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Evaluation of the National Weatherization Assistance Program during Program Years 2009-2011 (American Reinvestment and Recovery Act Period)

Draft Date: February 3, 2011

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ORNL/TM-2011/87

Environmental Sciences Division

NATIONAL EVALUATION OF THE WEATHERIZATION ASSISTANCE PROGRAM DURING THE ARRA PERIOD: PROGRAM YEARS 2009-2011

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LIST OF ACRONYMS

AFUE	Annual Fuel Utilization Efficiency
AHS	American Housing Survey
ANOVA	Analysis of variance
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
Btu	British thermal unit
CATI	Computer assisted telephone interviewing
CDA	Conditional demand analysis
cfm	Cubic feet per minute
CFR	Code of Federal Regulations
CH4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
CPS	Current Population Survey
CV	Coefficient of variance
DOE	Department of Energy
EERE	Energy Efficiency and Renewable Energy
GPRA	Government Performance and Results Act
IMT	Inverse Modeling Toolkit
kWh	Kilowatt hours
LIHEAP	Low-Income Home Energy Assistance Program
NAC	Normalized annual consumption
NASCSP	National Association For State Community Services Programs
NCAF	National Community Action Foundation
NEI	Non-energy impact
NOx	Nitrogen oxides
O_2	Oxygen
OMB	Office of Management and Budget
ORNL	Oak Ridge National Laboratory
PBA	Planning, Budget, and Analysis
PM	Particulate matter
PRA	Paperwork Reduction Act
PRISM	Princeton Scorekeeping Method
PVE	Petroleum Violation Escrow
PY	Program year
R^2	Coefficient of determination
RECS	Residential Energy Consumption Survey
SAE	Statistically Adjusted Engineering
SIR	Savings-to-investment ratio
SOx	Sulfur oxides
SSI	Supplemental Security Income
TANF	Temporary Assistance for Needy Families

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1. INTRODUCTION AND OVERVIEW

The U.S. Department of Energy's (DOE's) Weatherization Assistance Program (WAP) was created by Congress in 1976 under Title IV of the Energy Conservation and Production Act. The purpose and scope of the Program as currently stated in the Code of Federal Regulations (CFR) 10CFR 440.1 is "to increase the energy efficiency of dwellings owned or occupied by low-income persons, reduce their total residential expenditures, and improve their health and safety, especially low-income persons who are particularly vulnerable such as the elderly, persons with disabilities, families with children, high residential energy users, and households with high energy burden" (*Code of Federal Regulations*, 2005).

DOE sponsored the first comprehensive evaluation of the Program in the early 1990's to provide policy makers and Program implementers with the up-to-date and reliable information they needed for effective decision-making and cost-effective operations. Oak Ridge National Laboratory (ORNL) managed the five-part study, which was based primarily on data from Program Year (PY) 1989 and supplemented by data from 1991–92 (Brown, Berry, and Kinney, 1994). ORNL has also conducted four meta-evaluations[1] of the Program's energy savings using studies conducted by individual states between the years 1990–1996 (Berry, 1997), 1996–1998 (Schweitzer and Berry, 1999), 1993–2002 (Berry and Schweitzer, 2003), and 1993-2005 (Schweitzer, 2005).

In April 2009, DOE directed ORNL and its team of independent energy program evaluators to initiate a second, now retrospective, evaluation of the Program for PYs 2007 and 2008 (Ternes et al. 2007). The Program changed significantly during the almost two-decade period between these evaluations. In response to findings and recommendations resulting from the 1989 National Evaluation, the Weatherization *Plus* strategic planning process, and other federal, state, and local initiatives, the Program incorporated new funding sources, management principles, audit procedures, and energy-efficiency measures. In particular, the use of computerized audits was increased, cooling and baseload measures were added, and weatherization approaches that were tailored to the unique construction characteristics of mobile homes were developed; in addition, the weatherization of large multifamily buildings was expanded and became more sophisticated, while greater flexibility to improve "energy-related" health and safety was provided. Finally, the Program's ability to leverage influence with utilities, other state programs, and owners of large multifamily buildings increased considerably. The retrospective evaluation is expected to be completed by Fall 2012.

This report describes the third major evaluation of the Program, encompassing program years 2009 to 2011. In this report, this period of time is referred to as the ARRA Period. This is a special period of time for the Program because the American Recovery and Reinvestment Act (ARRA) of 2009 has allocated $5 billion of funding for the Program. In normal program years, WAP's annual appropriation is in the range of $200-250 million, supporting the weatherization of approximately 100,000 homes. With the addition of ARRA funding during these program years, the expectation is that weatherization activity will exceed 300,000 homes per year. In addition to saving energy and reducing low-income energy bills, expanded WAP funding is expected to stimulate the economy by providing new jobs in the weatherization field and allowing low-income households to spend more money on goods and services by spending less on energy.

During the ARRA period, the Weatherization Assistance Program is a much different program than it was as recently as PY 2008 and also likely different than it will be in the future. Among the key

[1]The term "meta-evaluations" refers to the analysis of analyses; these are a more rigorous alternative to the narrative discussion of research studies. Meta-evaluations involve the statistical analysis of a collection of analysis results from individual studies for the purpose of integrating the findings.

differences are the following: First, a greatly expanded weatherization workforce has been recruited, trained, organized, and sent into the field. In order to support this expansion, the percentage of spending allowed for training and technical assistance has been raised from 10 percent to 20 percent.

Second, all states and U.S. territories have received unprecedented increases in their weatherization funding and some grantees have grappled with budgets that were several times larger than anything they had previously managed. Some states, faced with this massive program expansion, have used WAP funds for weatherization, while others have implemented other approaches, including innovations in Program delivery and management.

Third, substantial amounts of funding have been set aside to support innovations in Program funding and design. The first of these, for the Sustainable Energy Resources for Consumers (SERC) grants, sets aside up to 2% of funds to encourage innovative projects by Weatherization subgrantees (i.e., local weatherization agencies) to further weatherization efforts that are outside the scope of existing Program regulations and restrictions. The second, the Weatherization Innovation Pilot Program (WIPP), sets aside $30 million to encourage the formation of partnerships with both traditional and non-traditional weatherization providers so that non-federal resources can be leveraged to pursue the Program's purposes.

Lastly, to accommodate the expansion of the weatherization program, several major changes in Program administration were made. Eligibility requirements were eased: The household income threshold increased from 150% to 200% of the Poverty Income Guidelines. Also, the average cost ceiling (the average amount of money that can be spent by grantees to weatherize homes) was increased from $2,500 to $6,500. Additionally, for the first time, the wages for weatherization workers were adjusted to conform to Davis-Bacon Act prevailing wage requirements. All of these factors affect energy and cost savings and have an impact on Program delivery; they may also have relevance to future Program design and are included as topics in this evaluation.

