

# THE NATIONAL HOME PERFORMANCE COUNCIL

## RESIDENTIAL ENERGY EFFICIENCY RETROFIT PROGRAMS IN THE U.S.

Financing, Audits, and Other Program Characteristics



Robin LeBaron with Kara Saul Rinaldi

December 2010

## INTRODUCTION

Whole-home energy efficiency retrofit programs are experiencing an unprecedented period of growth, expansion, and public exposure. The Federal government has recognized these programs' potential to create jobs, reduce energy consumption, and improve the quality of the nation's housing stock and has made energy efficiency one of the centerpieces of its efforts to revive the U.S. economy. The American Recovery and Reinvestment Act (ARRA) and the Better Buildings program have provided funds and support that are enabling states, municipalities and utilities to expand existing whole home retrofit programs and develop new ones.

The potential benefits from whole home energy efficiency retrofits are tremendous. At the level of the individual home, an energy efficiency retrofit can reduce the homeowners' energy bills by twenty to forty per cent while increasing the comfort and livability of the home. At the level of the U.S. economy, energy efficiency retrofits done at a large scale could substantially reduce both the nation's carbon footprint and the demand on its electric grid.



*Insulation is typically one of the most important components of a residential energy efficiency retrofit*

Existing techniques and technologies in energy efficiency retrofitting can reduce energy use by up to 40 percent per home and lower total associated greenhouse gas emissions by up to 160 million metric tons annually by 2020. Retrofitting existing homes also has the potential to cut home energy bills by \$21 billion annually.

But to reach the scale necessary to achieve ambitious national greenhouse gas reduction goals, many challenges remain. Energy efficiency retrofits still need to gain broad market understanding and acceptance. Many of the tools crucial to the success of residential retrofit programs, including loan funds, energy modeling resources, and data collection and transfer standards, are under development. Initiatives such as DOE's Better Buildings program, designed to encourage creativity and innovation within the field, will play a crucial role in helping whole home retrofit programs surmount these hurdles.

During this period of expansion and innovation, it is important not to lose sight of lessons previously learned. Whole home energy efficiency retrofit programs have been in existence for more than a decade. More than one hundred of these programs were in existence prior to the roll-out of the Better Buildings programs. They exist in every region of the country, and have flourished in a range of climactic zones, in very different social and legislative environments, and with a range of sponsors, predominant types of energy, and energy costs.

*“Existing techniques and technologies in energy efficiency retrofitting can reduce energy use by up to 40 percent per home and lower total associated greenhouse gas emissions by up to 160 million metric tons annually by 2020. Retrofitting existing homes also has the potential to cut home energy bills by \$21 billion annually.”*

— Council on Environmental Quality, Press Release,



*A contractor sprays insulation during a retrofit job*

No studies have looked at this universe of whole home retrofit programs in its totality. Although several research organizations have written high-quality cases studies of specific energy efficiency retrofit programs, (e.g. Consortium for Energy Efficiency 2005, Energy Programs Consortium 2007, York et al. 2008), these have focused primarily on a handful of the largest and best-known initiatives, such as the Home Performance with ENERGY STAR® programs in Wisconsin, New Jersey, New York and Austin, Texas. No existing study has attempted to provide a comprehensive overview of all the whole home energy efficiency retrofit programs in the U.S.

This study seeks to fill this gap through a survey of some of the most salient characteristics of the nation’s whole home energy efficiency programs. Data for the study was collected in May 2010, prior to the roll-out of the Better Buildings programs. In this sense, the data set in this study can be used as a baseline to track the development of whole home retrofit programs in the U.S.

## CHARACTERISTICS OF U.S. RETROFIT PROGRAMS

This report looks at all programs that support whole-house energy efficiency retrofits, through subsidies, technical assistance, and other resources. It provides basic data about a number of program characteristics, including:

- ▶ Geographic distribution of programs;
- ▶ Program sponsors
- ▶ Program type
- ▶ Type of audit used
- ▶ Auditor qualifications
- ▶ Use of third-party auditor (vs. auditor-contractor)
- ▶ Cost of audit (free, subsidized or market-rate)
- ▶ Rebate or other incentive offered
- ▶ Financing offered
- ▶ On-bill financing offered

A review was made of all energy efficiency programs listed in the Database of State Incentives for Renewable Energy (DSIRE) created by the North Carolina Solar Center and the Interstate Renewable Energy Council. All programs that met the working definition of “whole home retrofit,” as defined below, were listed. Data included in the study was drawn primarily from the materials made publicly available through program websites. This online research was supplemented with brief phone interviews with program officials from 24 (19%) of the 126 programs included in the study.

This study identifies some common patterns among whole-home retrofit programs, and makes some basic comparisons between different approaches. For the most part, the study is descriptive rather than analytical in nature. However, it is assumed that the material presented here will serve as the basis for more intensive and analytical studies of “best practices.”



*Programmable thermostats are an extremely cost-efficient way to reduce home energy bills*

### **What are Whole-Home Energy Efficiency Retrofits?**

One of the first challenges of a study of whole home energy efficiency retrofits is definition. The logic of the whole-home approach is described in a relatively early discussion of the term “home performance” as follows:

Recently, some of us have begun using the term “building performance” (or perhaps “home performance”). This is as good a description as any. It implies that we are primarily trying to make the assembled system function as well as possible.

