

Characterization of the National Weatherization Assistance Program

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ABSTRACT

The first national evaluation of the low-income Weatherization Assistance Program in over 20 years provides insights to those associated with weatherization, but also to programs seeking to reduce energy consumption in homes through comprehensive retrofits. The weatherization program has evolved an approach that includes a comprehensive delivery model and sophisticated administrative structures. One of the first deliverables from the national evaluation will be a characterization of the program based on extensive data collection from state weatherization offices and local weatherization agencies. This paper highlights selected early results from the characterization analysis.

Introduction

The U.S. Department of Energy's (DOE's) Weatherization Assistance Program has supported energy efficiency improvements to the homes of low-income households in the United States since 1976. The program provides grants, guidance, and other support to state-specific weatherization programs administered by each of the 50 states and the District of Columbia.¹ The states, in turn, oversee a network of local weatherization agencies – mostly non-profit organizations – that qualify eligible households, assess their homes' energy efficiency opportunities, install energy-saving measures, and inspect the work. The work performed includes air sealing, insulation upgrades, furnace replacements, and other dwelling-specific measures found to be cost-effective, as well as home improvements needed to ensure the health and safety for its occupants. The work is done at no cost to the eligible participants.

In 2008, the last year before a sizeable increase in program funding due to the American Recovery and Reinvestment Act, the Department of Energy provided grants totaling about \$237 million to the states to support their weatherization services (NASCSP, undated). These funds supported the weatherization of almost 100,000 homes. In addition to DOE's weatherization grants, state and local weatherization agencies also rely on a variety of other funding sources to support their work.

Although there have been studies of some state-administered weatherization programs, the overall effectiveness of the national weatherization program hasn't been formally evaluated since 1990. That evaluation found, among other things, that weatherization measures installed at that time reduced participant heating energy usage by an average of 18 percent (Brown 1993). The program has evolved significantly since that time with an increased focus on baseload electric usage, continued evolution of diagnostic tools, new guidelines and best practices for heating-related measures, and adjustments in program rules.

The national program is currently being evaluated for the first time in 20 years. Oak Ridge National Laboratory is leading this evaluation effort on behalf of DOE. The evaluation activities comprise extensive data collection from state and local agencies about their weatherization activities (both at the program and client level), observational studies, and field studies. The primary research questions center on the impact and cost-effectiveness of the national weatherization program, insights on

¹ The program also provides funding for weatherization in some U.S. territories, but these were not included in our analysis.

the relative effectiveness of measures being installed, as well as a process evaluation of the program. One of the first outputs of this large evaluation project is a characterization of the Weatherization Assistance Program. Selected tentative results of the program characterization with possible application to non-WAP programs are presented here.

Data presented are based on responses to surveys and data requests to all 51 “states” (includes the District of Columbia) and over 900 local agencies that were active providers of weatherization services and using DOE funds in program year 2008, which comprises the 2008-09 heating season.

DOE’s Weatherization Program in Context

The DOE weatherization program operates within the midst of several energy-related programs for low-income households and among several funding sources.

At the state level, weatherization is often administered by a department of social services or housing. Thirty-three of these agencies also administer the Low Income Home Energy Assistance Program (LIHEAP), which provides payments to eligible households’ energy providers to offset some of their energy costs and can fund some weatherization activities as well.² While weatherization and energy assistance are the largest low income energy programs in most states, some weatherization agencies also administer other programs, including:

- Community Service Block Grants (10 agencies);
- HOME Investment Partnerships Program (9 agencies);
- Community Development Block Grants (5 agencies);
- Emergency Shelter Grant Program (5 agencies);
- (unspecified) tax credits (5 agencies);
- public housing (4 agencies); and
- Weatherization Plus / Rehabilitation Program (4 agencies).

Funding Structure for Weatherization

Although federal weatherization funds represent the backbone of state weatherization programs, they are only part of the overall weatherization funding picture. Whereas some states rely exclusively on DOE funds, other states and some local agencies have developed a comprehensive network of funding sources. The national evaluation team is still deciphering the funding amounts, but we can describe the funding picture for program year 2008 qualitatively and present the relative size of each funding source.

Figure 1 illustrates this funding picture. Federal funds provided by the DOE and LIHEAP programs are the two main funding sources, accounting for more than two-thirds of the approximately \$800 million spent on weatherization in program year 2008. The vast majority of these funds flows through the state weatherization office to the local agencies, with the remainder used to support state-level activities, such as administration, training, and monitoring. Sometimes, however, LIHEAP funds appear to reach local weatherization agencies via other channels. State public benefit funds – often funded through utility ratepayer funds – and other state funding also support weatherization agencies as “pass-through funding” from the state weatherization office to local agencies. Finally, utility funds allocated directly for weatherization provide the remaining major funding source, sometimes reaching local agencies via the state office and often flowing directly to local agencies.