1.1 PURPOSES AND RESEARCH QUESTIONS

ORNL reconvened a National Weatherization Network Committee to provide comments and input for the evaluation of the WAP during the ARRA period (Section 1.1.1). The formalized planning process used for the retrospective evaluation, based on the concept of a program logic model and evaluation design matrix as developed by the W. K. Kellogg Foundation (2001), was again undertaken (see Sections 1.1.2 and 1.1.3, respectively). This section concludes with an overview of the WAP-ARRA period evaluation.

1.1.1 Network Planning Committee

One of the evaluation's most important goals is to meet the needs of the weatherization community, since that community, also referred to as the weatherization network, will be a primary beneficiary and user of the evaluation's findings. In addition, the network of state offices and over one thousand local agencies will be relied upon to collect and provide significant amounts of the data needed for the evaluation. Therefore, ORNL felt that it was important to involve the weatherization community early in the planning process in order to establish open communications with them, get them actively engaged in the evaluation, strengthen their voice in the planning process, clearly identify their expectations of the evaluation, and increase their participation in the evaluation's implementation.

ORNL convened a National Weatherization Network Committee to provide input for the retrospective evaluation in 2009 and reconvened a reconstituted Network Committee in January 2010 in Washington, DC to provide input for the WAP-ARRA period evaluation.

After receiving recommendations from DOE headquarters and regional program staff, ORNL selected 36 people from the National Association for State Community Services Programs (NASCSP) and the National Community Action Foundation (NCAF) to serve on the committee. The committee members are identified in Appendix A. The committee members include state weatherization officials, local weatherization officials, DOE staff, ORNL staff, and independent evaluators.

The committee was tasked by ORNL to identify the information that they would find most useful from the national evaluation; to identify data available at national, regional, state, and local levels that would be pertinent to the evaluation; and to provide insight into how the evaluation and specifically the data collection could be best conducted. This information was solicited to assist ORNL in developing the evaluation's research questions, identifying the various studies that would need to be performed under the evaluation, and formulating details of the implementation.

At the January 2010 meeting, a moderator led the committee through several discussions to identify numerous research questions. These research questions may be broken into five main groups relating to the following areas: (1) energy savings and cost-effectiveness; (2) process issues; (3) non-energy-related benefits; (4) indications for post-ARRA research; and (5) broad research questions.

1) Energy Savings and Cost-effectiveness: It is important to measure energy savings attributable to WAP during the ARRA period, but it is equally important to study changes "on the ground" resulting from the ARRA and those of its provisions related to weatherization assistance. Therefore, evaluation questions related to energy savings include these:

- How much in household energy savings is attributable to WAP during the ARRA period?
- How cost-effective are these savings?
- Were changes in the prices of weatherization measures possibly attributable to the uniqueness of the ARRA-period impact cost-effectiveness?
- Did the ARRA-period change in the formula for distribution of WAP funds to grantees (i.e., states and territories) affect energy savings and cost-effectiveness?
- Did the expansion of existing weatherization crews and the establishment of new ones have an impact on energy savings and cost-effectiveness?
- How much energy was saved in the studied initiatives to weatherize public housing units, and were those savings cost-effective?
- How did the change in the assistance eligibility standard impact energy savings?
- How did the increase in average expenditures on weatherization measures from $2,500 to $6,500 impact measure selection and energy savings?
- What are the energy savings attributable to the SERC and WIPP projects?

2) Process Issues: ARRA funding for the WAP has had a significant impact on Program operation and management. Process issues abound. These issues have been grouped into four categories: (a) management and oversight; (b) prevailing wages (Davis-Bacon Act), (c) the national weatherization network, and (d) labor force and training issues.

(a) Management and Oversight: The expansion of WAP has led to many management challenges and opportunities. Scrutiny of the Program has also increased substantially. Here are suggested evaluation questions that address Program management and oversight during the ARRA period:

- At the state level, what programmatic changes and innovative approaches were implemented to disburse weatherization funds, and how effective were those approaches (e.g., changes in reporting requirements, changes in subgrantee participation, changes in training and technical assistance procedures, changes in audit approaches)?

- What programmatic changes and innovative approaches at the local level were implemented to deliver weatherization services, and how effective were those innovations (e.g., changes in intake procedures, changes in the mix of buildings weatherized, etc.)?
- What were the results of experiments allowing some weatherization funds to be used in public housing?
- What types of projects were funded under SERC and WIPP?
- How did hot-climate states manage substantial increases in weatherization funding?
- How did U.S. territories deal with Program initiation?
- Did walk-away policies (i.e., deferrals of weatherization efforts on unsuitable properties) and the frequency of such deferrals change due to this increase in the amount of available funds for weatherization measures?
- How satisfied were clients with the weatherization services provided during the ARRA period?
- Have the demographic characteristics of clients receiving weatherization and those on weatherization waiting lists changed during the ARRA period?
- Has DOE managed WAP effectively during the ARRA period (i.e. in terms of clarity and timeliness of guidance);
- What have been the actual monetary administrative costs associated with increased oversight during the ARRA period for states and local weatherization agencies (e.g., from DOE IG, GAO)?
- Has ARRA funding both allowed states and agencies to afford new technologies and pushed them to use new information to increase operational and reporting efficiencies? If so, what new technologies are being implemented?
- Has ARRA funding allowed the purchase of new field technologies? If so, what new field technologies are being implemented?
- To what extent have the weatherization costs used in savings-to-investment ratio (SIR) calculations differed from actual, possibly highly fluctuating measure costs endured during ARRA?
- To what extent have other large DOE programs competed with WAP for labor during the ARRA period (e.g. SEP, EECGB)?
- Were there any material, equipment or other supply-chain bottlenecks that hampered or prevented weatherization production during the ARRA period?
- What new state regulations were enacted with respect to weatherization during ARRA, and to what extent did these regulations have unintended consequences?