Buildings are more complicated than ever before. The materials are more complex, more misunderstood, and in many ways more sensitive. We put more appliances and devices in than we used to. Many of them are bigger than they used to be. Homeowners tend to have higher expectations than in the past. Yet we still combine materials and equipment, hit or miss, and assume they will work. If we want a house that “works as a system,” we need more thinking and better planning.

Paying attention to the interactions and the overall building performance allows us to design and construct buildings that work, buildings that are durable, safe, healthy, comfortable and efficient. System thinking also makes it possible to fix existing problems effectively without surprise side effects. If we don’t take time to understand the connections, we’re just guessing. (Keefe 2005)

The crucial element of a whole-home retrofit, in other words, is that it looks not only at many different elements within the home that result in excessive consumption or waste of energy, but also considers the ways that these elements interact. Whole-home retrofit approaches also review at health and safety issues within a home as a crucial feature of a retrofit job, with a commitment to “do no harm.”

To carry out a whole-home energy efficiency retrofit, it is necessary to conduct an energy audit. Because audits are crucial to the whole-home approach, one of the two criteria used in this study to determine whether a residential energy efficiency program supports “whole house” retrofits is whether a program employs an audit. Programs that do not support audits were not included in the study.

There is considerable variation among both audits and auditors; audits use different methodologies that range from visual inspection to use of sophisticated diagnostic tools such as blower doors and infrared scanners, while auditors may or may not have certification from one of the main rater certification organizations such as the Building Performance Institute (BPI) or RESNET. This study has opted to be broadly inclusive: all energy efficiency retrofit programs that require an on-site whole house audit have been included in the study, provided that they meet the second criteria.

The second criteria used in this paper to determine whether a program qualifies as having a whole home retrofit approach is whether it actively supports whole-house retrofits through provision of free or low-cost audits, education,



*Geothermal HVAC units can heat and cool the home very efficiently*

rebates, financing, or other incentives. Existing programs vary greatly in the extent and ways in which they promote whole-house retrofitting, and this study adopted rebates or other financial support for insulation, weather-stripping and duct sealing as the minimum indicator of support for a whole house approach. These measures are indicative of a larger whole-house approach because they are demonstrated to be some of the most effective and cost-efficient strategies for increasing a home's energy efficiency. They also affect the implementation of other energy efficiency measures; correct sizing of a new, energy efficient heating system, for example, depends in part on the extent to which the home is airtight. It should be noted that this is a very expansive definition of whole home retrofits, and that many programs have developed much more sophisticated approaches than insulation and weather-stripping subsidies.

### **Universe of Programs Included in this Study**

During May 2010 this study identified 126 programs from the DSIRE database as meeting the criteria of a whole home retrofit program outlined above, i.e. programs that promote a whole home approach to energy conservation by providing access to a whole-house audit and support for a number of energy efficiency measures including insulation and weather-sealing. A number of programs that offer an audit but provide few incentives to follow up with a whole house retrofit, as opposed to piecemeal measures, were not qualified as “whole home retrofit” programs, even using the very broad definition of the term employed in this study.

As discussed below, utility-sponsored programs in several states share a common programmatic framework that typically results from sponsorship or partnership with a state or public utility commission. The four Home Performance with ENERGY STAR® programs operated by New Hampshire utilities, for example, might have been considered a single program. It was decided to treat the programs as separate for the purposes of this study because each utility operates some program components independently, and because the programs often vary slightly in detail from one to the other.

