist

### The Project Installation

**5.1** 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
- Ventilation shall be installed as prescribed by industry-accepted standards whenever the home's air exchange rate is determined to be below the required air exchange rate for good indoor air quality as determined by the referenced standard(s).
- Materials and installation techniques used shall be consistent with a building science-based approach
- Installations shall be completed by qualified workers

**Status:**  **Yes**

**Notes:**

**No**

**5.2** 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

**Status:**  **Yes**  
 **No**

**Notes:**

**Minimum Home Performance with ENERGY STAR Program Requirements Checklist:**  
*Quality Assurance*

**6.1** Ensure program and contractor compliance with the ENERGY STAR Brand Book

**Status:**  **Yes**  
 **No**

**Notes:**

**6.2** Ensure that a signed contractor participation agreement (CPA) includes requirements for compliance with the Sponsor's QA system

**Status:**  **Yes**  
 **No**

**Notes:**

**6.3** Implement a mechanism for customer feedback

**Status:**  **Yes**  
 **No**

**Notes:**

**6.4** Institute a conflict resolution procedure to address problems identified through Quality Assurance/Quality Control (QA/QC) activities and customer feedback.

**Status:**  **Yes**  
 **No**

**Notes:**

**6.5** Implement on-site inspection procedures and maintain records on quality control activities relating to the participating contractors including:

- Inspection sampling rate
- Inspection findings
- Corrective actions, including process improvements resulting from Quality Control activities

**Status:**  **Yes**  
 **No**

**Notes:**

**6.6 Establish and implement procedures for due process and remedial actions**

**Status:**  **Yes**  
 **No**

**Notes:**

**6.7 Implement one of the following two options:****6.7.1 OPTION 1: Meet minimum requirements for Quality Control****6.7.2 OPTION 2: Implement a Quality Management System**

**Status:**  **Yes**  
 **No**

**Notes:**


### Minimum Home Performance with ENERGY STAR Program Requirements Checklist: *Tracking and Reporting*

**7.1 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

**Status:**  **Yes**  
 **No**

**Notes:**

**7.2 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

**Status:**  **Yes**  
 **No**

**Notes:**



## Appendix B

### Home Performance with ENERGY STAR Partner Agreement – Normative

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## ENERGY STAR Program Requirements for Home Performance with ENERGY STAR Sponsors

### Eligible Organizations:

Utilities; national, regional, state, or local government entities; or other organizations involved in coordinating and/or administering an energy-efficiency program or environmental education campaign that promotes or intends to promote ENERGY STAR qualified products, homes, Home Performance with ENERGY STAR and/or buildings.

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### Commitment

The following are the terms of the ENERGY STAR Partnership Agreement as it pertains to Home Performance with ENERGY STAR (HPwES) Program Sponsors. All Sponsor requirements can be found in the *Sponsor Guide and Reference Manual (v1.5)*.

**ENERGY STAR and HPwES Brand Requirements:** The Sponsor agrees to comply with ENERGY STAR and HPwES branding requirements as follows:

### Minimum Home Performance with ENERGY STAR Program Requirements Checklist:

#### I. Use and Management of the Home Performance with ENERGY STAR Mark

- 1.1 Comply with current *ENERGY STAR Brand Book*
- 1.2 Maintain a list of authorized representatives, including participating contractors, who may use the brand and mark in compliance with the *ENERGY STAR Brand Book*
- 1.3 Use the Home Performance with ENERGY STAR name and mark to inform homeowners that services being rendered by participating contractors under the Sponsor's program follow the HPwES approach
- 1.4 Establish a process to ensure your business partners and participating contractors comply with the *ENERGY STAR Brand Book*
- 1.5 Send marketing materials, including web designs, to your HPwES Account Manager for compliance review; HPwES Account Managers require a minimum of five business days to review materials
- 1.6 Provide training about the value and minimum requirements of HPwES to all employees who provide customer service

- 1.7 Notify your HPwES Account Manager of any change in the designated responsible party or contacts for the Sponsor's program

## **II. Program Design and Development**

- 2.1 Review and sign a Home Performance with ENERGY STAR Partnership Agreement
- 2.2 Complete and annually update a Home Performance with ENERGY STAR Implementation Plan
- 2.3 Provide quarterly and annual data on the status of Home Performance with ENERGY STAR Program implementation

## **III. Workforce Development and Support**

- 3.1 Develop a contractor engagement plan
  - Assess the market to identify the target contractor base
  - Define required certifications and credentials
  - Contractor access to required diagnostic equipment and software tools
- 3.2 Establish minimum qualifying criteria for participating contractors including:
  - Training and credentialing requirements
  - Certification of supervisory staff
  - Capacity and resources to provide program related services
  - Compliance with local registration and licensing requirements
  - Access to qualified installation crews and/or sub-contractors
- 3.3 Provide a program orientation:
  - Conduct contractor training providing an overview of program goals and policies and procedures as they pertain to the participating contractors
  - Provide training on basic principles of building science and the house-as-a-system approach to all employees of the Sponsor, its implementation vendor, and other program staff who interact with customers
- 3.4 Ensure availability in the local market of home performance skills training (technical, software, sales, business development, installations, etc.) for participating contractors
- 3.5 Provide technical support for participating contractors and energy advisors
- 3.6 Develop and execute a Contractor Participation Agreement (CPA)
  - Explanation of agreement
  - Participating contractor commitments
  - Marketing and advertising guidelines, particularly with regard to use of the Home Performance with ENERGY STAR name and mark
  - Business Practices
  - Qualifications and credentials
  - Terms and conditions pertaining to termination