(b) Prevailing Wages (Davis-Bacon Act): "Davis-Bacon" is the common name applied to a 1931 Act that requires all federal construction projects to pay prevailing wages to their workers. As part of the ARRA legislation, Congress stipulated that projects funded with ARRA money must follow Davis-Bacon rules. The U.S. Department of Labor (DoL) has the responsibility for identifying "prevailing wages" in the construction industry. These wages are identified for a set of construction industry jobs and are estimated for each county in the United States. Prior to ARRA, weatherization activities have not been subject to the requirements of Davis-Bacon. However, under ARRA, it was realized that weatherization-related jobs did not overlap with construction-industry jobs. Therefore, DoL needed to establish prevailing wages for weatherization-related jobs in every county in the country and DOE needed to develop new guidance related to Davis-Bacon. Predictably, much confusion and many delays resulted. An entire set of evaluation questions is devoted to process issues surrounding Davis-Bacon:

- Did Davis-Bacon, on balance, lead to positive job creation?
- Did the application of Davis-Bacon lead to changes in weatherization wages?
- What were the actual monetary administrative costs for complying with Davis-Bacon?
- Did paperwork requirements lead some experienced weatherization contractors to leave the low-income weatherization field?

- Has Davis-Bacon led local weatherization agencies to change their mix of in-house vs. contractor labor and crews?
- How did multi-county weatherization agencies deal with county-specific Davis-Bacon wage-rate requirements?
- How has Davis-Bacon affected weatherization costs associated with multifamily buildings of four stories and higher?
- Have changes in weatherization costs associated with Davis-Bacon altered residents' choices of measures installed in homes?
- Overall, how did Davis-Bacon implementation impact the Program's cost-effectiveness?

(c) National Weatherization Network: The unprecedented flow of federal funds into low-income home weatherization efforts has changed the national weatherization network in several ways: firstly, the size of the labor force has necessarily increased; secondly, these funding increases have naturally drawn new stakeholders into the network. The new funding has also affected long-standing leveraging relationships, in which states and agencies are able to leverage DOE funding in order to attract non-DOE funding both positively and negatively; thus, it has increased the visibility of low-income weatherization. The following evaluation questions are designed to document and evaluate changes in the national weatherization network during the ARRA period.

- Has the composition of the national weatherization network changed during the ARRA period?
- What types of newcomers have joined the network during ARRA?
- Has the influx of ARRA funding negatively affected existing leveraging relationships?
- Are new leveraging relationships forming?
- Has the public's perception of low-income weatherization changed during the ARRA period?
- Has ARRA brought low-income weatherization more attention from state and local elected officials and administrators? If so, has the attention been generally positive or negative?
- How has the media portrayed low-income weatherization during the ARRA period?
- To what extent have inexperienced and unqualified entities entered the weatherization network and attempted to reap benefits from the increases in WAP funding?
- How have private companies tried to change state and local weatherization procedures to benefit themselves (e.g., by selling more insulation or energy-efficient lights)?
- How have relationships between state and local weatherization agencies changed during ARRA?
- How did local non-profit weatherization agencies deal with Program expansion (i.e., what models did they use and which were more successful than others)?
- Did expanding local weatherization agencies result in any economies of scale;
- Did ARRA change the way local agencies procured weatherization services under contract (e.g., changes in using requests for proposals [RFPs] vs. bids)?
- How did the weatherization community (including federal, state, and local stakeholders) interact with federal agencies during the ARRA period?

(d) Labor Force and Training Issues: As mentioned above, the weatherization labor force necessarily increased to meet the increase in the weatherization production rate. The following evaluation questions address how the weatherization community handled this challenge:

- What approaches did local agencies and/or contractors use to recruit qualified, reliable, and trustworthy weatherization crew members, and how effective were these recruitment approaches?
- What approaches did states and local agencies use to train the expanded weatherization workforce and how effective were these approaches?
- Did staff turnover and retention rates change during the ARRA period?
- How did states manage the creation and training of staff associated with new subgrantees?
- How did states and agencies manage increasing workloads and performance expectations?

- How well did new weatherization staff perform?
- How have certification programs changed during the ARRA period?
- What are the strengths and weaknesses of national weatherization certification practices?
- How have certification requirements changed weatherization staff hiring and retention practices?

3) Non-Energy-Related Benefits: The national evaluation currently being implemented will assess non-energy benefits associated with WAP for houses under the $2,500 average expenditure level per house. It is also important to assess non-energy benefits at the higher $6,500 level. Additionally, the greatly increased scale of the ARRA weatherization effort should also increase the scale of the non-energy benefits, especially with respect to employment and other economic issues. The following are potential evaluation questions related to non-energy benefits:

- Did utilities experience fewer problems with arrears and shut-offs associated with weatherized homes because the Program participants' utility bills were more manageable as a result of the increase in measure expenditures and the number of homes weatherized?
- In households whose homes were weatherized at the higher level, how much more affordable were their energy bills?
- What other non-energy benefits to households increased at the higher level of expenditures (e.g., home value increases, improvements in health)?
- Are low-income households whose homes have been weatherized less vulnerable to the impacts of climate change, and if so, to what extent?
- Nationally, how many new weatherization-related businesses were created during the ARRA period?
- Nationally, how many new jobs were created and existing jobs retained during this period?
- Did the increased scale of WAP assistance affect local unemployment rates directly? Indirectly?
- To what extent have people who received weatherization training under ARRA been able to transfer their new skills to other sectors of the green economy in particular and the larger economy in general?
- Has WAP during ARRA affected the market for non-low-income weatherization?
- Has WAP during ARRA affected the market for building related energy-efficiency products; and
- What amount of greenhouse gas emissions was avoided during this period?

4) Indications for Post-ARRA Research Questions: This section poses additional policy-related and research questions whose answers could benefit the low-income weatherization community in the period after ARRA. The questions fall into four groups: (a) fundamental Program management and regulation questions; (b) post-ARRA challenges; (c) technical research questions; and (d) broader research questions. This evaluation of WAP during the ARRA period will not be able to pursue all of the questions listed below due to time and budget constraints. In addition, answers to some questions will not be available until the results from the retrospective and the WAP-ARRA period evaluations can be synthesized. Lastly, many of the questions are not evaluative questions per se; rather, they represent important research and analytical questions that should be pursued through other projects. However, these questions are included in this report to ensure that important points made during the Network Committee meeting are documented.

(a) Program Management and Regulation Questions: Numerous policy decisions shape the implementation of the Program ranging from what measures are allowed to be installed in homes to who is eligible for the Program. Some of these provisions were changed during ARRA. Moving forward, several policy-related questions such as these could be considered:

- Should WAP endeavor to go "deeper" into home-weatherization efforts?