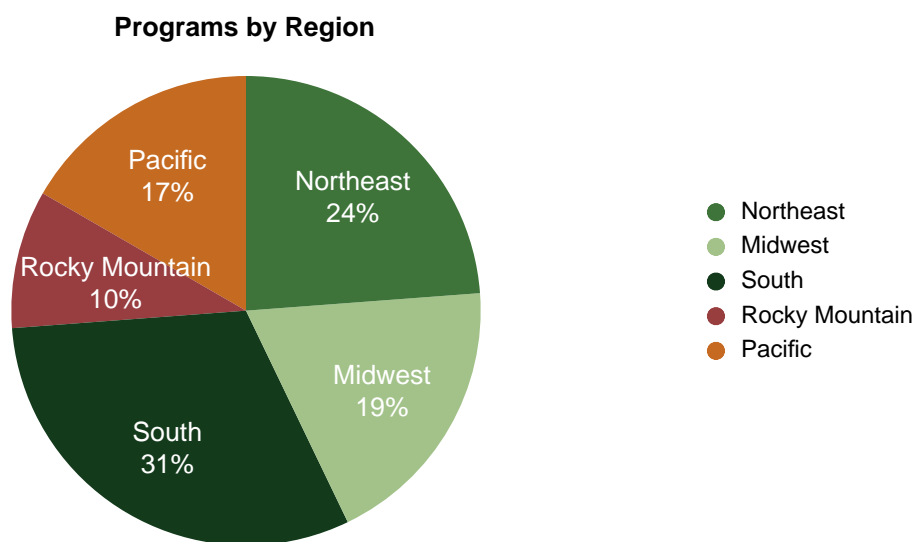
### **Programs by Region**

Whole-home retrofit programs have broad geographic distribution across the U.S. For the purposes of this study, the U.S. was divided into five regions: Northeast, Southeast, Midwest, the Rocky Mountain area and Pacific West. The Northeast region includes the six New England states, New York, Pennsylvania, New Jersey, Maryland and Delaware; the South includes the states to the south and east of Virginia, West Virginia, Kentucky, Tennessee, Arkansas, Oklahoma and Texas, including the District of Columbia. The Midwest includes the states of the industrial Midwest and the Great Plains south to Missouri and Kansas and west to the Dakotas. The Rocky Mountain states include Montana, Idaho, Utah, Wyoming, Nevada, Colorado, Arizona, and New Mexico. The Pacific states include Washington, Oregon, California, Alaska, and Hawaii.

Whole-home retrofit programs were distributed throughout these regions. The eight Rocky Mountain states have the smallest number of programs: 12, or 9.5% of the total — of these, seven were based in

Colorado. The fourteen Southern states have the largest number of programs: 39, or 31% of total programs, reflecting the fact that several states (Florida, Texas, Kentucky and North Carolina) have a large number of utility-sponsored programs. The eleven Northeastern states have 30 programs, or 24% of the total; many of which were utility programs with strong state-level coordination. The twelve Midwestern states have 24 programs, or 19% of the total; thirteen of these were in Missouri, Iowa and Minnesota. The five Pacific states have 21 programs, almost 17% of the total, most of which were utility-based programs in Washington and Oregon.

One southern program, currently under development by the Tennessee Valley Authority (TVA) in conjunction with its utility partners, was regional in scope, with activity in a number of states in the Appalachian region.



Eight states had no programs that could be reasonably defined as whole home retrofit programs (apart from the developing TVA program). These states, which include West Virginia, Tennessee, Mississippi, Oklahoma, North Dakota, New Mexico, Utah, Hawaii, were largely located in the South and Rocky Mountain regions. However, some of these states were in the process of creating whole-home retrofit programs during the research period.

It should be noted that number of programs was not an indicator of program size, or number of retrofits conducted by a program or within a region.

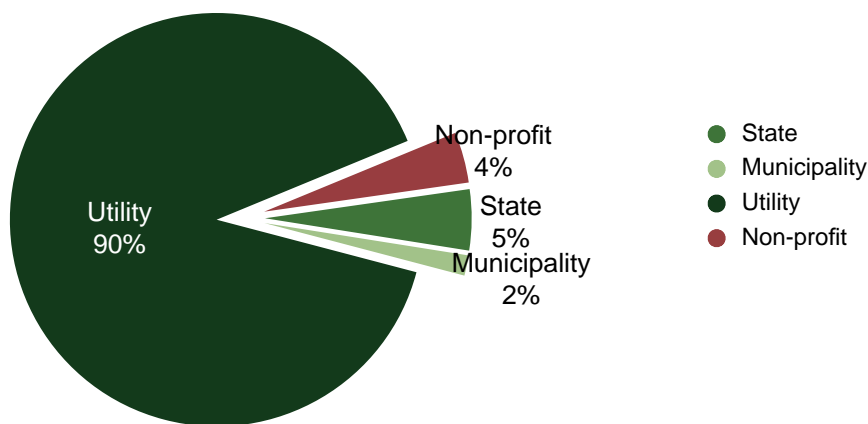
### Program Sponsors

Utilities were the sponsors of the large majority of programs (113 of 126 programs, or 90% of the total). Five programs were run by states: Alaska, New York, New Jersey, Idaho, and Louisiana, and one state (Ohio) offers a financing program designed to promote whole-home retrofits. Five programs, in California, Maine,

Vermont, Wisconsin and Wyoming, were run by non-profit organizations, most of which have close ties either with the state government or the local utilities. At the time of data collection two municipalities offered whole-home retrofit programs: Fort Collins, in Colorado, offers a program that includes a subsidized audit and a third-party, BPI-certified auditor; and Babylon, New York offers a Property Assessed Clean Energy (PACE) program that provides funding for retrofit work in the form of a loan that is secured by a municipal lien against the improved property.

However, in practice, the lines dividing state, utility and municipal programs were not always as clear as the chart implies. Some of the utilities providing programs were municipally-based, including Seattle City Light, The City of Garland Power and Light (Texas), Austin Energy, Idaho Falls Power, and the City of Tallahassee Utilities. In Massachusetts, New Hampshire, Maryland and Missouri, some of the utility programs were run as Home Performance with ENERGY STAR® programs in coordination with the state utility commissions and/or state energy departments, with the result that the utility programs within each state were very similar to each other, and the state has a significant role in their development and implementation, in effect serving as a co-sponsor. In Massachusetts and New Hampshire state involvement was channeled through a non-profit that provides some programmatic and administrative support, e.g. providing an initial screening of callers. In effect, many programs were effectively run through a