## **IV. The Assessment**

- 4.1 Develop and require a Home Performance Assessment (HPA) for each HPwES project, which ensures 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
- Minimum diagnostic tests
- Data collection of building assemblies and mechanical systems

4.2 Develop and require a Home Performance Assessment (HPA) Summary Report for each HPwES project, which includes at a minimum:

- General information
- Existing conditions
- Prioritized list of recommended improvements (the proposed improvement measures)
- Notice of health and safety related issues
- Savings projections (estimated, modeled, or calculated)

## **V. The Project Installation**

5.1 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
- Ventilation shall be installed as prescribed by industry-accepted standards whenever the home's air exchange rate is determined to be below the required air exchange rate for good indoor air quality as determined by the referenced standard(s).
- Materials and installation techniques used shall be consistent with a building science-based approach
- Installations shall be completed by qualified workers

5.2 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

## **VI. Quality Assurance**

6.1 Ensure program and contractor compliance with the ENERGY STAR Brand Book

6.2 Ensure that a signed contractor participation agreement (CPA) includes requirements for compliance with the Sponsor's QA system

6.3 Implement a mechanism for customer feedback

6.4 Institute a conflict resolution procedure to address problems identified through Quality Assurance/Quality Control (QA/QC) activities and customer feedback.

6.5 Implement on-site inspection procedures and maintain records on quality control activities relating to the participating contractors including:

- Inspection sampling rate

- Inspection findings
- Corrective actions, including process improvements resulting from Quality Control activities

6.6 Establish and implement procedures for due process and remedial actions

6.7 Implement one of the following two options:

6.7.1 OPTION 1: Meet minimum requirements for Quality Control

6.7.2 OPTION 2: Implement a Quality Management System

## **VII. Tracking and Reporting**

7.1 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

7.2 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

## Appendix C

### Home Performance with ENERGY STAR Implementation Plan Template – Normative

# Home Performance with ENERGY STAR Implementation Plan Template for Prospective Program Sponsors



Home Performance with ENERGY STAR® (HPwES) is a public-private voluntary partnership program designed 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 enhance home performance for healthier and more comfortable living environments, enhanced durability of the homes’ structures and systems, and improved energy savings for the homeowners.

Home Performance with ENERGY STAR, like all ENERGY STAR programs, facilitates market transformation by increasing the availability and adoption of energy-efficient goods and services. HPwES is based on the nationally recognized ENERGY STAR brand and is grounded in a building science driven approach to home improvement 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 HPwES projects and related services.

Eligible organizations include: Utilities; national, regional, state, or local government entities; or other organizations involved in coordinating and/or administering an energy-efficiency program or environmental education campaign that promotes or intends to promote ENERGY STAR qualified products, homes, Home Performance with ENERGY STAR and/or buildings.

Interested organizations must use this Sponsor Implementation Plan Template to outline your proposed Home Performance with ENERGY STAR program. Review the *Sponsor Guide and Reference Manual (v1.5)* for detailed Program requirements that must be incorporated into your program design. Use Appendix A—the Minimum Requirements Checklist Worksheet as a quick reference to help complete Sponsor Implementation Plan Template.

Please allow HPwES two weeks to review your plan. Once reviewed, HPwES will contact you to discuss your plan with you. Once your plan is approved you will be listed on the HPwES website and receive an email with My Energy Star Account (MESA) instructions to access our in-kind supporting material. DOE reserves the right to decline sponsorship if there are inadequate resources and planning to initiate a HPwES program, and will advise you as to what needs to be addressed.

Please complete and submit the Sponsor Implementation Plan Template to [homeperformance@energystar.gov](mailto:homeperformance@energystar.gov).

## I. GENERAL PROGRAM AND CONTACT INFORMATION

Sponsor Candidate Organization Information: Fill information about your organization and support team.	
Sponsor Candidate’s Official Organization Name(s)	
Program Name (i.e., public name associated with HPwES platform). Note: program name will be listed on the <a href="http://energystar.com/hpwes">energystar.com/hpwes</a> “Connect” map.	
Implementation Vendor Name(s) <i>(If applicable)</i>	
Program Administrator Type <i>(Identify the type of organization that best describes your organization.)</i>	
Sponsor Candidate’s Mailing Address	Address Line 1
	Address Line 2
	City
	State
Implementation Vendor’s Mailing Address <i>(If applicable)</i>	Implementation Vendor
	Address Line 1
	Address Line 2

		City		
		State	Zip	
<b>Contact Information (list all that apply)</b>				
1st Administrative POC	First name		Last name	
	Email		Phone	
2nd Administrative POC	First name		Last name	
	Email		Phone	
Implementation POC	First name		Last name	
	Email		Phone	
Reporting/Data POC	First name		Last name	
	Email		Phone	
Marketing POC	First name		Last name	
	Email		Phone	
Quality Assurance POC	First name		Last name	
	Email		Phone	
In reference to the POCs listed above, please indicate the HPwES program's primary POC.				
<b>Program Background: Provide information about your proposed program.</b>				
1. Provide a brief description of your HPwES program, its intent and value for your target market. DOE may use the text you provide for publication in your Sponsor Profile on websites and presentations.				
2. Provide a list of your implementation partners, such as organizations affiliated and/or supporting the local program, including co-marketing partners and organizations your program will authorize to use the HPwES logo. Partner A: _____ Partner B: _____ Partner C: _____ Partner D: _____				
3. What elements of the program will be implemented by the program sponsor or implementation partners				
	Partner A	Partner B	Partner C	Partner D
<b>Contractor Recruitment</b>				
<b>Contractor Training</b>				
<b>Contractor Certification</b>				
<b>Contractor Mentoring</b>				
<b>Consumer Incentives/ Financing</b>				
<b>Consumer Awareness/ Marketing</b>				
<b>Quality Assurance</b>				
<b>Program Evaluation</b>				
<b>Other:</b>				