- What are the benefits of having greater Program flexibility diversity in state and local weatherization agency administration of WAP?
- What are the benefits and costs of various income eligibility thresholds (e.g., 150%, 200% or more of poverty level)?
- Is it possible for homeowners' participation in a weatherization program to help forestall home foreclosure?
- Should the policy on re-weatherization be reconsidered in light of Program changes and new technology developments?
- What are the benefits and costs of various average per-house weatherization investment levels (e.g., $2500, $6500)?
- How should certification efforts move forward after the ARRA period?
- What are the benefits and costs of using e-learning programs in weatherization training?
- Should the fundamental funding mechanism of WAP (block grants) be reconsidered;
- How might anticipated retirements in the next five or so years impact the leadership of the national weatherization community?
- Could WAP formally incorporate water conservation into its Program? Should it?

(b) Post-ARRA Challenges: An important issue for the weatherization community is what will happen after ARRA. States and subgrantees are gearing up to weatherize up to twice as many homes per year as they have in recent years. The capacity of the national weatherization network is expected to expand greatly. Will efforts to retain this capacity be made? If so, what might those efforts be at the federal, state, and local levels? Post-ARRA evaluation questions include the following:

- What are states and agencies planning to do, if anything, to maintain their expanded capacities for weatherization after ARRA?
- What options are there at the federal, state, and local levels for marshalling additional resources to maintain the expanded weatherization capacity?
- How many weatherization jobs created during ARRA may be lost after ARRA?
- What might the costs to states and local weatherization agencies associated with workforce reductions (e.g., workers compensation) be?
- How can leveraging relationships that were damaged or lost during ARRA because abundant ARRA money took the place of the leveraging partners' involvement during the Program be rebuilt?
- What leveraging opportunities, such as opportunities to tap into voluntary carbon-reduction markets, might expand after ARRA?
- Will quality issues identified, rightly or wrongly, by the media during ARRA have lasting impacts on weatherization funding?
- What level of emission reductions (for carbon and other pollutants) is necessary for the weatherization program to attract other funding?
- Will the training capacity that has been created by states, agencies, community colleges, etc., be sustainable after the expiration of ARRA?
- Will expenses for new equipment, software, etc. purchased during ARRA be sustainable after ARRA?
- What strategies can be used to retain young weatherization staffers hired during ARRA?

(c) Technical Research Questions**:** The availability of data from two national evaluations of the Program brings up many interesting research questions whose answers could have an impact on future Program design. These questions include the following:

- What lessons about the delivery of weatherization services can be learned through insights gained from the retrospective and WAP-ARRA evaluations (e.g., through comparing energy savings, cost-effectiveness, weatherization staff training and retention etc.)?
- How long do energy savings attributable to weatherization last?
- What are the benefits and costs of using computer audits vs. priority lists?
- Are there any differences in energy savings and cost-effectiveness between homes weatherized using only DOE WAP funds vs. a combination of DOE WAP and LIHEAP funds;
- What are the benefits and costs of various new information technologies that allow real-time reporting of audits and weatherization activities from the field?
- Can energy savings attributable to weatherization be estimated or "normalized" without taking human behavior into account?
- What opportunities exist to use random control trial methodologies to evaluate aspects of the low-income weatherization program;
- What are the impacts of weatherization on "whole-service" utility bills;
- Have any areas in the United States been "saturated" with WAP-funded low-income weatherization (i.e., are there any areas where most eligible homes have been weatherized with WAP-funded assistance)?
- Should weatherization decisions take into account local or regional peculiarities of utility rate structures and other whole billing provisions?
- Has the consolidation of the natural gas and electric utility industries impacted low-income weatherization and/or evaluation?

5) Broad Research Questions: Lastly, numerous questions can be asked about the Program in the larger national context. Suggested questions include the following:

- Can weatherization programs be used to increase the market penetration of new energy efficiency and renewable technologies in the residential sector, whether or not they meet current cost-effectiveness standards (i.e., the currently defined SIR)?
- What are the prospects for building a low-income weatherization portfolio within the voluntary carbon markets?
- How has the proliferation of historic preservation programs and historic districts affected the implementation of low-income weatherization?
- What might be the impact of the potential Home Score program on low-income weatherization?
- How can states and other governmental entities build their own evaluations upon the retrospective and ARRA period evaluations?
- Has the expanded weatherization effort under ARRA transformed markets for any energy efficient products?
- What other weatherization programs serving the low-income community exist in the United States?
- Are the terms "weatherization," "green jobs," and "clean energy" confused in the minds of the public?

1.1.2 Program Logic Model

A program logic model is a tool used to provide complete analysis of a program's inputs, activities, outputs (products), and outcomes. In following the W. K. Kellogg Foundation's formalized evaluation planning process, development of a program logic model is an integral first step before a set of program evaluation questions within the framework of a design matrix can be formulated. The program logic model shown in Table 1.1 shows how the WAP is intended to work by systematically identifying first, the resources available to operate the Program; second, the activities the Program is intended to perform; and third, the results the Program is intended to accomplish. The program logic model for the WAP shown in Table 1.1 comprises four sections:

1. **Resources/Inputs** — The first column identifies the resources ("inputs") of various kinds—human, financial, organizational, and community—available to operate the Program. The first input identified is the Federal legislation authorizing the Program and stipulating the Program's mission and overall objectives. Financial inputs include direct DOE funding of the Program, funding from other Federal sources such as the Low-Income Home Energy Assistance Program (LIHEAP), Petroleum Violation Escrow (PVE) funds, and other leveraged sources, such as state public benefits funds or utility programs. The organizations involved with the Program include Department of Energy (DOE) program staff; state grantees and local agency subgrantees that directly implement the Program, along with their related national organizations; a network of support groups such as DOE's national laboratories, state and regional training centers, and various support contractors; and other organizations, such as utilities and national and state energy organizations.

2. **Activities**—The processes, techniques, tools, events, technologies, and actions that the Program conducts using the resources/inputs are considered its "activities" and are listed in the second column. The Program's primary activities are performed by three groups: DOE, the state grantees, and the local agency subgrantees. DOE's activities focus on administering and running the Program; these activities involve developing policy, guidance, and regulations; making and monitoring grants; providing training; maintaining technical capabilities and tools; performing periodic evaluations; and coordinating with other organizations. The states' activities are also administrative in nature, as they involve making and monitoring contracts with the local agencies, establishing goals and implementation procedures for the agencies, providing training, and establishing partnerships to

leverage resources. Local agencies implement the Program at a basic level, identifying clients and performing all the tasks needed to select and install weatherization measures. The local agencies also perform some administrative functions, such as providing client education, referring clients to other programs and services, and teaching crews the correct procedures needed to perform these tasks.