**Programs by Sponsor**



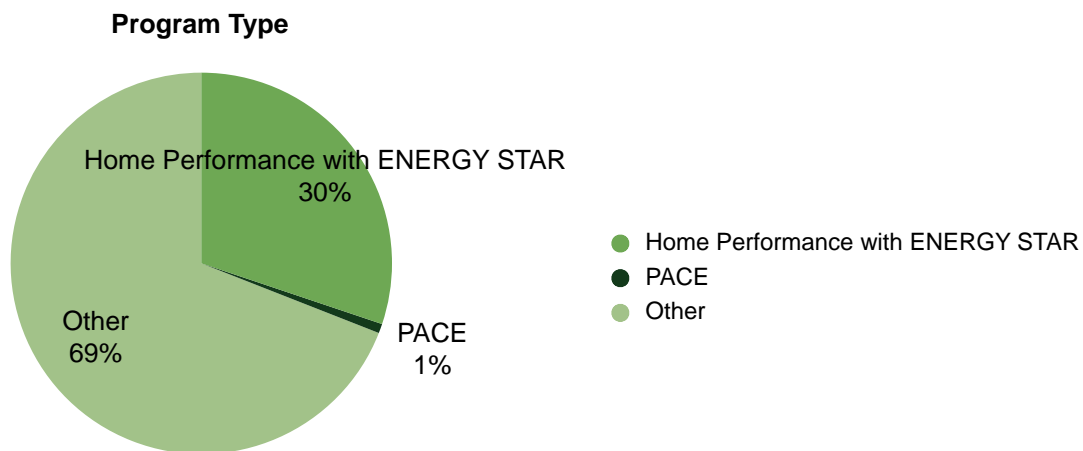
collaboration of states, utilities, and special-purpose non-profits.

### Program Type

Thirty-eight programs in the study have been approved by the Department of Energy (DOE) and the Environmental Protection Agency (EPA) as meeting the guidelines of the Home Performance with ENERGY STAR® (HPwES) program, which was jointly administered by the two agencies. To receive Home Performance with ENERGY STAR designation, programs must include the following components:

- An assessment of the home by a certified energy specialist trained in building science principles using visual and diagnostic methods;
- A set of recommendations for improving the home based on the assessment;
- Assistance for homeowners in identifying contractors who can implement the recommendations provided through the assessment;
- Verification that work was installed and that health and safety issues were addressed by a certified energy specialist;
- Quality Assurance measures;

As discussed in the previous section, the eighteen programs in Massachusetts, New Hampshire, Maryland and Missouri were run by utilities with substantial state engagement and coordination, so that the eighteen HPwES programs might alternatively be considered four programs. The other twenty HPwES programs were distributed across the country in Vermont, Rhode Island, New York (2), New Jersey, Pennsylvania, Georgia (2), Florida, Texas (2), Wisconsin, Colorado (2), Arizona, Wyoming, Idaho, Washington, Oregon, California.



Only one PACE program, run by the Town of Babylon, in New York State, was sponsoring an active PACE program that supported a whole home retrofit approach as defined herein at the time of data collection (May 2010). However, it is anticipated that other whole-home retrofit programs supported largely or entirely through PACE-type financing will emerge if the issues surrounding this financing vehicle can be addressed.

The remaining 87 programs fell into several broad categories. First were the programs that have not received HPwES designation, but were similar in terms of the rigor of their audit, retrofit, quality assurance and other programmatic protocols. Alaska’s statewide program, run by the Alaska Housing Agency, and the programs run by PSE&G in New Jersey and by Vermont Gas fit this category.

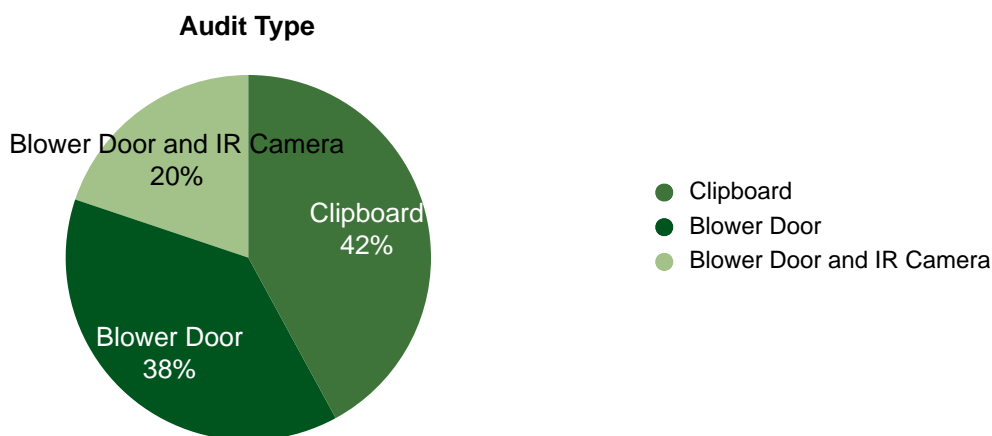
Alternately, a number of utility programs which provide an auditor who conducts a visual inspection of the home (a “clipboard audit”), and makes a series of recommendations which the homeowner may or may not

adopt as he or she sees fit. Many of these programs offer rebates for specific measures such as insulation; a smaller number offer financing for retrofit work. These programs were not always as comprehensive as the Home Performance with ENERGY STAR® programs, but offered other potential benefits, such as responsiveness to customers with high utility bill complaints and ability to implement simple, cost-effective energy efficiency measures.