² The other 17 states administer LIHEAP through a different agency than the one responsible for WAP administration.

Figure 1: Funding flow to the national network of weatherization agencies

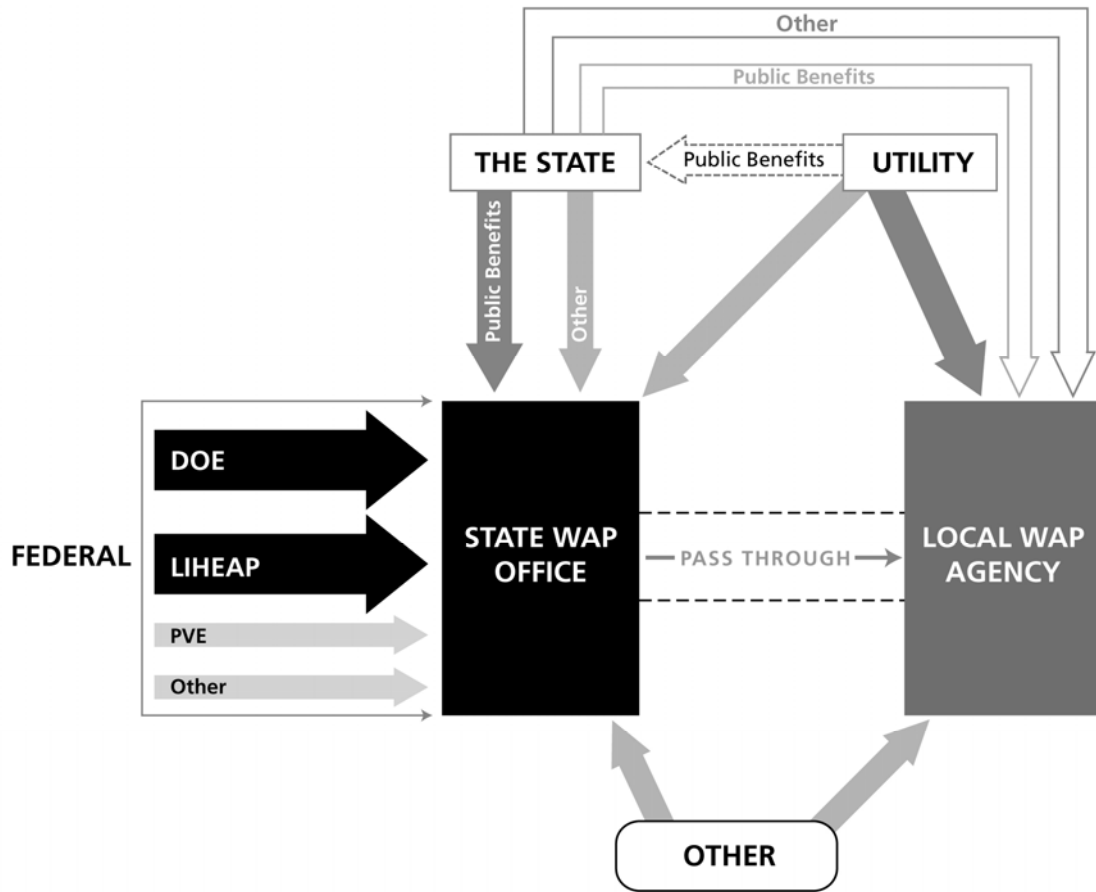


Table 1 lists the number of state programs and local agencies that use these various funding sources. While all 51 state programs receive DOE funds, six rely solely on DOE, but most states also use LIHEAP funds for weatherization. The next most common funding comes from utilities, followed by public benefits, other state funds, and federal funds other than DOE and LIHEAP. Generally, DOE funds provide the bulk of the program support, thereby allowing other funding sources to be used primarily or exclusively for on-the-ground weatherization work.