4. Provide a URL for your planned HPwES program website (Note: This URL will be listed on the energystar.gov/hpwes “Connect” map) *The URL can be provided during the onboarding process after Sponsorship approval.*

5. What geographical area(s) will be targeted by the HPwES program? (Indicate state, counties, cities, towns, and/or zip codes)

6. Provide information on the current and/or past residential energy efficiency programs that have been implemented in this market, from which your program will be building. Please indicate whether the program(s) target electric, gas, and/or oil savings.

7. What is the estimated number of targeted homeowners (i.e. potential customers) in your market?

## II. HPwES PROGRAM BUDGET AND GOALS

For additional information, please reference Section 2 in the *Sponsor Guide and Reference Manual (v1.5)*.

8. What is the estimated annual program budget planned for each of the following categories?					
	Year 1	Year 2	Year 3	Year 4	Year 5
<b>Program Administration</b>					
Marketing, Outreach, and Customer Acquisition	\$	\$	\$	\$	\$
Program Administration	\$	\$	\$	\$	\$
Quality Assurance	\$	\$	\$	\$	\$
Research & Evaluation	\$	\$	\$	\$	\$
<b>Customer Incentives</b>					
Costs of Direct Install Measures	\$	\$	\$	\$	\$
Other Customer Incentives & Rebates	\$	\$	\$	\$	\$
Customer Financing Costs	\$	\$	\$	\$	\$
<b>Contractor Incentives</b>					
Contractor Training & Certification	\$	\$	\$	\$	\$
Contractor Production/Reporting Incentives	\$	\$	\$	\$	\$
Contractor Equipment Incentives and other Business Development Support	\$	\$	\$	\$	\$
<b>Total</b>	<b>\$</b>	<b>\$</b>	<b>\$</b>	<b>\$</b>	<b>\$</b>
<b>Goals</b>					
Number of participating contractors					
Number of HPwES assessments					
Number of completed HPwES projects					
% energy saved per completed HPwES project					
Gross annual revenue (\$)					
Gross site energy savings (MMBtu)					



<p>9. What are your program's top three funding sources?  <i>(Hold down the control key to select multiple options.)</i></p>	
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### III. HPwES PROGRAM DESIGN

For additional information and program requirements, please reference Section 2 in the *Sponsor Guide and Reference Manual (v1.5)*.

10. What is your schedule for implementing the program?																				
Activity	Year 1				Year 2				Year 3				Year 4				Year 5			
	Quarter				Quarter				Quarter				Quarter				Quarter			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Identify/recruit contractors																				
Train/equip contractors																				
Execute marketing campaign																				
Implement quality assurance protocols																				
Implement project tracking																				
Explore program expansion																				
Program evaluation																				
11. How will energy savings be estimated at the project level?																				
12. Will your program track pre and post project-level energy consumption data to verify energy savings?																				
13. Will your program focus on single family housing, multifamily housing, or both?																				
14. What type of homeowner incentives will your program offer? <i>(Select all that apply. Hold down the control key to select multiple options.)</i>																				

15. If you offer financing, what type(s) of lending products will be offered? Please provide information on rates and terms.	
16. What type of credit enhancements or financing buy downs will your program offer to customers?	
17. What type of mid-stream (e.g., targeting contractors, suppliers, etc.) incentives will your program offer? <i>(Select all that apply. Hold down the control key to select multiple options.)</i>	
18. What direct install measures will your program offer? <i>(Select all that apply. Hold down the control key to select multiple options.)</i>	
19. Will your program require fixed and/or capped measure pricing for measures paid for by customers?	
20. Is the program regulated by a public utility commission? If so, how long is your program filing cycle? (Example: 1 year, 3 years or 5 years)	

#### IV. WORKFORCE

For additional information and program requirements, please reference Section 3 in the *Sponsor Guide and Reference Manual (v1.5)*.

*Please attach these documents:*

- *Copy of your contractor participation agreement*
- *Process diagram showing how contractors that fail to meet program standards will be identified, monitored, re-trained, sanctioned, or removed from the program*

21. Describe the qualifying criteria and enrollment process for participating contractors in your program. Please also explain how you plan to recruit contractors to participate in the program.
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22. Which credentials will be required for participating contractors? Please include specialty credentials if your program requires them for certain measure installations or working on certain building types.

23. Describe how the program will evaluate the performance of participating contractors in terms of QA results, productivity, energy savings achieved, customer satisfaction, etc. Include a brief description of any contractor rating or scoring system(s) the program plans to use.

24. Describe how the program will provide feedback to contractors regarding their performance including both the type and frequency of reporting to the contractors.

25. What type of training(s) will be provided or made accessible to your contractors? *(Please explain if you plan to offer home performance sales training)*

## V. QUALITY ASSURANCE

For additional information and program requirements, please reference Section 6 in the *Sponsor Guide and Reference Manual (v1.5)*.