### Energy Audit Type

Fifty-three programs, 42% of the total, used “clipboard” audits — audits that involve a walk-through and visual inspection of a home. Officials from several of these programs stated that they owned a blower door and/or other diagnostic equipment, but did not use it on a regular basis.

Seventy-three programs, or 58% of the total, used a blower door as part of the audit. Forty-eight programs, or 38% of the total, only describe blower door testing as a diagnostic tool, while at least twenty-five programs (20% of the total) routinely used an infrared camera in addition to a blower door. (The count of programs using infrared cameras was probably understated, as programs were more likely to mention the blower door than the camera in promotional literature.)

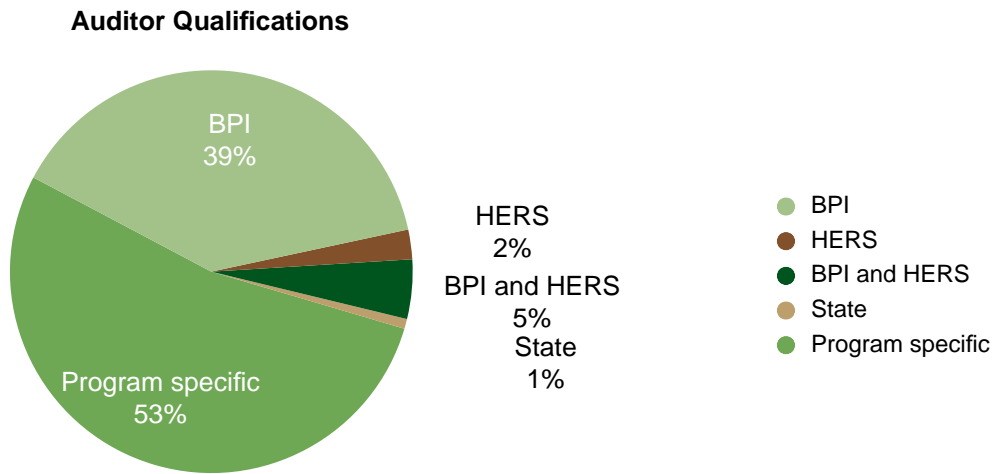


Several program officials mentioned during interviews that they were interested in moving towards incorporation of blower door testing into their audit procedures.

### Auditor Qualifications

Forty-five programs (39% of the total) required program auditors to be BPI-certified, three required HERS certification, and six programs required either BPI or HERS certification. Sixty-seven programs (53% of the total) did not explicitly require BPI or HERS certification. Some of these programs had their own training programs and protocols for auditors: the program run by United Cooperative Services in Texas, for example, trains auditors through a program at Oklahoma State University, and program staff at MidAmerican Energy have developed and refined their own internal audit protocol over a period of many years. Several other

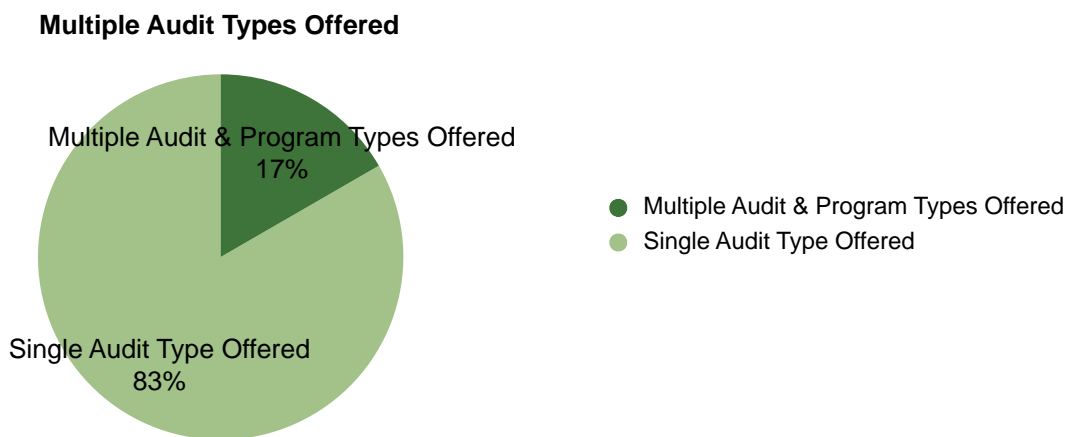
programs indicated that they were interested in moving to a system in which all program auditors were required to have BPI or HERS certification, but had not yet done so.



A number of officials interviewed expressed interest in making BPI and/or RESNET certification a program requirement, or bringing BPI- or RESNET-certified auditors into their program.