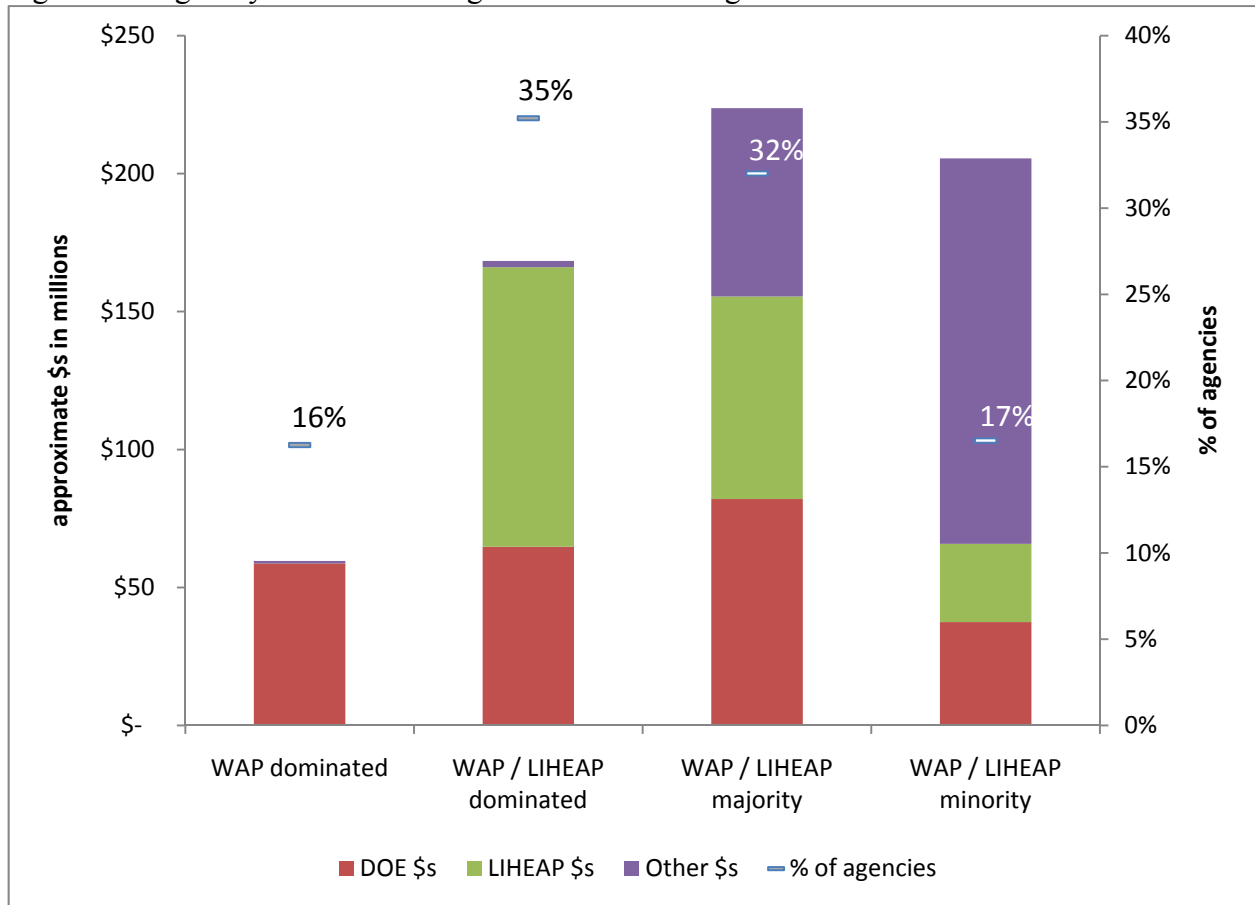
Table 1: Share of programs and agencies using various weatherization funding sources

<i>Funding Source</i>	<i>% of State Programs</i>	<i>% of Local Agencies</i>
DOE	100%	100%
LIHEAP	87%	68%
PVE and other federal	18%	14%
Public benefits administered by state	16%	11%
Other state funds	18%	20%
Direct utility funds	26%	34%
Other	8%	11%

Funding Sources at the Local Level

Some local weatherization agencies have additional funding as well, often through relationships with their local utilities. As a result, local funding can be separated into four different models, as illustrated in Figure 2. Approximately half of the local weatherization agencies rely on DOE and LIHEAP funding for 90 percent or more of their weatherization work. (See the two left-most columns in the chart.) The other half of agencies receive other funding sources, either through their respective state programs or independently. However, for one in six agencies overall, DOE and LIHEAP funds accounted for less than 50% of the available weatherization funding.