*Please attach a copy of your plan for managing consumer inquiries about the program (e.g., workflow to handle calls and emails).*

*Please attach a copy of your Quality Assurance Plan (Option 1 or Option 2)*

26. Which quality assurance system will you administer? <i>(Please refer to Section 6 of the <a href="#">Sponsor Guide and Reference Manual</a> for descriptions of options 1 and 2.)</i>	
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## VI. MARKETING AND CUSTOMER OUTREACH

For additional information and program requirements, please reference Sections 1 and 2 in the *Sponsor Guide and Reference Manual (v1.5)*.

*Attach examples you plan to use, if developed.*

27. Describe how the Home Performance with ENERGY STAR name and mark will be used and monitored in your program marketing efforts and strategies?	
28. Will the program offer Certificate of Efficiency Improvements or Certificates of Performance to homeowners upon completion of a HPwES Project? ( <i>Please see the <a href="#">Sponsor Guide and Reference Manual</a> for a definition.</i> )	If yes, please explain:

THANK YOU!

Please complete and submit the Sponsor Implementation Plan Template to [homeperformance@energystar.gov](mailto:homeperformance@energystar.gov).

## Appendix D

### The Guidelines for Home Energy Professionals – Informative

The *Guidelines for Home Energy Professionals* is a suite of resources developed by DOE’s Weatherization Assistance Program (WAP) and the National Renewable Energy Laboratory in collaboration with the home performance industry. The resources include work quality specifications, a training program accreditation process, and job task analyses for worker certifications. While HPwES Sponsors are not currently required to adhere to these specifications in their programs, Sponsors are encouraged to use this set of tools as a reference and resource when designing program technical specifications and worker qualification criteria.

#### 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. While developed with WAP in mind, these products are closely aligned with the needs of a well-designed HPwES program as well.

#### 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 provide the industry with a uniform way to ensure that all workers are trained and have the knowledge skills and abilities to do the work right. The Job Task Analyses (JTA) for the four major energy upgrade job classifications identified by WAP 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 with a mechanism for ensuring that employees are capable of meeting the expectations of a national industry. Four new Home Energy Professional worker certifications are aligned with the other Guidelines efforts and target a worker’s capacity to demonstrate practical ability to perform the work of the industry.

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## The Details

### The Standard Work Specifications

Taken at its most basic level, a home energy upgrade 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 the installation 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 uniform national industry. They provide a foundation for training and the development of best practice guides. They also provide a consistent 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](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#jta](http://www1.eere.energy.gov/wip/guidelines_accredited_training.html#jta)

### 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](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 be the first to deliver the four new professional certifications to the weatherization network and the greater home performance marketplace. The certification blueprints are also available to other qualified certifying bodies.

For further information, please visit:

[http://www1.eere.energy.gov/wip/guidelines\\_certifications.html](http://www1.eere.energy.gov/wip/guidelines_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 E

## Energy Savings Calculations – Informative

### 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. While the following discussion addresses cost-effectiveness from the program administrator’s perspective in terms of energy savings, to capture all potential benefits of HPwES program designs should offer mechanisms that both allow and encourage each stakeholder to invest in HPwES projects based on their own perceived value.

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 Energy<sup>11</sup> has defined deemed savings in the following way:

**Deemed Savings Calculation:** An agreed to (stipulated) engineering algorithm(s) used to calculate the energy and/or demand savings associated with an installed energy efficiency measure. These calculations are developed from common practice that is widely considered acceptable for the subject measure and its specific application. It may include stipulated assumptions for one or more parameters in the algorithm, but typically it requires users to input data associated with the actual installed measure into the algorithm(s).

<sup>11</sup> “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](http://www1.eere.energy.gov/seeaction/pdfs/emv_ee_program_impact_guide.pdf)



**Deemed Savings Value:** An estimate of 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. Program Sponsors without access to their own EM&V data may elect to use the data and/or algorithms derived from data obtained through another state or region and tailor those existing databases to reflect conditions for their own climate, retrofit techniques, housing stock, and typical energy consumption in their jurisdictions. For example, the Northeast Energy Efficiency Partnerships (NEEP) has developed a technical reference manual<sup>12</sup> articulating a standardized methodology for calculating deemed measure savings for the entire Mid-Atlantic region. This manual is then used as a basis for deemed savings calculations in multiple states, each with their own level of customization applied to the methodology.

#### **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 amounts available
- Utilities and other entities to have clear “rules of the game”
- A perceived level playing field for a public utility 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 do-it-yourself (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

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<sup>12</sup> Northeast Energy Efficiency Partnerships, “Mid-Atlantic Technical Reference Manual, Version 2.0”, July 2011

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, published by DOE, is a list of available software tools covering a wide variety of applications and can be found at: [http://apps1.eere.energy.gov/buildings/tools\\_directory/subjects\\_sub.cfm](http://apps1.eere.energy.gov/buildings/tools_directory/subjects_sub.cfm)

### Advantages of Modeled Savings:

- Allows for flexibility and customization of measures
- Enables the creation of custom improvement packages specific to each home and project
- Enables the predicted savings to take interactivity of measures into account
- May enable the predicted energy savings to be calibrated or “trued up” to align with the historical energy consumption for the home (depending on the software tool used)
- Calculates cost-benefit analysis from the customer's perspective, which can be helpful for customer education and closing the sale
- Most energy modeling tools offer reporting capability and templates that can be used to make customer presentations, generate bid sheets, populate contracts, etc.
- Data from project files can be uploaded to central databases at the contractor and program level, allowing for detailed project tracking and analysis
- Can be linked to share data with Customer Relationship Management (CRM) tools enabling seamless project tracking and management.