**Multiple Audit Types Offered**

Twenty-one programs have designed a tiered system that offers consumers a range of options. The menu of choices varies, but the most common options are either a clipboard audit or a full whole home audit with blower door and infrared camera. The Energy Trust of Oregon, for example, offers either a full HPwES audit or a free half-hour “clipboard” audit through its Home Energy Review program. Austin Utilities and Owatonna Public Utilities in Minnesota offer a “Standard House Call” audit for \$50 that includes a blower door test, or a “Performance House Call” audit for \$125 that includes both a blower door test and infrared

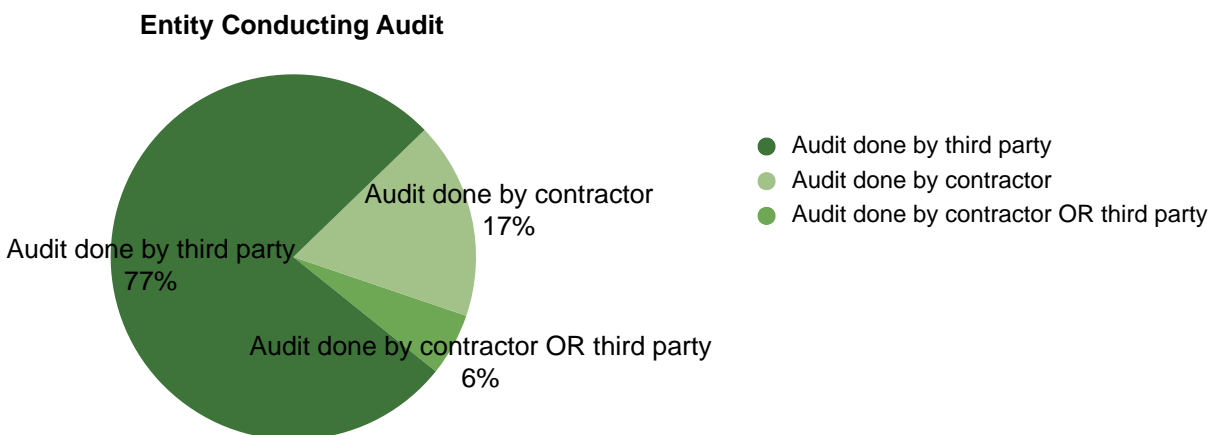


camera imaging. Xcel Energy in Colorado has developed a three-tier system, with “Standard” (clipboard), “Blower Door” and “Infrared” audits, which cost the consumer \$60, \$90 and \$120, respectively.

Many programs offer an online, do-it-yourself audit, but this was *not* considered as a second program in this count.

### Entity Conducting Audit

An important difference between programs is whether the audit is done by the contractor or by a third party. Third parties may be employees of the program sponsor (such as staff of a sponsoring utility), or an independent agency. Twenty-two programs (18% of the total), including the NYSERDA, Wyoming, Austin and Vermont Home Performance with ENERGY STAR® programs, support the auditor-contractor model. In ninety-six programs (75% of the total) the audit is done by a third party rather than the contractor. Seven programs, including those run by Georgia Power and the Idaho Office of Energy Resources, offer homeowners the option of having the auditor serve as the contractor or retaining a contractor other than the auditor.

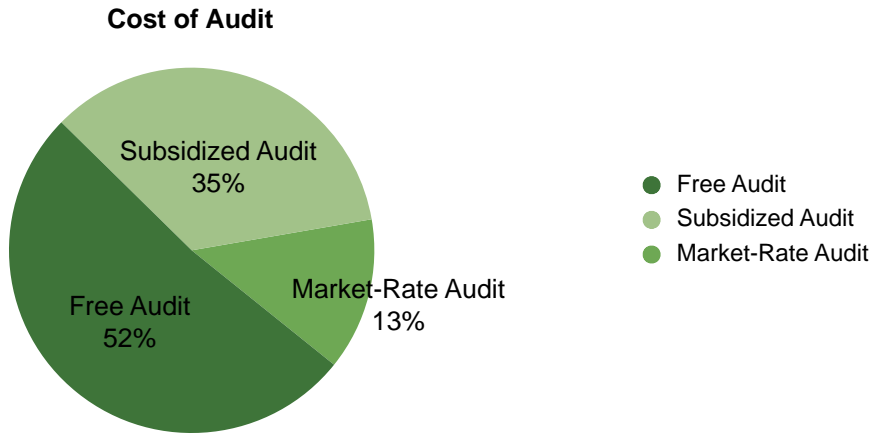


### Cost of Audit

The issue of what to charge for an audit has been extensively debated within the home performance field. The justification for free or low-cost audits is that they may increase program participation by lowering an initial barrier for homeowners who are considering energy efficiency retrofits. Conversely, the justification for an audit fee is that it may conserve and target scarce program resources by discouraging casual consumers who have no real intention of carrying out retrofit work.