Figure 2: Program year 2008 funding sources for local agencies



Local agencies that were most successful in attracting utility funding tended to be those in the western Census region, where utility funding accounted for 14 percent of locally reported weatherization funding, and least in the southern Census region, where utility funding comprised 5 percent of the total. Interestingly, both non-profit agencies and units of local government that run weatherization programs were equally successful at attracting utility funding. The size of an agency's DOE grant also did not appear to matter, although agencies with higher shares of utility funding had higher total weatherization budgets. In all, 33 of the approximately 800 local agencies that reported cost information indicated that utility funding comprises more than half of their weatherization funds.

Weatherization Process – One Model for Comprehensive Residential Efforts?

Weatherization services at the local (client) level have evolved into a sophisticated process designed to obtain the cost-effective savings available in each home while ensuring participant health and safety. The work done in each home is based on the needs and circumstances of the home. As such, the program's components can help to inform the design of other comprehensive, "deep savings" programs being discussed for the residential sector. Similarly, the local basis of weatherization agencies – most of whom serve either a single county or a small number of counties – and their involvement in qualifying clients may offer some insights for neighborhood or community-based initiatives that have been considered or have sprung up in recent years. In this section of the paper, we characterize the structure and activities of weatherization agencies.

The "average" weatherization agency is a non-profit organization with a caseload of about 100 homes (in program year 2008) and an established presence in the communities it serves. (Caseload grew substantially during the subsequent ARRA-funded years, however.) Agencies may use either in-house weatherization crews or coordinate and oversee work that is subcontracted; some do both.

The weatherization work is governed by program rules established at both the federal and state levels. As such, all individual projects that use any DOE funding – even if just a dollar – are required to adhere to federal weatherization rules that govern both administrative and technical aspects of weatherization work. State program rules add additional expectations to ensure that standards are followed, while training offerings and quality control complement the program rules. The technical rules, in particular, and their enforcement provide a level of assurance to clients that the work will be done in accordance with acceptable practices, and an emphasis on diagnostic measurements seeks to ensure effectiveness of energy-saving measures.

Not all low-income weatherization projects are performed under the DOE guidelines, however, as projects funded entirely from other funding sources need not adhere to DOE rules. Table 2 shows the overall distribution of weatherization projects completed by the local weatherization network by building type and DOE funding status in program year 2008.

Table 2: Program year 2008 units weatherized by WAP agencies*

<i>Type of Structure</i>	<i>Number of units weatherized as part of the DOE program</i>	<i>Number of units weatherized outside the DOE program</i>
single-family	54,121	49,897
small multi-family	5,920	6,231
large multi-family	11,058	16,416
mobile homes	14,998	10,394

* Includes only units reported to us by responding agencies; some additional units were weatherized in 2008 by agencies that are no longer active or that did not respond to our data requests.

Services WAP delivers to clients

The full weatherization process involves a multi-step sequence, which comprises an important aspect of the weatherization process. The main steps involving the participant are:

Client intake – Agency office staff, or sometimes another organization providing low-income energy services, explains the program to interested participants and verifies client eligibility. Because agencies are local, they often have an established presence and are known to their clients. Some agencies also provide other social services and may have existing relationships with the clientele. Although verification of eligibility applies only to low-income programs, having relationships with

potential participants is important for any comprehensive residential energy efficiency program that seeks extensive customer commitment.

Audit – Once a household is deemed to be eligible, a trained auditor visits the home to conduct various diagnostic tests and determine what measures would save energy and be cost-effective for that home. This audit process is more comprehensive than assessments conducted by some other residential programs and more complete than diagnostics performed by many private sector remodelers who provide energy efficiency improvements as part of their services. The audits are an important backbone for the entire weatherization process and would be important for any whole-house energy retrofit program.

Weatherization – After the audit, a weatherization crew, private contractors, or a combination visit the home over the course of several weeks and perform the work specified by the audit. This part of the project is akin to having a contractor perform an energy remodel of one's home.

Client education – In addition to physical work on the premises, the vast majority of weatherization projects include some form of client education about energy efficient practices and/or the measures being installed. Agencies reported that, on average, they provide about 30 minutes of client education at various times during the weatherization process, especially during the intake process, the audit, and the inspection. In most cases, the client education comprises direct interaction with the participant and the dissemination of some energy literature. Table 3 below lists some common topics covered as part of client education. Some non-weatherization energy efficiency programs include client education as well, whereas this step tends to be more limited within the private sector remodeling industry.