### Disadvantages of modeled savings:

- Can require a significant investment on the part of the program and contractor in training and working through the initial learning curve for using the selected software tool correctly
- Can represent a significant on-going expense to the program and/or contractor in software licensing and use fees
- Can add significant time to the energy assessment process (depending on the software tool and how it is used)
- Does not calculate cost-effectiveness from the program's perspective
- Relies on accurate data inputs, leaving control over many of these inputs out of the hands of the Program Sponsor.

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 required input data (e.g. SEER rating)

- Volume of data points needed to complete a simulation
- Cost and who pays software licensing and use fees (will contractors be required to pay for 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.

- Homeowner “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 HVAC units)
- 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<sup>13</sup>.

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

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<sup>13</sup> ANSI/BPI-2400-S-2012 Standard Practice for Standardized Qualification of Whole-House Energy Savings Predictions by Calibration to Energy Use History (The Delta Standard) provides guidance for calibrating whole house energy models ([http://www.bpi.org/tools\\_downloads.aspx?selectedTypeID=1&selectedID=115](http://www.bpi.org/tools_downloads.aspx?selectedTypeID=1&selectedID=115)).

modeling outputs. However, Sponsors may also want to investigate how actual energy usage (post-installation) could be used to motivate homeowners. Creative strategies designed to influence customer behavior may be pursued using advanced metering, online utility data tracking (Green Button or other third-party service), on-bill financing, etc.

The *Guidelines for Home Energy Professionals* is a suite of resources developed by the Department of Energy's Weatherization Assistance Program (WAP) 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. While Home Performance with ENERGY STAR (HPwES) Sponsors are not currently required to adhere these specifications in their programs, Sponsors are encouraged to use these references as a resource when designing program technical specifications and worker qualification criteria.

## Appendix F

### Quality Management System-Based Quality Assurance Overview – Informative

The quality management system (QMS) approach is based on four fundamental principles<sup>14</sup>:

1. Quality is defined as conformance to the requirements
2. Prevention is the only effective means to achieve quality
3. Performance standards must be specific
4. The cost of non-conformance must be quantified to value quality.

To better understand how these concepts apply to Home Performance with ENERGY STAR (HPwES), the following chart takes each of the basic principles and breaks them down into a set of underlying concepts that are directly related to HPwES. To better illustrate what this means for a HPwES Sponsor, the set of steps a HPwES Sponsor might take to achieve these goals is also provided. A step-by-step example of how to apply these principles to develop a quality assurance (QA) Plan is provided in Section 6: Quality Assurance.

#### QMS Principle 1: Quality is defined as conformance to the requirements

##### Concepts related to HPwES:

- Industry creates technical standards
- Gov't and Regulatory bodies set goals and measurement criteria
- HPwES Sponsors establish program rules
- Contractors develop and apply internal work specifications
- Customers define their own terms for satisfaction

##### Steps for HPwES Sponsors:

1. Define measure, project, and program criteria based on all customer needs (consumers, contractors, regulators, etc.) – *for example, DOE's Standard Workforce Specifications could provide a basis*
2. Ensure that all players (program and contractor staff) adopt processes for meeting the criteria within the context of their own work (management, customer service, auditors, installers, etc.)

#### QMS Principle 2: Prevention is the only effective means to achieve quality

##### Concepts related to HPwES:

- Inspections verify conformance but don't improve quality
- Repairs, re-inspections, and retraining are costly
- Reinforcing individual accountability minimizes defects before they occur
- Prevention is achievable if the process is understandable

##### Steps for HPwES Sponsors:

1. Ensure that all players are trained to provide services that conform to the criteria
2. Execute processes to ensure detection of defects as the work is being done (e.g., require documentation of proper performance of installed measures before the crew leaves the home)

<sup>14</sup> Adapted from Crosby, P.; *Quality Without Tears*; 1984 McGraw-Hill, Inc.

**QMS Principle 3: Performance standards must be specific**

**Concepts related to HPwES:**

- Allowing for failure tolerances promotes the idea that “good enough” should be considered acceptable practice
- Zero-defect happens only when every player takes personal responsibility for their work
- Checks at the time work is being done allow for defects to be detected and repaired before the job is complete
- Documentation and non-conformance reports should inform process improvements

**Steps for HPwES Sponsors:**

1. Require documentation of conformance to the criteria before the project is closed
2. Establish blame-free processes for reporting non-conformancies detected and repaired in-process to inform systemic improvements
3. Use data to detect gaming or other patterns suggesting non-conformance (*HPXML, BEDES could help*)
4. Establish standardized (e.g. annual) QA audits for experienced contractors, invoking external quality control (QC) inspections only on a limited basis

**QMS Principle 4: The cost of non-conformance must be quantified to value quality**

**Concepts related to HPwES:**

- The cost of a QC-based approach is high and might not improve performance over time
- Post-inspection repairs are costly to the program and the customer
- Undetected defects can negatively impact customer satisfaction and realization rates, or cause other missed metrics
- Integrated QMS costs money to establish but reduces all defects over time

**Steps for HPwES Sponsors:**

1. Establish systems to track and quantify results
2. Quantify the cost of inspections AND repairs for detected defects
3. Quantify the cost of undetected defects (e.g. poor realization rates, missed opportunities, customer attrition, bad word-of-mouth, etc.)
4. Quantify the value of reduced field QC, early detection and correction of systemic problems, and greater program efficiency

## Comparison of QC-based and QMS-based Approaches

To assist HPwES Sponsors in selecting a QA system, the following chart summarizes some of the critical features and pros and cons of the two allowable options.

