



HOME PERFORMANCE WITH ENERGY STAR— A COST-EFFECTIVE STRATEGY FOR IMPROVING EFFICIENCY IN EXISTING HOMES

The U.S. Environmental Protection Agency (EPA) and U.S. Department of Energy (DOE) offer a program strategy for encouraging comprehensive home energy improvements for existing homes called Home Performance with ENERGY STAR. This innovative program goes beyond providing product incentives to homeowners to help capture the significant savings potential of improving whole-house performance in the existing housing market. As product standards have increased, there is less savings potential from single-product rebate strategies. Home Performance with ENERGY STAR can be a cost-effective addition to an energy efficiency program portfolio that provides significant energy savings to homeowners as well as improve the health, comfort and safety of their homes.

WHOLE-HOUSE STRATEGIES DELIVER RESULTS

The time is right for program strategies that promote whole-house energy improvements such as Home Performance with ENERGY STAR (HPwES). After more than 20 years of energy conservation programs in some parts of the country, there is still enormous potential to reduce energy consumption and peak demand from existing homes.

Over the past five years, EPA and DOE have worked with states, utilities, and others to implement and pilot Home Performance with ENERGY STAR in a dozen markets with significant results. At the end of 2006, 26,000 homes were retrofitted under HPwES. The first HPwES programs include: Austin Energy, Wisconsin Focus on Energy, and the New York State Energy Research and Development Authority (NYSERDA).

- In 2005, Austin Energy had over 70 contractors participating in its HPwES program, completing 1,400 projects with a peak demand savings of over 3,000 kW.⁴
- From 2001 to the middle of 2007, over 150 contractors participating in NYSERDA's HPwES program helped New Yorkers invest over \$110 million to improve the energy efficiency of more than 15,000 homes and save over 16,000 Mwh of electricity and over 600,000 MMbtu of fossil fuels. As of 2005, the on-Peak Coincident Demand Reduction attributed to the program was 1.7 MW.⁵
- Wisconsin Focus on Energy estimates that their home performance program is saving on average 1,100 kWh of electricity and 500 therms of natural gas per home.⁶

These leaders provide valuable models and lessons to successfully implement HPwES programs in other markets.

HOW HOME PERFORMANCE WITH ENERGY STAR WORKS

Home Performance with ENERGY STAR starts with a whole-house energy assessment, and provides the infrastructure for homeowners to follow through and complete energy improvements and quality assurance. A whole-house energy audit is a good first step, but recommendations are seldom implemented if the homeowner does not know who to trust to complete the work or is unable to easily finance improvements. With Home Performance with ENERGY STAR, the contractor who performs the home assessment is also prepared to complete the recommended renovations or work closely with participating contractors who will perform these renovations. Contractors that are qualified to perform the assessment and make the improvements are key to turning energy and comfort problems into solutions for satisfied customers.

More than half of the over 66 million single-family homes in the United States were constructed before modern energy codes existed.¹

Many of these homes have no wall insulation, high levels of air infiltration, inefficient heating and air conditioning, and inefficient water heaters and appliances.

Over 40% of households report at least some winter drafts² and 62% complain of a room that is too warm in the summer.³

A local or regional program administrator is crucial to the implementation and operation of Home Performance with ENERGY STAR. Organizations such as utilities, state energy agencies, and non-profit energy efficiency organizations are typical program administrators. These types of organizations understand local market conditions, can provide third-party oversight to home improvement contractors and work to protect the integrity of the ENERGY STAR mark.

The program administrator is responsible for recruiting home improvement contractors who are qualified to perform a whole-house energy assessment and complete the recommended improvements. Based on this assessment that looks at the heating and cooling systems, windows, insulation, and flow of air into and out of the house, the participating contractor offers solutions to fix comfort problems and address high energy bills. To maintain a high level of trust with homeowners, the contractor must test the home after the project is completed to document the home's performance was improved and is operating safely. The program administrator provides an additional level of quality assurance by checking the work of participating contractors and verifying homeowner satisfaction.

PROGRAM DESIGN AND IMPLEMENTATION

To date, organizations such as the New York State Energy Research and Development Authority, Wisconsin's Focus on Energy, and Austin Energy have demonstrated success running Home Performance with ENERGY STAR Programs and providing valuable lessons for launching programs in different parts of the country. The experiences of these organizations suggest that there are several common barriers that potential program administrators need to address during program design and implementation. These barriers and strategies for overcoming them are discussed below by the following major program components:

- Contractor participation
- Consumer financing and/or incentives
- Marketing
- Quality assurance.