Table 3: Topics covered as part of client education in more than half of weatherization agencies

<i>Client Education Topics</i>	<i>% of agencies</i>
Thermostat management	89
Insulation	87
Lighting	84
HVAC system operation / maintenance	79
Windows	76
Ventilation	75
Hot water use	74
Safety monitors (e.g., CO monitors, smoke alarm)	69
Mold	67
Refrigerator	64
Water heating system operation/maintenance	60
Energy bills	58

Post-weatherization inspection – After weatherization is complete, an agency inspector visits the home to ensure that all measures were installed and that the work was done well. Sometimes, these inspections may involve a repeat of diagnostic measures to verify the effectiveness of the weatherization work performed. Other energy efficiency programs, such as the ENERGY STAR Homes programs, often include a similar process that verifies the energy effectiveness of measures installed, but private market remodeling may not go beyond client verification that a measure was actually performed. The inspection component of weatherization results in rework that increases energy efficiency in roughly 10 percent of cases.

Distribution of effort among the components of weatherization

One measure of the relative effort expended on these various activities is spending by category. As shown in Table 4, local agencies spent approximately two-thirds of their weatherization funds on the installation of measures and another tenth on health and safety measures in program year 2008. However, it's noteworthy that about seven percent of local weatherization funds were spent on auditing and inspecting homes – two important functions that help support program effectiveness. Program management costs were about 12 percent of the total amount spent at the local level. (The amounts shown in the table are based on all funding sources used by local agencies – not just DOE funds.)

Table 4: Distribution of local weatherization agencies' expenditures by category

<i>Expenditure Category</i>	<i>Amount Spent* by Reporting Agencies (PY 2008)</i>	<i>Share of Total</i>
Weatherization measure installation	\$470 million	70%
Health and safety measures	\$70 million	10%
Audits and inspections	\$50 million	7%
Training and technical assistance	\$10 million	1%
Program management	\$80 million	12%

* Note: Amounts shown here are approximate and based on responses received from local weatherization agencies. They have not been adjusted for non-respondents.

We were still collecting project-specific data from a sample of weatherization agencies when this paper was finalized, so final results on the measures installed was not yet available. Cases for which we received early data suggest that the following efficiency measures are installed or performed in large numbers of weatherized units: air sealing; insulation upgrades; heating system repairs, replacements, and tune-ups; the addition of pipe insulation; installation of low-flow showerheads and faucet aerators; and indoor lighting replacements. Frequently installed health and safety measures among these cases included smoke alarms and carbon monoxide detectors. The rate of installation of these and other measures – and the associated average cost per unit – will be included in the evaluation reports.

Administration of a Large Federal Program for Local Impact

As with many federal programs, DOE's Weatherization Assistance Program provides funding, program guidelines and rules, and assistance to states, but relies on state grantees to administer state-specific programs. The states, therefore, establish their own network of grant recipients, program rules, and support structures for the local program implementers. This section of the paper describes the state-level activities put in place to support the 51 programs.

State Level Staffing and Functions

On average, state programs comprise eight full-time equivalent positions for a total of about 400 state-level staff³³³ (to run the 51 weatherization programs in the states and the District of Columbia. These positions serve several supporting functions to run the statewide programs. As one would expect with any program, there is some management and administration – usually two to three positions – to handle program and staff oversight, grant management, program reports to DOE, and accountability to the state agency within which the program is housed. Most of the remaining positions at the state level

³³³ These 400 full-time equivalent positions are distributed among approximately 500 individuals.

are designed to ensure effective implementation of weatherization by the local agencies. One of these functions – agency monitoring – tracks agency performance and thereby provides a quality assurance function. Staff size for agency monitoring tends to vary with program size, ranging from one or two people in small programs to four or more in large programs. The other supporting function – training and technical assistance – provides direct and indirect assistance to local agencies on technical matters related to weatherization. This function comprises another one to six positions, depending on program size, but can be as high as 14 positions. Table 5 below summarizes program staff sizes by function and program size.

Table 5: State support functions in program year 2008 – in full-time equivalent staff (FTE)

<i>Support function</i>	<i>States with small programs (pop = 12)</i>	<i>States with mid-sized programs (pop = 26)</i>	<i>States with large programs (pop = 12)</i>
Management & administration	Mean: 1.89 Range: .25 to 5 FTE n=7	Mean: 2.43 Range: .5 to 12 FTE n=23	Mean: 3.56 Range: 1 to 7 FTE n=10
Agency monitoring	Mean: 1.35 Range: .1 to 5 FTE n=6	Mean: 2.58 Range: .1 to 18 FTE n=21	Mean: 4.30 Range: .5 to 7 FTE n=10
Training & technical assistance	Mean: 1.00 Range: .5 to 2 FTE n=5	Mean: 1.55 Range: .3 to 6 FTE n=19	Mean: 5.74 Range: .5 to 14 FTE n=10
Other	Mean: 4.00 Range: 4 to 4 FTE n=1	Mean: 0.49 Range: 0 to 1 FTE n=7	Mean: 2.5 Range: 0 to 6.8 FTE n=4

*For this table, we defined small programs as the quartile of states with the smallest total program funding. Large programs comprise the quartile of states with the greatest total program funding. We classified all state programs in-between to be mid-sized.