3. **Outputs**—The Program's outputs are the direct products and services delivered as a result of its activities. DOE's activities result in guidance and regulations being published and audits being developed, improved, and approved. Through the activities of DOE, the states, and local agencies, a known number of homes are weatherized, priority households weatherized, weatherization staff trained, and clients referred to other programs or services. Other important services resulting from the Program include the installation of cost-effective measures in the weatherized homes, the mitigation of health and safety deficiencies in these homes, and the education of clients on energy usage. Through the combined efforts of all organizations, partnerships with the Program are established.

Table 1.1. Logic model for the Weatherization Assistance Program

Resources/ Inputs	Roles/Activities	Outputs	Outcomes		
			Short-Term	Medium-Term	Long-Term
Federal authorizing legislation Direct funding from DOE, LIHEAP, PVE, and leveraged sources DOE Program staff State grant administration agencies and related national organizations Local service network of 900 agencies and related national organizations Support network in national laboratories, training centers, and support contractors with special technical skills Utilities and national and state energy organizations	**DOE** - Establish and explain national policy direction - Formulate annual budgets and grant guidance, and make grants - Formulate Program rules and regulations - Initiate and coordinate strategic planning with network - Approve and monitor state plans and their implementation - Create, coordinate, and conduct technical training and assistance to state and local agencies - Develop and maintain core capabilities of the Program including audit tools and standards, evaluations, and assessments - Coordinate Program relations with other Federal agencies, programs, and institutions **States** - Set eligibility requirements and priorities for participants - Contract with local agencies and allocate funding - Establish production goals (number of units weatherized) and schedule - Specify diagnostic, audit, and inspection procedures and allowable measures for local agencies - Determine extent of allowable repair, health, and safety work - Provide training and assistance to local agencies - Establish leveraging programs and expand resources and partnerships - Monitor local agency work **Local Agencies** - Solicit and process applications and select low-income residents to receive weatherization services - Train crew members - Perform home energy diagnostics, audits, and inspections - Determine most cost-effective weatherization measures and other work needed for each home - Purchase, store, and maintain equipment, materials, and supplies - Install measures and perform other specified work - Perform quality assurance work - Meet with clients to review improvements and provide educational materials - Support advocacy and leveraging - Link clients to other programs and services - Track and report client status, expenditures, and funding	Number of low-income homes weatherized Number of priority households weatherized Cost-effective measures installed in weatherized homes Health and safety deficiencies mitigated in weatherized houses Clients receive education on energy savings Number of weatherization staff trained Number of clients referred to social programs Guidance and regulations published Audits developed, improved, and approved Partnerships established	Weatherized homes, particularly those of priority populations, have increased energy efficiency Health and safety of those living in weatherized homes improved Indoor comfort of those living in weatherized homes improved Clients have increased knowledge of energy savings strategies	Reduced energy consumption in weatherized houses Reduced energy bills and burdens for clients Reduced emissions of pollutants and greenhouse gases involved in energy production and consumption Other non-energy benefits for clients, utility rate payers, and society Robust weatherization network Increased Program leveraging	Reduced gap between low-income energy needs and actual consumption of energy services Reduced impact of energy price inflation and market disruptions on low-income communities Improved health and safety for communities Improved local housing stock Workforce enhancement in local communities Creation of sustainable weatherization services market Increased non-energy purchases in low-income communities Transform market for weatherization products

4. **Outcomes**

4a and 4b. Short- and Medium-Term Outcomes—Program outcomes are those short-term (1–3 months) and medium-term (1-year) changes that occur as a result of the Program's activities that impact the Program's participants, participating households, and the Program itself. The immediate results of the Program are that the energy efficiency of the weatherized homes is increased; that the health, safety, and comfort of those living in the weatherized houses are improved; and that clients know more about energy-saving strategies. In the medium term, energy consumption in the weatherized houses is reduced, leading to reduced energy bills and energy burdens for the clients as well as non-energy benefits realized by the clients, utility ratepayers, and society as a whole (especially benefits related to reductions in pollution and greenhouse gas emissions from reduced energy use). In addition, a more robust weatherization network community should result and the ability of the program to leverage additional resources should increase.

4c. Long-Term Outcomes—The fundamental, long-term (3–7 years) changes in organizations, communities, or systems that result from the program's activities are its "long-term" outcomes. By reducing low-income clients' energy use and energy burdens, the gap between the energy needs of the low-income community and the available resources to meet this need should be reduced; in addition, the low-income community should be less susceptible to rising energy prices and market fluctuations; and finally, clients should have more funds available to make non-energy purchases within their communities. Non-energy benefits realized by the community as a result of the program include improved health and safety, better housing stock, greater job creation, and a more skilled work force. Finally, the program would be expected to encourage market transformation for weatherization products.

1.1.3 Program Evaluation Design Matrix

The evaluation design matrix shown in Table 1.2 identifies the general questions the program evaluation will address. These questions were developed by examining the program's logic model (see Table 1.1 and Section 1.1.2) and incorporating the input received from the Network Planning Committee (see Section 1.1.1). The evaluation questions are organized into three categories in the design matrix:

1. **Context: Relationships and Capacity**—The context questions explore how the program functioned within the economic, social, and political environment of the weatherization community; these questions also address issues regarding the program's relationships and capacity. In terms of the program's logic model, the context questions focus on how the program's resources and inputs led to its activities. The evaluation questions dealing with the program's context focus primarily on characterizing the low-income weatherization market, the weatherization network/community and how it operates, and the partnership and leveraging opportunities available to the program and how well the program is taking advantage of these opportunities. Context questions also deal with whether the program has the capacity and structure to fulfill the mission and objectives established for it by law, and put into context the role the program plays in the larger low-income energy assistance effort.

2. **Implementation: Quality and Quantity**—Implementation questions assess the extent to which the activities listed in the program's logic model were executed as planned, and whether the outputs listed in the program's logic model were achieved. Implementation questions deal with the characterization of the clients and households served by the program, the services the program delivered to these clients and households and how well these services were provided, and the costs associated with delivering the program. An important implementation question based on the input received from the Network Planning Committee is to fully determine the best approaches to implementing audits, client education, training, and technical monitoring. A final implementation question deals with whether the states and local agencies are fulfilling their obligations under federal regulations and the state plans they have submitted.

3. **Outcomes: Effectiveness, Magnitude, and Satisfaction**—Outcome questions focus on the extent to which progress was made toward the desired changes in the program participants, participating households, and the low-income community and systems. In terms of the logic model, these questions examine how well the program's outputs led to its desired outcomes. The Outcomes questions focus on the energy savings achieved under the Program, the non-energy impacts that are being realized, the Program's cost-effectiveness, how well individual measures work, and process variables that affect these outcomes. These outcome questions include Items 1–4 raised by the Network Planning Committee (see Section 1.1.1). Several final outcomes questions bring all the results of the evaluation together, asking whether the Program is meeting the legislative missions and objectives identified previously in the context questions, to what extent the program is meeting the needs of the low-income weatherization community, and how the program and the weatherization network can be improved.