Option	Pro's	Con's
Option 1: QC	<ul style="list-style-type: none"> <li>• Typical of what most programs are doing now</li> <li>• The majority of supply chain actors are minimally impacted so transition period is short once inspection staff is up and running</li> <li>• Fixed costs to the program are more easily compartmentalized and predictable</li> </ul>	<ul style="list-style-type: none"> <li>• Potentially high start-up costs in planning, systems development, and training</li> <li>• Potentially high long-term fixed and variable costs in implementation, re-work, retraining, and remedial and punitive actions</li> <li>• Responsibility for quality lies primarily with the Program Sponsor. Pass through to contractors is mostly limited to remedial and punitive actions.</li> <li>• Remediation and re-work become ingrained in the program culture which can negatively impact morale (the “blame game”)</li> <li>• Difficulty in determining actual costs resulting from deficient quality, particularly for highly compartmentalized (“siloesd” operations)</li> </ul>
Option 2: QMS	<ul style="list-style-type: none"> <li>• Responsibility for quality is shared by all actors in the supply chain</li> <li>• Focus on prevention helps avoid customer exposure to defects</li> <li>• Zero-defect approach minimizes or eliminates the need for post-work remediation and re-work, resulting in reduced variable costs to the program and contractor in the long-term</li> <li>• Offers a systematic approach to continuous improvement that becomes ingrained within the program culture (blame-free)</li> </ul>	<ul style="list-style-type: none"> <li>• Represents a paradigm shift for most programs</li> <li>• Potentially high start-up costs in planning, systems development, and training</li> <li>• Requires buy-in at all levels of the supply chain from executive management to workers</li> <li>• Potentially long transition period to fully incorporate</li> </ul>

Fundamentally, the QC-based approach is limited in its ability to promote sustainable quality. The process loop shown in the following figure leading from box “I” to box “D” illustrates a key weakness of this system. Quality management 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 after they occur 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.

QMS is a way to ensure the quality of a product (or a service in the case of HPwES) by assessing the procedures, people, and materials used during the production process rather than just the final product. By evaluating the individual parts and processes that make up the product (service), areas for improvement can be pinpointed and addressed. QMS is more efficient than quality control because it focuses efforts on process-based solutions instead of post-work repairs.

## Process-Flow Comparison: QC vs. QMS

The following section provides an illustration of the differences in the process and flow of a QC focused approach to quality as it compares to a QMS QA Plan. The following table lists the basic components, or steps in the operational processes followed under each system and compares how each approach applies these components to manage quality. The following two figures show how the process differs under the two approaches, and most significantly, highlights the distinction between the primary feedback loops that are typically followed under each system.

### QA System Components Comparison Chart

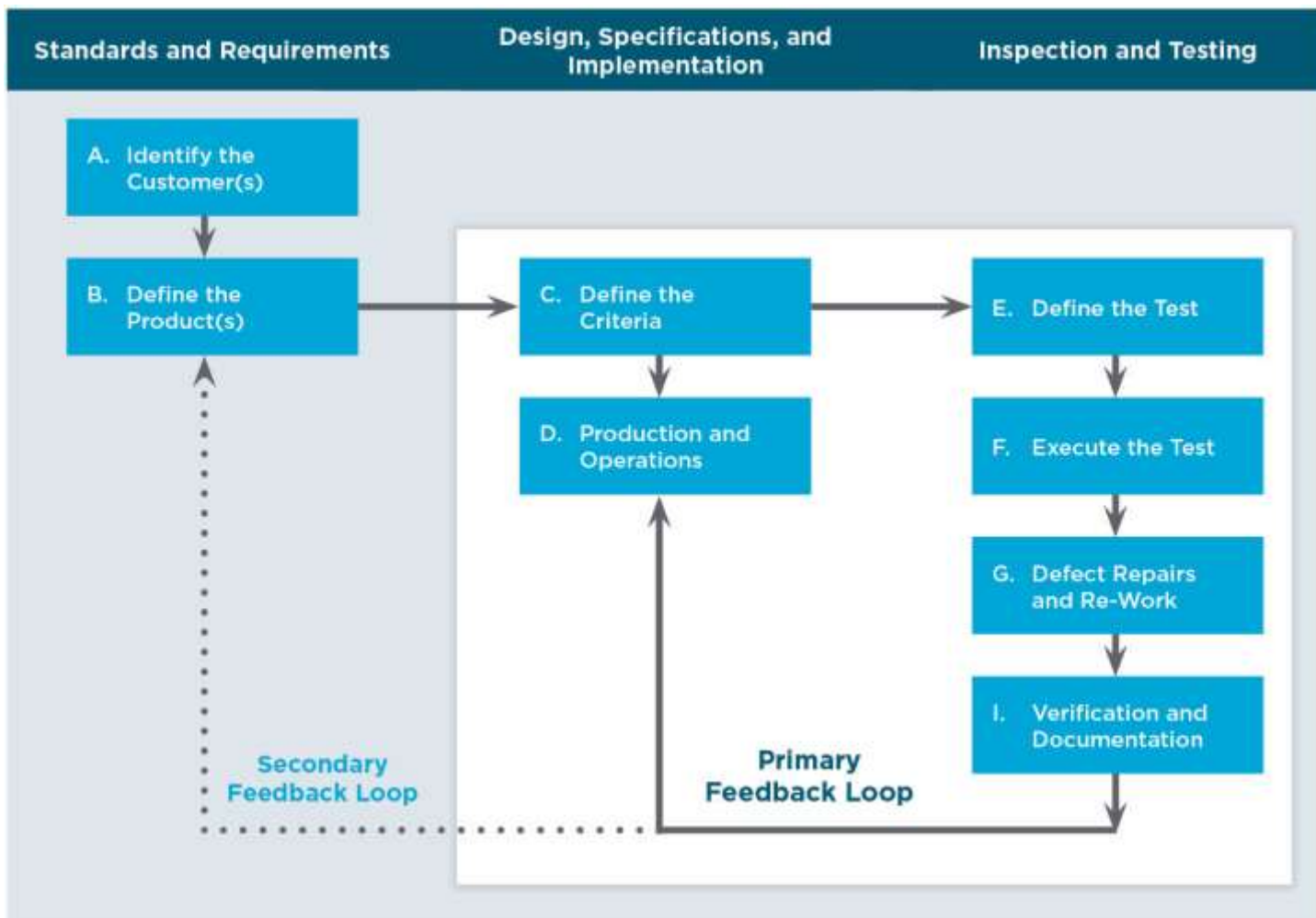
	QA Activity	Description	QC vs. QMS Approach
A	<b>Define the Customer(s)</b>	All end users or recipients of products and services being delivered	Addressed similarly in both approaches, though often not clearly defined in QC-based systems.
B	<b>Define the Product(s)</b>	All products and services delivered 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 that may not always occur in QC-based approach.
C	<b>Define the Criteria</b>	Specifications and metrics needed to meet customers' needs	Addressed similarly in both approaches. Specifications inform validation criteria, which in turn inform the design of the test protocols (E).
D	<b>Production and Operations</b>	All activities performed for production resulting in delivery of products and services to the customer	<b>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 – typically just before or after delivery to the customer.</b>
E	<b>Define the Test</b>	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	<b>Execute the Test</b>	Inspection activities including data review and physical inspections conducted by parties other than the workers themselves	The QC-based approach relies primarily on post-work inspections to ensure quality. The QMS focuses on production-based quality validation, using inspections strategically to supplement and spot-check results.
G	<b>Defect Repairs and Re-Work (post-production)</b>	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 retraining 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	<b>Repair Non-Conformance (in-process)</b>	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	<b>Verification and Documentation</b>	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.