Quality Control

Quality control inspections and agency monitoring by the state promotes accountability and quality among the local weatherization agencies and consistency within state programs. Most or all state programs use state staff to conduct quality control inspections in the field, and most do so between once and four times per year.

During their quality control inspections, states visually inspect installed measures, assess the quality of measure installations, and discuss the project with the occupants of the inspected units. Most states also verify the operation or amounts/depth of the measures installed, identify needed measures or health and safety issues that were not addressed, conduct blower door tests, and check carbon monoxide levels. Approximately half of the states also conduct heating systems tests (draft/spillage tests and flue gas analysis) and perform infrared scanning to identify remaining thermal losses.

Most state programs inspected around 100 to 300 units in program year 2008, and they found problems with about 10 percent of inspected units. The most common problems were with:

- insulation
- general work quality
- air sealing
- duct / attic sealing and

- missing or improperly installed measures.

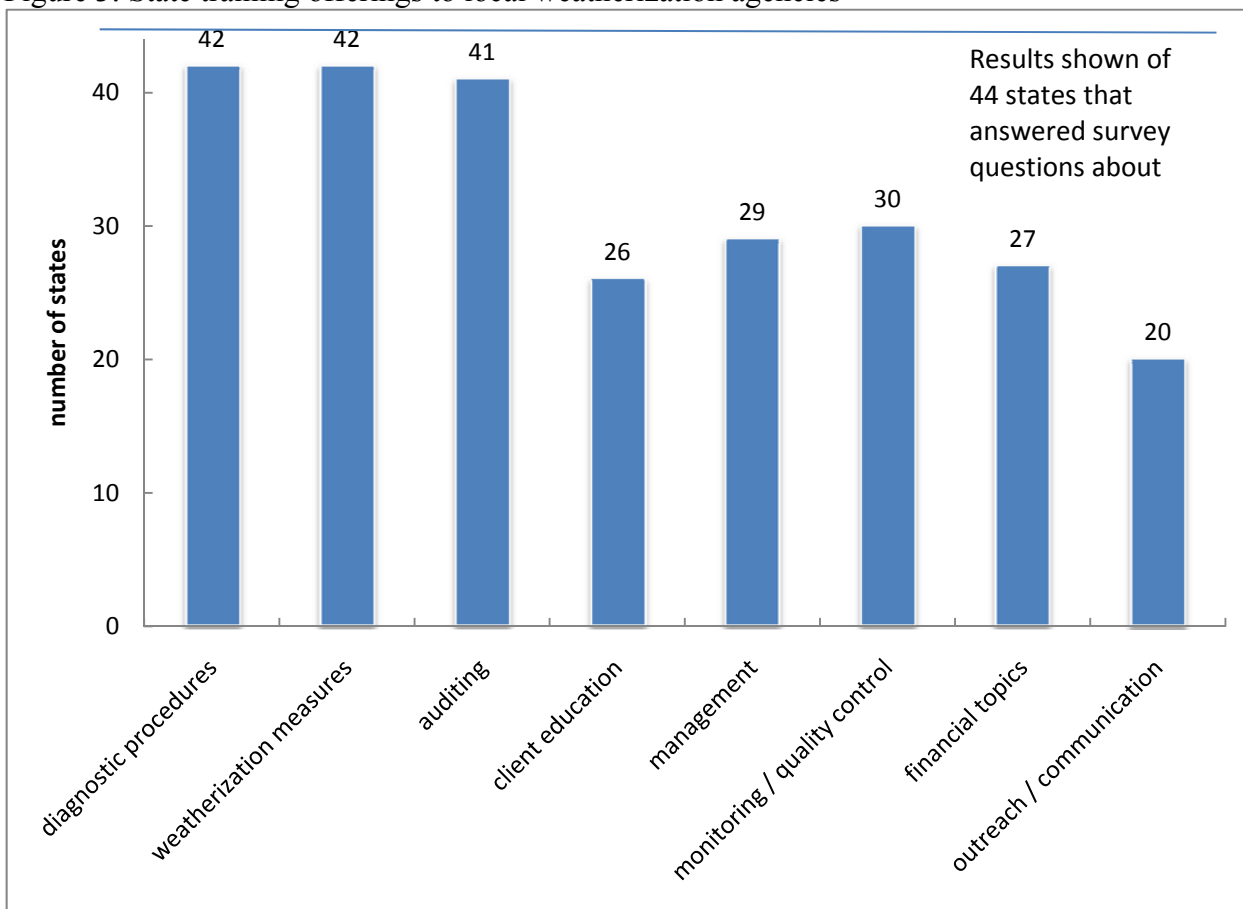
When problems are found in inspections, state programs ask their local agencies to return to the homes to address the issues. In the majority of these cases, states reported that any rework was likely to result in additional energy savings for the program participants.