Table 1.3 compares the program outcomes identified in the logic model (Table 1.1) to the program evaluation questions listed in the design matrix (Table 1.2) to make sure that the evaluation is addressing and measuring all the outcomes associated with the program. As shown by Table 1.3, all the program outcomes are being addressed by the questions posed in the design matrix with the exception of the market transformation activity anticipated for the program, which is beyond the scope of this evaluation.

The evaluation as planned takes and evaluates a snapshot of the program's performance as it was implemented in PYs 2009-2011. The evaluation does not focus most directly on the long-term outcomes, instead focusing on the short- and medium-term outcomes listed in the logic model (Table 1.1). However, longer-term outcomes are also being addressed, in some cases by assuming that short- and medium-term results will have larger impacts as they are sustained over time. The snapshot-type evaluation being planned does not allow long-term market transformation activity to be evaluated. Although this outcome could be addressed by looking back in time at how the Program helped transform the weatherization market, such an effort is not being planned at this time.

In the final synthesis (see Section 5), the evaluation should recommend how a longer-term, more continuous evaluation of the Program could be implemented by DOE so that the longer-term outcomes of the program could be more fully addressed. One process that should be explored is to identify other government programs that are evaluating community and public-welfare issues (e.g., the Health Department, the Census Bureau) and determine how the program's long-term outcomes might be evaluated from these existing sources.

Table 1.2. Evaluation design matrix for the Weatherization Assistance Program

Evaluation focus area	Question	Audience	Information use	Study
Context: Relationships and Capacity	1. What are the mission and associated objectives of the Program as established by law?	DOE – WAP Weatherization network	Establish mission context	Process Assessment
	2. Does the Program have the capacity and structure (e.g., funding, staffing) to meet its objectives?	DOE – EERE DOE – WAP Weatherization network	Program administration	Synthesis
	3. What are the characteristics of the national low-income weatherization market?	DOE – WAP Weatherization network	Strategic planning; Program design and marketing	Impact Assessment
	4. Which segments of this market are being served by the Program and other parties?	DOE – WAP Weatherization network	Strategic planning; Program design and marketing	Impact Assessment
	5. What organizations are involved in national low-income weatherization (e.g., agencies, states, utilities, private sector firms)?	White House Congress DOE – Secretarial DOE – EERE DOE – WAP Weatherization network	Establish Program context; Program support and marketing	Process Assessment
	6. What are the characteristics of the weatherization network?	DOE – WAP Weatherization network	Strategic planning; Program design and marketing	Impact Assessment
	7. How does the weatherization network work?	DOE – WAP Weatherization network	Organization and participation decisions	Process Assessment
	8. What are the core leveraging and partnership opportunities for the Program?	DOE – WAP Weatherization network	Program design and marketing	Synthesis
	9. Is the Program exploiting its leveraging and partnership opportunities?	DOE – WAP Weatherization network	Program design and marketing	Process Assessment
	10. Are the Program's regulations enhancing and/or inhibiting leveraging and partnership opportunities?	Congress DOE – Secretarial DOE – EERE DOE – WAP Weatherization network	Program design	Process Assessment

Table 1.2. Evaluation design matrix for the Weatherization Assistance Program

Evaluation focus area	Question	Audience	Information use	Study
Implementation — Quality and Quantity	1. What are the characteristics of those receiving Program services?	DOE – WAP Weatherization network	Program design, planning, and implementation	Impact Assessment
	2. What Program services are being delivered to low-income households?	DOE – WAP Weatherization network	Program design, planning, and implementation	Impact Assessment
	3. How well is the Program delivering its services, including from the client perspective?	DOE – WAP Weatherization network	Program design, planning, and implementation	Process Assessment
	4. What are the costs associated with the Program services?	DOE – WAP Weatherization network	Program design, planning, and implementation	Impact Assessment
	5. What are the best approaches to implementing audits and measure selection tools, client education, training, and monitoring?	Weatherization network	State- and agency-level Program design, planning, and implementation	Process Assessment
	6. Are the Program's characterization and process results valid and reliable?	Evaluation community	Generalize results to other contexts	Peer Review
	7. Are the states and local agencies fulfilling their obligations under federal regulations and state plans?	DOE – WAP Weatherization network	Program design, planning, and implementation	Synthesis
Outcomes — Effectiveness, Magnitude, and Satisfaction	1. What are the Programs average energy benefits (heating, cooling, and baseload) nationally and by climate region, housing type, and fuel type?	OMB DOE – Secretarial DOE – EERE DOE – WAP Weatherization network Utilities Commissioners	Budget justification; Program marketing; utility business planning; rule making	Impact Assessment
	2. How much energy is saved in aggregate by the Program?	DOE – EERE (PBA) DOE – EERE	Energy savings and GPRA metrics	Impact Assessment
	What are the Program's non-energy impacts?	DOE – WAP Weatherization network Utilities Commissioners	Program marketing; utility business planning; rule making	Impact Assessment

Table 1.2. Evaluation design matrix for the Weatherization Assistance Program

Evaluation focus area	Question	Audience	Information use	Study
	4. How do clients feel about the Program's impact on their comfort, health and safety, and energy costs?	DOE – WAP Weatherization network	Program design, planning, and implementation	Impact Assessment
	5. Is the Program cost-effective?	White House Congress OMB DOE – Secretarial DOE – EERE DOE – WAP Weatherization network	Cost-benefit analysis; future funding decisions; Program design, planning, and implementation	Impact Assessment
	6. What impact do alternative per household investment levels (e.g., $2500 vs. $6500) have on key Program metrics (e.g., units weatherized, average savings per house, house and Program SIRs)?		State and agency-level Program design, planning, and implementation	Impact Assessment
	7. How well do the selected measures result in energy savings	DOE – WAP Weatherization network	Program design, planning, and implementation	Impact Assessment
	8. What factors and measures explain variation in energy savings and cost-effective results?	DOE – WAP Weatherization network	Program design, planning, and implementation	Impact Assessment
	9. How are the hot Southern climate region market and performance unique?	DOE – WAP Weatherization network	Program design, planning, and implementation	Impact Assessment and Special Technical Studies
	10. Are the outcome estimates valid and reliable?	Evaluation community	Generalize results to other contexts	Peer Review
	11. Is the Program meeting its legislative missions and objectives?	DOE – WAP Weatherization network	Budget justification; Program marketing	Synthesis