Sixty-five programs, slightly more than half of those surveyed, provided customers with free audits. Forty-four programs (35% of the programs), provided a partial subsidy, or a full rebate *if* the customer decided to implement some or all of the energy efficiency improvements recommended by the audit. Seventeen

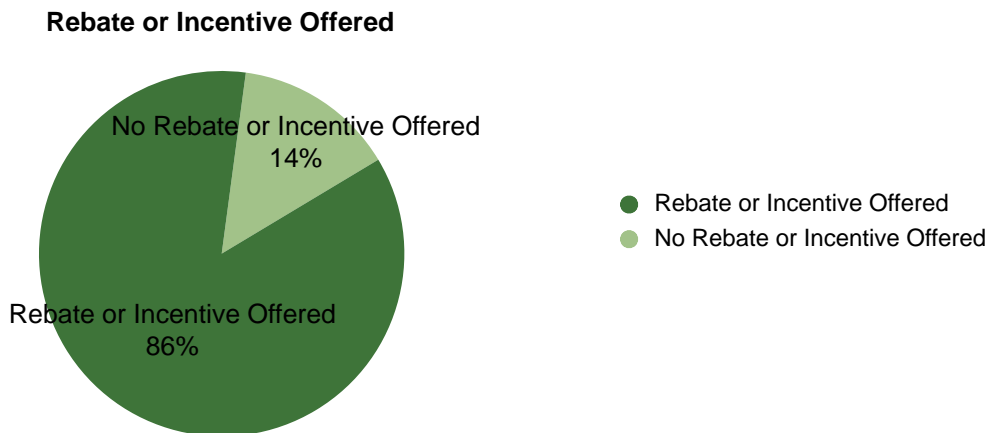
programs (13%) provide no subsidy, resulting in the customer paying the full audit cost. However, some of the programs with at-cost (unsubsidized) audits provide financing that can incorporate the cost of the audit if the homeowner decides to implement the audit recommendations.



Many programs offer a rebate for part or all of the cost of the audit, which provides an incentive for customers who get an audit to follow up energy efficiency retrofit measures.

### Rebates or Incentives Offered

Financial incentives, typically in the form of rebates, were a very common although not universal features of whole home retrofit programs. One hundred and eight programs, or 86% of the total, offer some form of rebate or rebate-like incentive.



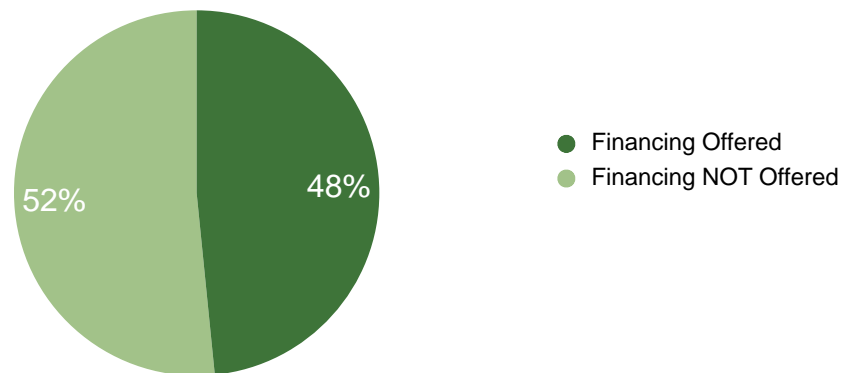
The amount of the rebate varies substantially by measure and by program: New Smyrna Beach in Florida runs a program that offers a \$200 rebate for duct sealing and \$375 for insulation upgrades, while the New Hampshire utilities offer an incentive of 75% of the cost of eligible measures up to a cap of \$4,000.

Many rebate programs were structured on an a la carte basis, with the homeowner receiving rebates for the measures she or he chooses to implement. Some programs, like New Hampshire's make implementation of a set of auditor's recommendations a condition of the rebate.

## Financing

It was less common for programs to provide financing than rebates, but almost half the programs in the study (61 programs, or 48% of the total) provide financing in some form. The most common form of financing was an unsecured consumer loan, although some programs require various forms of security. PeeDee Electric in South Carolina, for example, requires that its loan be secured by a lien on the property, and the Alaska Housing Finance Agency offers below-market subordinate mortgage financing to fund energy efficiency retrofits, although it also offers an unsecured loan product.

**Financing Provided Through Program**



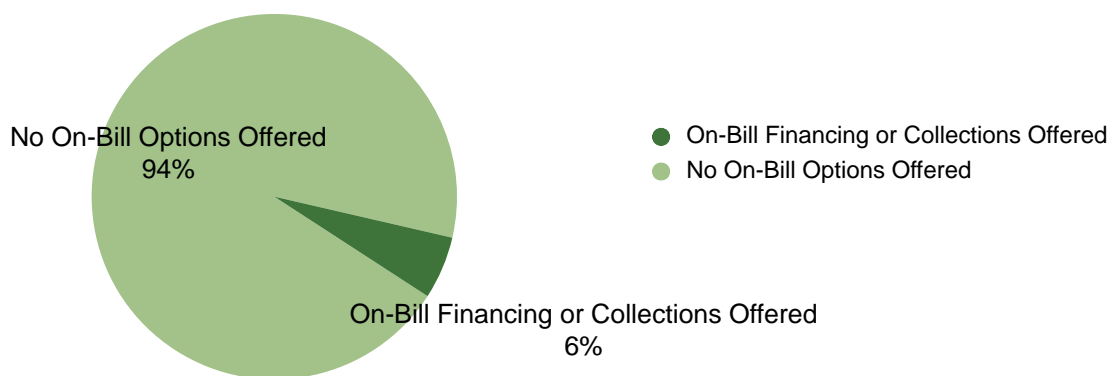
Loan pricing, term and size all vary substantially from program to program. Many programs offer subsidized interest rates, ranging from 0% to prime or a few points above prime. Three to seven year terms were common for unsecured financing. Some programs, such as Alliant Energy in Iowa, offer different rates depending on the term of the loan. Other programs, like New Jersey's Home Performance with ENERGY STAR program, offer different rates depending on the projected improvement in energy efficiency to be achieved through the retrofit. Many programs offer loans up to \$5,000; some offer loan sizes up to \$7,000 (Guadalupe Valley Electric Corporation in Texas) or \$7,500 (City of Ashland in Oregon and the New Hampshire Electric Coop), and a few go up to \$10,000 (Piedmont EMC) and Tideland EMC in North Carolina or \$15,000 (Clark Public Utilities in Washington and the Idaho Office of Energy Resources).