State programs also tended to conduct annual monitoring of local agency administration of their weatherization programs.

Training

Training by state staff supports similar goals as agency monitoring by facilitating an in-state network of agency weatherization staff who are well-informed on state program expectations, requirements, and processes and who are technically prepared to do high-quality and effective weatherization projects. Training for local agencies tends to fall into three categories: technical training about diagnostic procedures, technical training about measure installation, and training on a variety of management and client contact topics. As Figure 3 shows, most states provide training on most of these topics.

Figure 3: State training offerings to local weatherization agencies



The most technically oriented training covers diagnostic procedures and measure installation, which are both essential to effective weatherization that results in real energy savings. Auditors (and weatherization crews) use diagnostic procedures to determine what measures a home needs and which

would be cost-effective. Some diagnostic tests are intended to identify health and safety risks that may already exist or that might be made worse with weatherization measures that reduce air infiltration. Diagnostic procedures on which many states provide training include:

- blower door testing (41 of 44 states that answered the relevant survey questions)
- CO measurement (39)
- cooking stoves (32)
- zonal pressure (31)
- draft / spillage (31)
- duct pressure pan (30)
- flue gas analysis (29)
- refrigerator energy use (29)

Training on measure installation focuses on those that provide the greatest savings opportunities in most homes. These include:

- infiltration reduction (42 of 44 states)
- space heating systems (38)
- insulation (37)
- water heating systems (35)
- baseloads (35)

Program Flexibility for States

With a dual layer of program design and oversight – one each at the federal and state levels – there is some risk that state programs seeking to be innovative or tailor the program to their states' needs will be constrained by the federal program rules and expectations. We directly inquired with state program directors about the degree to which they perceived the federal program to be sufficiently flexible.

State program directors characterized DOE program rules as generally flexible. As shown in Figure 4, 87 percent of respondents to our questions on the topic characterized DOE program rules as flexible or very flexible.

At the same time, as shown in Figure 5, 61 percent of respondents thought that program rules should become more flexible (46%) or much more flexible (15%). (No one who responded thought the programs should become less flexible!) Areas in which program directors sought more flexibility tended to focus on the types of measures that can be implemented in homes, spending limits, and timing of when reweatherization may occur. Other comments focused on client education and the ability to loan funds to multi-family building owners. One respondent suggested that the main issue isn't flexibility, but lack of clarity and consistency in the existing program rules.

Figure 4: Flexibility in federal program rules as perceived by state program directors