Table 1.2. Evaluation design matrix for the Weatherization Assistance Program

Evaluation focus area	Question	Audience	Information use	Study
	12. How much have the emissions of greenhouse gases been reduced?	White House Congress OMB DOE – Secretarial DOE – EERE DOE – WAP Weatherization network	Cost-benefit analysis; future funding decisions; Program design, planning, and implementation	Special Studies
	13. How well have expanded weatherization activities in the U.S. territories succeeded?	DOE – WAP Weatherization network	Budget justification; strategic planning	Special Studies
	14. What are the impacts and process outcomes of the SERC and WIPP projects?	White House Congress OMB DOE – Secretarial DOE – EERE DOE – WAP Weatherization network	Cost-benefit analysis; future funding decisions; Program design, planning, and implementation	Special Studies
	15. To what extent is the Program meeting the needs of the national low-income weatherization market?	DOE – WAP Weatherization network	Budget justification; strategic planning	Synthesis
	16. In what ways can the weatherization network's performance be improved?	DOE – WAP Weatherization network	Program planning	Synthesis

Table 1.3. Design matrix questions addressing each logic model outcome

Outcomes listed in the logic model (Table 1.1)	Number of questions in the evaluation design matrix related to context, implementation, and outcomes (Table 1.2)		
	Context	**Implementation**	**Outcomes**
Short -Term Outcomes			
1. Increased energy efficiency in homes	4		1, 2
2. Improved health and safety in homes			3, 4
3. Improved indoor comfort			3, 4
4. Increased client knowledge of energy		5	
Medium -Term Outcomes			
1. Reduced energy use in homes		7	1, 2, 8
2. Reduced bills and financial burden for clients		7, 14	1, 2, 4, 8
3. Reduced emissions			3, 12, 14
4. Other non-energy benefits			3, 4
5. Robust weatherization network	2, 5, 6, 7	13	13, 16
6. Increased Program leveraging	8, 9, 10		
Long-Term Outcomes			
1. Reduced gap between energy need and use			1, 2, 4, 11, 15
2. Reduced impact of inflation/market fluctuations			1, 2, 4, 15
3. Improved health and safety in community			3, 4
4. Improved local housing stock			3, 4
5. Workforce enhancements			3, 14
6. Creation of sustainable weatherization service market	2, 4-11		14,15
7. Increased non-energy purchases			3
8. Transformed market for weatherization products	Will not be addressed in this evaluation		

1.2 EVALUATION ORGANIZATION

Based on a review of the evaluation design matrix (see Section 1.1.3), the evaluation of the Program will include four studies, identified in Table 1.2, which will address each of the questions listed in the evaluation design matrix. These studies and the organization of the remaining elements of the report are outlined below:

- **Impact Assessment**—Section 2 describes the plan for evaluating the Program's impact in PYs 2009-2011. The weatherization network will be characterized, along with the nature and scope of the Program's implementation and weatherization processes. Energy and its subsequent costs savings will be quantified, along with non-energy impacts in order that the Program's cost-effectiveness can be determined. Explanatory factors pertinent to energy savings, energy costs savings, and cost-effectiveness will be identified.
- **Process Assessment**—Section 3 describes a process assessment that will examine how well the weatherization network and Program operated in during the ARRA period in delivering weatherization services, and how well the Program is exploiting opportunities for leveraging and partnership. Case studies of weatherization programs in territories will be performed. The national weatherization network will be approached to assess plans post-ARRA.
- **Special Studies**—Section 4 describes special studies that will be performed. These studies include an analysis of underperforming weatherized units; energy savings analyses for selected U.S. territories; SERC; and WIPP. To explore the feasibility of employing random control trial methods to estimate energy impact savings, an encouragement design study will be conducted. Lastly, an in-depth study of greenhouse gas emission reductions and further potential reductions at the local level will also be conducted.
- **Synthesis Study**—Section 5 describes how results from the evaluation work performed under Sections 2–4 will be synthesized to address how well the program is meeting its overall goals, the extent to which the program is serving the weatherization needs of the low-income community; and how the program's and weatherization network's performance can be improved. Lessons learned from both the retrospective and ARRA period evaluations will be identified.
- **Schedule**—Section 6 outlines a schedule for the evaluation.

It should be noted that under the terms of the Paperwork Reduction Act, the Office of Management and Budget (OMB) must approve most of the sampling plans and survey instruments associated with this evaluation. Therefore, the sampling plans and survey instruments presented in this preliminary evaluation plan may be modified during the OMB review process. However, once approved by OMB, they will not be subject to any substantive modifications.

1.3 COMPARISON OF WAP RETROSPECTIVE AND ARRA PERIOD EVALUATIONS

There are several important points to make regarding the similarities, differences, and overlaps between the retrospective evaluation of WAP as described in Ternes et al. (2007) and the WAP-ARRA evaluation described in the balance of this report. First, as Table 1.4 shows, the two evaluations generally encompass the same research tasks. For example, the central component of each evaluation is the collection of billing histories for homes heated with electricity and natural gas; these data provide the basis for the national estimate of energy savings attributable to the program as well as associated cost-effectiveness analyses. Non-energy impacts are assessed by both evaluations. Additionally, both evaluations administer a core set of surveys and data forms (e.g., S1: All States Program Information Survey). All of these tasks focus on the Program Years (PYs) indicated in the Table 1.4.

The third column of Table 1.4 shows that the retrospective evaluation overlaps with the ARRA period in five research areas. When the retrospective evaluation was conceived in 2005 and when the plan was written in 2006 and 2007, it was assumed that the Program would not undergo any major changes that could change the evaluation results. Thus, the retrospective evaluation was designed to estimate national energy savings and to constitute most of the process assessment for the immediately past Program Year (PY2008) while simultaneously implementing several research tasks during the Program Year in which the evaluation was to take place (i.e., PY 2009). When the retrospective evaluation began, though it was decided to look back to pre-ARRA Program Years 2007 and 2008, the ARRA period had already begun.

Thus, these five research tasks that are being funded by the retrospective evaluation are actually assessing weatherization activities that took place during the ARRA period: analysis of sub-metered data for homes heated with bulk fuels; a major indoor air-quality study; case studies of high-performing agencies and exemplary client-education programs; and the administration of two major surveys, S4 (Occupant Survey) and S5 (Weatherization Staff Survey).