THREE STEPS TO START A PROGRAM

Step 1: Conduct Market Research

Start by establishing an advisory group made up of key stakeholders to assess market conditions and make preliminary plans for developing the program and marketing plan.

Step 2: Develop Policies and Procedures

Develop specific policies and procedures for quality assurance, contractor participation, contractor reporting, and financing or other incentives.

Step 3: Partner with ENERGY STAR

Submit a signed ENERGY STAR Partnership Agreement and Program Implementation Plan to the Federal government. The Program Implementation Plan should document how the local program's policies and procedures will meet national program requirements.

Contractor Participation

One common market barrier is a limited supply of qualified contractors with the skills to diagnose and market whole-house energy efficiency improvements. Even if homeowners receive recommendations from an energy audit to improve their home, most homeowners don't know who is qualified to make the improvements. A key strategy to overcome this barrier is to help develop a local network of qualified professionals. Offering technical training to participating home improvement trade contractors is one place to start.

Training—Training should include classroom and field sessions and cover building science principles, diagnostic testing and installation best practices. However, it is not necessary for training to happen all at once. Time and cost are two factors that typically limit contractor participation in training. Program administrators need to find the right balance to ensure that training is accessible to contractors who are serious about adding home performance contracting to their existing home improvement business.

In addition to technical training, some program sponsors offer sales and business process training to help contractors succeed in selling and delivering home performance services. Some program administrators include training elements focused on helping the contractor create internal procedures for quality assurance, employee training, and understanding program incentives or financing. The inclusion of such elements can help programs achieve quality and reach goals.

Certification—To make sure training is effective, written exams and field testing should be used to ensure contractors are skilled to begin performing work associated with the program. Certification from the Building Performance Institute (BPI) or a similar organization with equivalent standards can be used to measure contractor competence at the conclusion of training.

Mentoring—Establishing in-field mentoring opportunities is a valuable way to ensure that contractors are skilled to offer whole-house improvements. Mentoring provides contractors with direct experience performing diagnostic tests, making recommendations, developing a scope of work and installing improvements to best practice standards. Program administrators typically bring in experts to guide participating contractors through their initial projects and help them transition from their existing business offerings to home performance contracting.

For several years, Austin Energy has been providing training to participating contractors in order to develop an extensive network of qualified home performance contractors in the area. Austin Energy has offered discounted training; cooperative advertising; public recognition awards; and monthly meetings to discuss the program improvements, new technologies, and strategies for resolving problems. Austin Energy has also started to encourage technicians to become certified by the Building Performance Institute.

Incentives—Some programs have reimbursed contractors for the cost of training or diagnostic equipment. This approach

In New York, NYSERDA has offered financial assistance to new participating contractors to help them purchase necessary diagnostic equipment (e.g. blower doors, infrared camera) and become accredited through the Building Performance Institute. Each of these actions can help increase the number of qualified contractors in the chosen market and build a sustainable network of professionals who can deliver whole-house energy improvements.

encourages contractor participation—however, incentives should be contingent on completing specific milestones. Milestones can include passing a certification test or completing and reporting a specific number of jobs. In addition to financial incentives, awards and public recognition for a contractor's achievement (i.e. completing 100 jobs) is a good way to encourage participation.

Consumer Financing and Incentives

Another common barrier to whole-house energy efficiency improvements is the up-front cost to the homeowner. Comprehensive energy efficiency improvements can include adding insulation, air sealing, replacement of heating or cooling equipment, duct repair and replacement of windows. A package of improvements needed to upgrade the efficiency of a typical home can easily cost more than most homeowners can pay out-of-pocket. For example, in New York the average cost of projects ranges from \$5,600 to \$8,500. Although the improvements may increase the value of the home and provide other benefits beyond energy savings, many homeowners will delay making the home improvements unless they have a convenient way to pay for them. Financing is one strategy that can help make a difference. If the monthly cost to finance improvements is less than the estimated savings in energy costs, the decision to improve the home can be easy. Program administrators in Wisconsin, New York and Austin, TX have all partnered with financial institutions that offer homeowner financing. Their experience has shown that the availability of financing and a quick loan approval process can serve as the “tipping point” for homeowners to decide to purchase comprehensive home energy improvements. In addition to financing, some sponsors have offered cash rebates to homeowners. Rebates can help generate consumer interest in the program and offset some costs, especially when the rebates are contingent on the purchase of a comprehensive package of improvements from participating contractors.