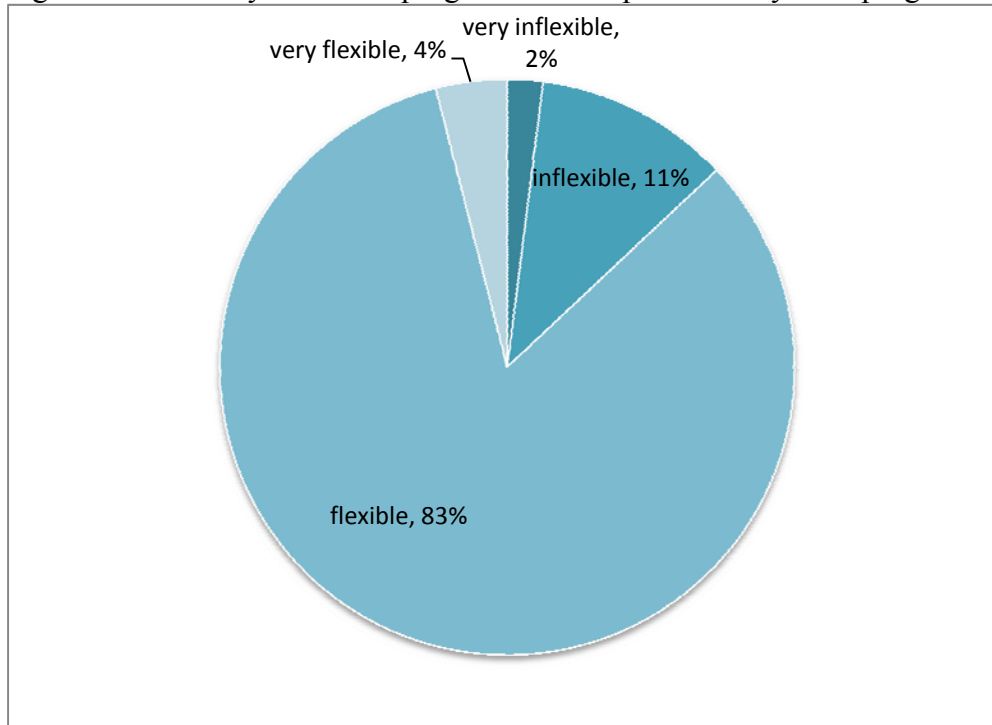
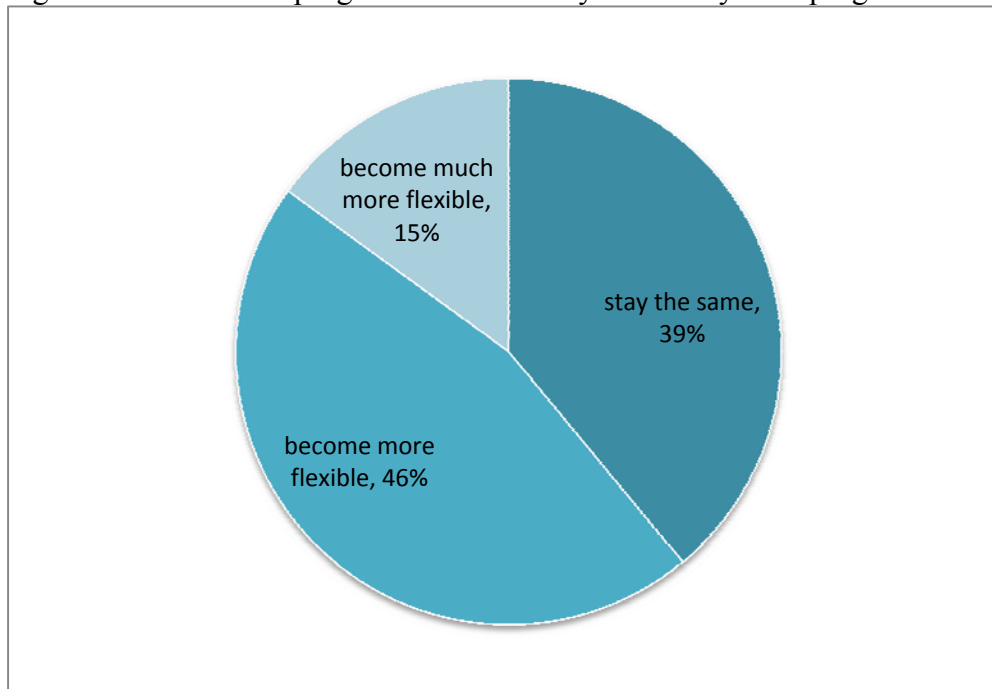


Figure 5: Direction of program rule flexibility desired by state program directors



Conclusion

The results shown above are only the tip of the informational iceberg being gathered and analyzed to better understand state and local implementation of the national Weatherization Assistance

Program. This wealth of data will be useful not only for the Department of Energy and the network of state and local weatherization programs, but also to those exploring program concepts for which weatherization serves as a potential model. With its comprehensive approach to investigating home-specific savings opportunities, installing measures considered to be cost-effective through a network of local providers, and verifying quality through inspections, weatherization offers approaches that would be relevant for other programs. The value proposition may be different because programs outside the low income field cannot provide whole-house retrofits at no charge to the customer, but aspects of the program structure provide a template to consider. Hence, insights gleaned from the characteristics of the 51 state-level weatherization programs can hold value to other comprehensive residential-sector programs.

Upcoming evaluation tasks include a large-scale billing analysis to determine the level of energy savings achieved on thousands of weatherization projects throughout the country. This analysis will identify not only the relative effectiveness of weatherization measures installed, but may also facilitate exploration of program components that are comparatively more or less effective. To the extent that best practices can be identified for weatherization programs, this information will be useful to other comprehensive residential sector programs as well. We will also publish results of several field studies of energy savings and indoor air quality, and our complete program characterization report will include much more detail than we could present in this conference paper.

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