The following figures illustrate the process and flow of information that occurs using each of the two QA approaches described in the *Sponsor Guide*. The light blue highlighted areas on each chart indicate the primary feedback loop used to process results and utilized information gathered through the quality assurance process.

## Option 1: QC-Based Approach

### Typical Quality Process Diagram (QC-based Approach)

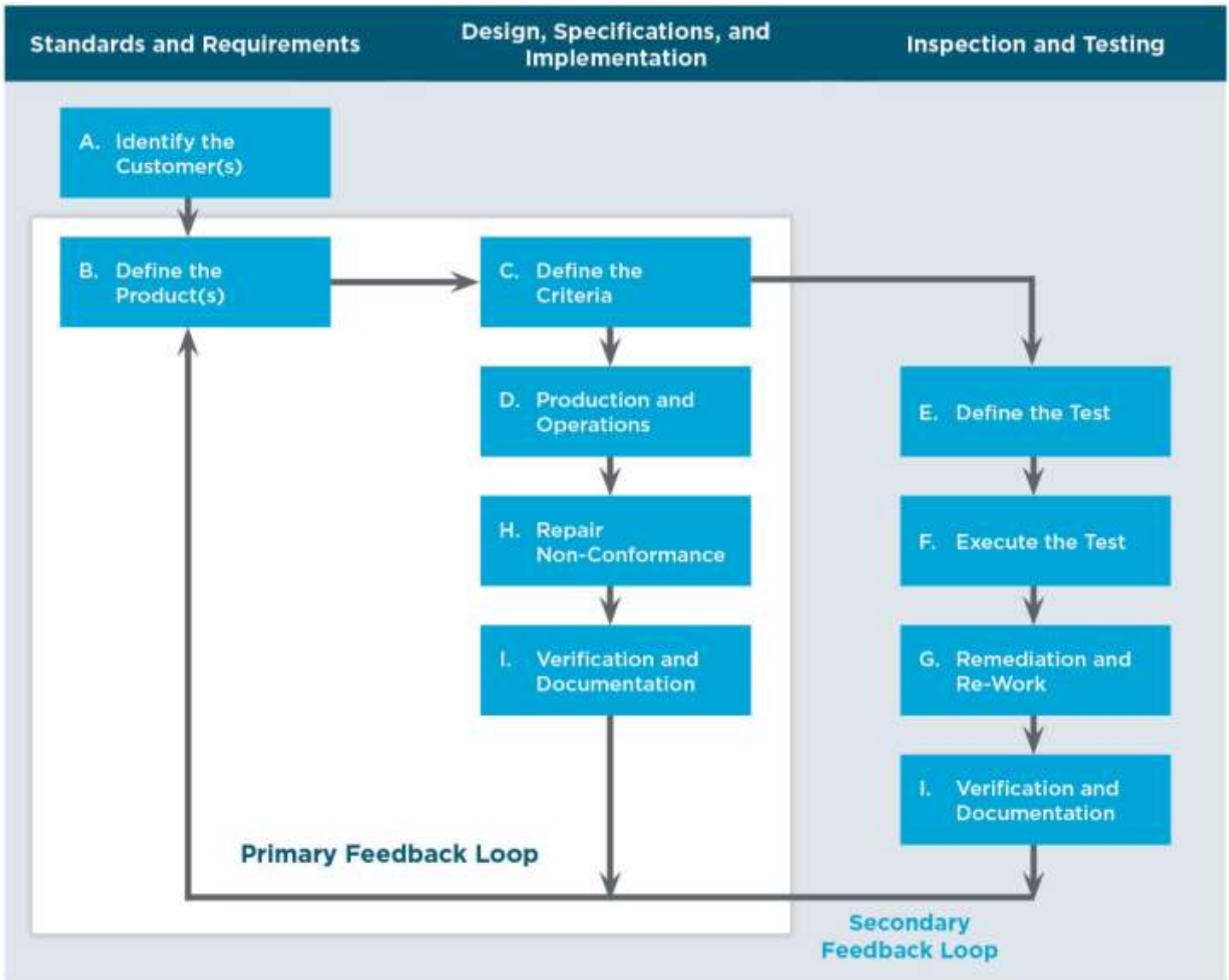


In the QC-based model, the primary feedback loop tends to be focused around post-work error detection and remediation, which does nothing to prevent errors from occurring in the first place. The costs associated with this model include significant resources dedicated to remediation, re-work, and re-inspection. Additionally, there may be significant costs that are much harder to quantify associated with errors and defects that do not appear until it is too late to fix (e.g. unfavorable realization rates for energy savings) or go completely undetected (e.g. unhappy customers spreading bad word-of-mouth resulting in reduced participation rates.)

Process improvements may be informed via a secondary feedback loop as shown in the diagram, but the information carried through this loop is typically limited only to those issues that appear within the inspection sample set and typically to only those defects that trigger an elevated level of concern due to the nature of the issue or the frequency of the problem.

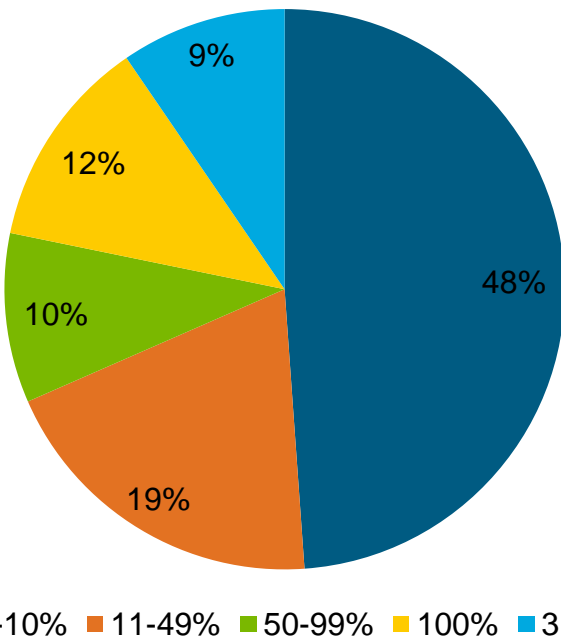
## Option 2: QMS-Based Approach

### Typical Quality Assurance Process Diagram (QMS Approach)



The QMS-based process focuses on feedback processed through the entire system. Errors and non-conformities are reported to enable detection of the underlying cause so modifications to the system can be implemented. *Defects do not occur* because errors and non-conformities are corrected prior to closing out a project. The primary feedback loop is informed by the production-based validation checks which occur in-process during a job. The secondary feedback loop is informed by external error checking conducted by third-party reviews and inspections. This secondary system serves as a back-up to the primary system.