Many programs offer their own financing; others, such as Austin Energy and Vermont Gas, offer it through partner credit unions. The NYSERDA program in New York and the Focus on Energy program Wisconsin and New York offer financing through Energy Financial Services (EFS), a specialized non-profit lender, while the West Penn Power program offers financing through AFC First Financial, a specialized for-profit lender. Participants in the Columbia Gas of Ohio program can access financing through ECO-Link, a program created by the Ohio Treasurer of State.

### On-Bill Financing or Collections Offered

Only seven programs were identified as currently offering on-bill financing or on-bill collections. These programs were located in New Hampshire (2), New Jersey, Florida, Texas, Indiana, and Kansas. While this may be an undercount as the result of programs that did not advertise on bill collections on their websites and other public materials, it is clear that programs with on-bill financing or collections features were uncommon.

**On-Bill Financing or Collections Offered**



### Total Program Outputs

Retrofit programs do not typically make data on the number of retrofits completed during a given period readily available in their public documents, so this study had limited data on program production. The Environmental Protection Agency (EPA) provided information on the production of Home Performance with ENERGY STAR® programs. Questions about program outputs were asked during the interviews, but not all respondents were able to provide numbers, and many who did provided only rough estimates.

The Home Performance with ENERGY STAR® programs supporting the greatest number of retrofits during recent years include New York (6,343 retrofits in 2009), the eight Massachusetts utilities (combined, 6,259 retrofits in 2009), Austin Energy (2,773 retrofits in 2009) and Wisconsin Focus on Energy (1,944 retrofits in 2009). The other Home Performance with ENERGY STAR® programs sponsored less than 1,000 retrofits in 2009.

The non-Home Performance with ENERGY STAR utility programs that provided data on production suggested that between 100 and 400 audits per year was reasonably common. Midwest Energy, for example, does approximately 400 audits per year, and since program inception (the pilot was launched in July 2007 and the full program in September 2008) it has completed 385 whole-house retrofits. Springfield City Water Power and Light in Illinois estimates that it conducts roughly 200-250 audits per year, and receives 20-30 requests annually for a test-out audit, indicating that the retrofit has taken place. (This number is probably an undercount, as some homeowners may have the work done but not request the test-out audit.)



*Window treatments can help keep a building cool even during hot weather*

Some of the utility programs reported high volumes of retrofits. The City of Tallahassee in Florida was conducting 8,000 audits per year at one point, although the volume has slowed with the collapse of the real estate market; it made 500 energy efficiency loans per year for years since its inception in the early 1980s, and has recently been making over 600 loans per year. United Services Cooperative in Texas conducted 898 audits in 2009, and had conducted over 900 by May of 2010.

Although some of the utility programs achieve a relatively modest output in terms of total number of retrofits on an annual basis, over time they succeed in reaching a relatively large proportion of their customer base. The Emerald Public Utility District in Oregon, for example, conducted approximately 200 audits per year and supports approximately 50 retrofits annually through a rebate and financing if the homeowner requests it. The program official interviewed noted that, unlike many others in the U.S., the

program was not ramping up because it had been in existence for more than 25 years, had conducted very aggressive outreach at various points in its history, and at this point had supported retrofit work in a substantial proportion of the 16,000 homes that the utility serves, including many of the most energy inefficient buildings.

## CONCLUSIONS

This survey demonstrates the breadth and diversity of whole home retrofit programs across the U.S. For the past three decades, states, municipalities and utilities have crafted different approaches to encouraging residential energy efficiency. The logical next step — which will be vitally important for the industry to reach scale — is to assemble the lessons learned from these very different programs and incorporate them into a coherent “best practices” framework.

## REFERENCES

Consortium for Energy Efficiency. 2005. Residential Home-Performance Programs National Summary. Boston.

Energy Programs Consortium. 2007. Increasing Demand for Assisted Home Performance with ENERGY STAR in the Affordable Housing Market. Washington, DC.

Keefe, David. 2005. Building Performance and System Thinking. Unpublished report.

York, Dan, Marty Kushler, and Patti Witte. 2008. Compendium of Champions: Chronicling Exemplary Energy Efficiency Programs from Across the U.S. Washington, D.C.: American Council for an Energy-Efficient Economy.