Marketing

Many homeowners are not aware that a whole-house assessment can uncover their home's performance problems and identify improvements that, when made together, can greatly improve their home's energy efficiency and comfort. Program administrators can use a variety of marketing and media activities to overcome this barrier. For example, web sites, bill inserts, advertising, or events can help educate homeowners about the benefits of a comprehensive approach to energy improvements and the availability of qualified contractors to do this work in their area.

Enlisting contractors in program promotion has been an effective strategy for some programs. New York, Wisconsin and Austin,

TX have all offered incentives for contractors to participate in cooperative advertising. This shared advertising encourages contractors to play an active role in the program and leverages marketing resources to reach more consumers.

One innovative strategy to increase consumer awareness about the benefits of the whole-house approach to energy efficiency is a Home Energy Makeover Contest. Contest organizers award a whole-house energy efficiency retrofit to the winning contest participant in a highly visible demonstration. The home, chosen for its inefficiency, produces dramatic energy savings. Because the Energy Makeover Contest can be designed to specifically attract consumers to a whole-house approach, it is a promising promotional tool for existing Home Performance with ENERGY STAR programs. The contest also can be used as a tool to launch a Home Performance with ENERGY STAR program.

Quality Assurance

Quality assurance is a required component of any Home Performance with ENERGY STAR program and essential to maintaining a good reputation. Quality assurance also reassures homeowners that participating contractors will be held accountable for the work they perform. Following a quality assurance plan will help streamline delivery and avoid problems associated with contractor reporting. This plan will determine how and what information contractors will submit and how it will be reviewed. This information will also become the basis for program evaluation.

Successful programs have made benefits (such as financing or incentives), contingent on contractor reporting. For example, in New York, contractors are offered an incentive for completing and submitting the comprehensive home assessment report. This report is the same information contractors are required to give the homeowner and includes recommended improvements, estimated costs and energy savings. This information is used to verify the project meets program guidelines.

MEASUREMENT AND VERIFICATION

Program administrators typically track the number of participating contractors, the number of projects completed, and the average energy saved per project. Average savings are typically calculated based on information submitted by the contractor as a condition of program participation, rebates processed, and/or financing information. As described previously, making program benefits contingent upon contractor submission of documentation has proven successful for programs. Information for measurement and verification must be detailed enough to allow program sponsors to independently review the contractors work, verify energy savings, and improve program delivery, but minimize duplication of effort for participating contractors. At a minimum, contractors should provide:

- Name and address of homeowner
- Home assessment summary report
 - Results of assessment and diagnostic tests
 - Recommended improvements
 - Estimated cost of improvement
 - Estimated energy savings
 - Summary of completed improvements and test-out results.

In addition, program sponsors agree to check projects completed by each contractor and/or adhere to other quality assurance practices as outlined in the partnership agreement. Onsite verification of work completed can assist program administrators in verifying energy savings claims and program impacts.

SUPPORT FOR HOME PERFORMANCE WITH ENERGY STAR

In order to take full advantage of the Home Performance with ENERGY STAR marketing graphic and other benefits, programs sign a partnership agreement with the EPA and DOE. ENERGY STAR provides program sponsors with assistance in program planning, promotion and contractor participation. EPA and DOE have established a national network of experienced program implementers, building scientists, marketing and ad firms, and contractors that can serve to advise and assist in program start-up, as well as program direction.

Examples of HPwES Program Support:

- **National Symposium on Home Performance with ENERGY STAR**—this national meeting for program administrators, prospective administrators, and contractors updates sponsors on policy, marketing efforts and program tools. The Symposium is an excellent venue to share lessons among program sponsors and to provide feedback to ENERGY STAR program staff. The Symposium is usually held in the spring, during the national ACI Home Performance Conference.
- **Assistance with market assessment and program design**—our team is ready to walk potential program administrators through the steps to assess their market and design a program. We have tapped into a variety of experts so that start-up programs can benefit from the lessons others have learned. Our team can also guide you through the preparation of a program plan.
- **Marketing Toolkit**—the web-based Home Performance with ENERGY STAR Marketing Toolkit allows program administrators and contractors to customize a variety of marketing materials to feature their company, while using high quality ENERGY STAR graphics and important language that best describes Home Performance with ENERGY STAR. This is a great tool for contractors who don't have the resources to develop high quality marketing materials to promote their new home performance contracting business. Templates include

magazine and newspaper advertisements, yellow page ads, web banners, and flyers.