### Inspection Rates Reported by HPwES Sponsors for 2012 (N=43)



### The Cost of Quality

Although it may appear that a significant investment is necessary to design and implement a QMS-based QA Plan, it is projected that the long-term fixed and variable costs associated with a QC-only approach far outweigh the costs associated with a well-functioning QMS plan. Although DOE’s minimum requirement for field inspection sampling rates for HPwES is set at 5% of the projects completed, most Sponsors deem it necessary to exceed this minimum, many by a large margin. As shown in the graph to the left, in program year 2012, 52% of participating sponsors reported inspection sampling rates in excess of 10% with an overall average sampling rate of 35% of all projects. That pencils out to a significant amount of program overhead going to QC, with no real assurance that progress is being made toward reducing the occurrence of defects in the first place. Factor in the hidden costs associated with dissatisfied customers who go undetected or unsatisfactory energy savings realization rates

detected too long after the fact to remedy and the problem multiplies. Many of these programs have been operating for years (even decades) using the same approach, but logic would dictate that if a quality assurance program is working, then the overall quality of the program should improve over time, allowing for QC rates to be reduced freeing up program funds for other endeavors. Instead, the trend appears to be toward adding more QC as programs mature, instead of less. This conundrum suggests that there must be a better way.

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## Referenced Website URLs

- <sup>i</sup> [http://www.energystar.gov/index.cfm?c=home\\_improvement.hpwes\\_sponsor\\_resources](http://www.energystar.gov/index.cfm?c=home_improvement.hpwes_sponsor_resources)
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- <sup>xix</sup> [http://www.epa.gov/cleanenergy/documents/suca/program\\_incentives.pdf](http://www.epa.gov/cleanenergy/documents/suca/program_incentives.pdf)
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