- **Sales training**—this training course, available to all program administrators, helps contractors learn to effectively sell home performance contracting to homeowners.
- **Contractor Business Development Guide**—written by experienced contractors, this guide helps contractors transition to the home performance business model.
- **Case studies**—documented stories of contractors and homeowners from all major climate zones provide insight on the potential benefits of Home Performance with ENERGY STAR.
- **National web site**—energystar.gov is a key vehicle for communicating with homeowners and program sponsors. Homeowners use the web-site to understand the features of Home Performance with ENERGY STAR, understand what to expect from contractors, and to authenticate this service as part of the ENERGY STAR Program. It is through the national web-site that program sponsors access the latest tools, policy information, logos and marketing initiatives.

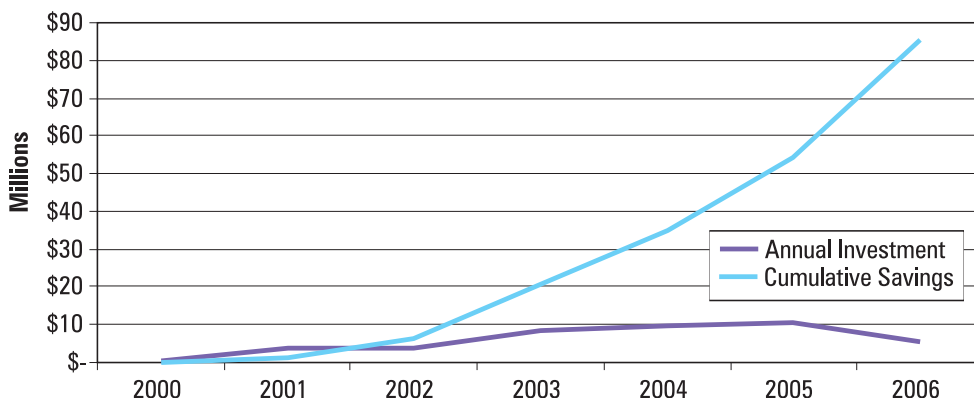
For more information visit www.energystar.gov/hpwessponsors.

PROGRAM COST EFFECTIVENESS

Building a network of qualified professionals to deliver whole-house services requires substantial resources, particularly during the first year. This is one reason many program administrators choose to start with a pilot program in a target market. A pilot program allows for flexibility to work out the details of efficient program design and delivery. Once the infrastructure is established in the pilot market, the investment to maintain and expand the program decreases and the cumulative savings increase (Graph 1).

For a mature Home Performance with ENERGY STAR program, a levelized cost of conserved energy (CCE) of about 0.05 \$/kWh is estimated. Programs with integrated gas and electric savings will be more cost effective because typical home performance improvements deliver both. There is also more security investing in this type of program because improvements are verified through a quality assurance process and the measures result in persistent changes to the home. Table 1 shows the potential per home energy savings and typical improvements.

Graph 1. New York Home Performance with ENERGY STAR Program Investment and Customer Savings (15 yr life cycle)



Energy savings from Home Performance with ENERGY STAR will vary based on the region of the country and type of improvements completed, but an average per home estimate of 20% is realistic to achieve. EPA estimates a peak electricity demand saving of 1.6 kW per home in the summer and 0.9 kW per home in the winter. Existing home performance programs have achieved even better results. Austin Energy's 2005 results estimated a deemed savings per participant of more than 2500 kWh of electricity and 2 kW in peak demand.⁴

Table 1. Potential per Home Energy Savings by Climate Zone

	NORTHEAST	MIDWEST	SOUTH	WEST
Electricity (kWh)	1400	1700	4600	1400
Natural Gas (Therms)	400	400	200	200
Typical Improvements	Increasing attic insulation; insulating crawl spaces or rim joists; duct sealing, repair and insulation; air sealing; and installing programmable thermostat, energy-efficient replacement water heater, heat pump, air conditioner, furnace, boiler, lighting or windows.			

To offer a Home Performance with ENERGY STAR program, an Energy Efficiency Program Administrator is required to be an ENERGY STAR partner and to develop and submit an annual program plan outlining how they will deliver on the following program elements.

- **Ensure that energy specialists conduct whole-house analyses** including a complete visual and diagnostic energy inspection of the home’s thermal and mechanical systems including attics, exterior walls, infiltration, windows, basement, heating and cooling systems, and hot water systems. A visual inspection of the home lighting and appliances also is recommended. Additionally, ensure that all recommendations to the homeowner are made on a fuel-neutral basis and ensure that the homeowner (or tenant) is provided with a summary report including results and recommendations, expected costs and savings, and the non-energy benefits of implementing recommendations.
- **Facilitate installation of recommended measures** through information, marketing, financial incentives, and/or financing, placing emphasis on the installation of recommended measures such as to insulation, air-sealing, heating, cooling, and duct system improvements, and energy-efficient lighting and appliance upgrades.
- **Facilitate direct connection of homeowners to appropriate qualified contractors** who are able to implement the recommendations. This can be either by contractor providing the inspection or other contractors qualified in home energy inspection, building science, and proper installation techniques. All measures are required to be installed in accordance with industry best practices.
- **Verify energy performance and conformity to health and safety standards** through diagnostic testing that includes measuring air infiltration and duct leakage and combustion safety testing [in accordance with ASTM Standard E1998-99, “Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances”; Section H of the National Fuel Gas Code (ANSI Z223.1/NFPA 54); or Canada General Standards Board- 51.71-95, “The Spillage Test Method to Determine The Potential for Pressure Induced Spillage from Vented, Fuel-fired, Space Heating Appliances, Water Heaters and Fireplaces” for example).
- **Ensure quality through rigorous contractor certification and accreditation or through direct oversight and inspection as detailed below:**
 - **Certification/Accreditation.** The certification/accreditation must be at least as rigorous as the technical certifications offered by the Building Performance Institute. Required elements include 1) written and performance-based skill evaluations in all relevant areas; 2) evaluation against consensus-based building science standards; 3) an accreditation agreement in which the contractor performing the work agrees to meet consensus-based building science standards for all work performed, using oversight by certified technicians with appropriately trained crews; and 4) a contractor agreement to establish and use internal quality control and consumer complaint resolution procedures. In addition, contractors must agree to oversight, such as review of records and job inspections by the certifying/accrediting body or the energy efficiency program administrator.
 - **Inspection Oversight.** The energy efficiency program administrator will ensure that participating contractors receive building science and measure training sufficient to perform the diagnostic testing and properly install improvement measures. Further, the program administrator or designated agent will directly inspect the completed work at no less than a 15% sampling rate to ensure that cost-effective recommendations are being reasonably presented to homeowners and improvements are performed according to established standards.

RESOURCES FOR ADDITIONAL INFORMATION

- Home Performance with ENERGY STAR Web site: <http://www.energystar.gov/hpwesspsponsors>
- ENERGY STAR Web site: <http://www.energystar.gov>
- EPA's Clean – Environment Guide to Action Appendix B: Energy Efficiency Program Resources: <http://www.epa.gov/cleanenergy/stateandlocal/guidetoaction.htm>
- Links to innovative technologies for existing homes via DOE's Building America Web site: www.buildingamerica.gov
- Database of state incentives for renewables and efficiency: <http://www.dsireusa.org/>

SOURCES

- ¹ Harvard, The Changing Structure of the Home Remodeling Industry, (2005), Joint Center for Housing Studies
- ² Energy Information Administration, 2001 Residential Energy Consumption Survey
- ³ Decision Analyst, 2004 American Home Comfort Study
- ⁴ Austin Energy, 2005 ENERGY STAR awards application
- ⁵ New York State Energy Research and Development Authority, New York Energy \$martSM Program Evaluation and Status Report, (May 2006), 5-39-41.
- ⁶ Wisconsin Energy Conservation Corporation, 2005 ENERGY STAR awards application

ENERGY STAR[®], a program sponsored by the U.S. EPA and DOE, helps us all save money and protect our environment through energy efficient products and practices. Learn more. Visit www.energystar.gov.