Table 1.4 also indicates that a few of the tasks undertaken by the retrospective evaluation will not be duplicated by the WAP-ARRA period evaluation (and vice versa). For example, the retrospective evaluation will fund case studies of high-performing agencies and exemplary client-education programs, but the WAP-ARRA evaluation will not. Conversely, the WAP-ARRA period evaluation will fund case studies of underperforming weatherized units and one U.S. territory that received new, substantial ARRA funding (e.g., Puerto Rico), which, naturally, is not covered in the retrospective evaluation.

Table 1.4 Comparison of WAP Retrospective and WAP-ARRA Period Evaluations

	Retrospective Evaluation on Weatherization Assistance Program	Retrospective Evaluation Research Taking Place during (Overlapping with) ARRA Period	WAP-ARRA Period Evaluation Research
Analysis of Billing Histories: Homes heated with electricity and natural gas	Program Years 2007 and 2008		Program Years 2009, 2010, and 2011
Analysis of Submetered Data: Homes heated with propane and fuel oil		Winter 2010-2011 and Winter 2011-2012	
Analysis of Persistence of Energy Savings in Weatherized Homes			Program Years in the 1990s
Cost-effectiveness Analyses	Program Year 2008		Program Year 2010
Non-Energy Impacts	Program Year 2008		Program Year 2010
Social Network Study			Program Year 2011
GHG Emissions Study			Program Years 2007-2010
S1: All States Program Information Survey	Program Year 2008		Program Year 2010
S2: All Agencies Program Information Survey	Program Year 2008		Program Year 2010
S3: Subset of Agencies Detailed Program Information Survey	Program Year 2008		Program Year 2010
S4: Occupant Survey		CY's 2011 and 2012	CY2012
S5: Weatherization Staff Survey		CY 2011	CY 2012
Program Characterization	Program Year 2008		Program Year 2010
Case Studies		Program Year 2008 – Six High Performing Agencies and Six Exemplary Client Ed Programs	Program Year 2010 – One U.S. Territory
Weatherization Deferral Study			Program Year 2010
Under-Performers Study			Program Years 2007-2009
DF2/3: Housing and Building Information Data Forms	Program Year 2008		Program Year 2010
DF4: Utility Information from Agencies Data Form	Program Years 2007 and 2008		Program Years 2009, 2010, 2011
DF5: Utility Billing History Data Forms	Program Years 2007 and 2008		Program Years 2009, 2010, 2011
Indoor Air Quality		Winter 2010-2011, Summer 2011, Winter 2011-2012	
Field Process Study		CY 2011	
Special Studies			WIPP and SERC Program Years 2010-2011 ; Encouragement Design – Program Year 2011

2. IMPACT ASSESSMENT

The impact assessment portion of the evaluation will address many of the questions identified in the evaluation design matrix (see Table 1.2), especially those dealing specifically with the following:

- Context—Questions 3, 4, and 6;
- Implementation—Questions 1, 2, and 4; and
- Outcomes—Questions 1–9.

The context, implementation, and outcomes questions listed above deal with characterizing the weatherization network, the market that the Program serves, and the households served by the Program; identifying the services delivered by the Program and their costs; determining the Program's energy and non-energy benefits and cost-effectiveness; and understanding factors that have an impact on savings, cost-effectiveness, and other key Program metrics, such as the number of units weatherized.

In addition, the impact assessment will address the following high-priority and consensus goals that were identified by the Network Planning Committee:

- **Energy savings analysis**—reports energy savings by various subgroups and includes measured savings from propane and fuel-oil heated houses in the evaluation;
- **Baseload measures**—includes savings for all end uses in the measured savings from the Program;
- **Non-energy impacts**—quantifies non-energy impacts produced by the Program;
- **Cost-effectiveness**—determines the impacts of alternative per-household investment levels on cost-effectiveness; and

The impact assessment will be performed by executing five integrated studies, focusing on the performance of the Program in Program years 2009-2011:

1. The **Program Characterization** study will characterize the low-income population eligible for and in need of the Program and, for PY 2010, characterize the segment of this population served by the Program; the housing units and clients served; the weatherization and other services performed by the Program; and the Program's expenditures and funding sources.
2. The **Energy and Costs Savings** study will establish the total and per-household energy and cost savings (heating, cooling, and baseload) being achieved nationally and by climate region under the Program in Program years 2009-2011, classified by the principal building types served and primary fuel types used.
3. **Non-Energy Impacts** study will ascertain the non-energy impacts attributable to the Program in PYs 2009-2011 (especially those benefits addressing health and safety) and the value of those impacts from the client, utility, and societal perspectives;
4. The **Program Cost-effectiveness** study will estimate the cost-effectiveness of the Program in PYs 2009-2011 on a national and climate-region basis and will seek to clarify the impact that alternative per-household investment levels can have on cost-effectiveness and other Program metrics; and
5. The **Explanatory Factors** study will identify how specific weatherization measures and process variables correlate, both positively and negatively, with energy savings and cost-effectiveness.

Each of these studies is described in detail below, including an outline of the data that need to be collected to perform the study and how these data will be analyzed. For each study, a final report including all the details of the study will be written; a final summary report for the impact assessment will also be written to draw all the findings from the studies together.

2.1 PROGRAM CHARACTERIZATION STUDY

As mentioned in the introduction, the WAP during the ARRA period has been very different from the Program as it existed in the past. Not only are several key Program guidelines different (for example, the average allowable investment in homes was increased from $2500 to $6500), but the grantees and subgrantees faced numerous challenges with ramping up the weatherization production, complying with the Davis-Bacon Act, and handling other issues unique to ARRA. The impact assessment will collect key data on the Program's implementation and weatherization processes in order to describe the following:

- the low-income population eligible for the Program, in need of it, and actually being served by it;
- the weatherization network (community) and how it works; especially the organizations that administer the Program at the state and agency level (e.g., organization features and structure, staffing, operational processes, funding levels);
- the housing units that are served (including descriptors of their condition, state of repair, health and safety issues with respect to them, and the types of heating and cooling equipment installed), the clients served by the Program, and how they were selected for inclusion in it;
- the types of audit and diagnostic procedures used on the houses, the time when the diagnostics were performed relative to when measures were installed, and by whom the diagnostics were performed (e.g., auditor, crew, or inspector);
- the weatherization measures installed in the weatherized units (including repairs made, health and safety issues addressed, and client education provided), the installation methods employed, and by whom the measures were installed (contractor vs. in-house crew);
- other Program services performed on the weatherized houses and how they were delivered; and
- the Program's expenditures, expenditures per household, and funding sources.

The data to be collected and the analysis to be performed for the characterization study are presented below.

2.1.1 Data and Sampling Frames

The eligible low-income population will be characterized using data from the following three national databases:

- Residential Energy Consumption Survey (RECS) conducted by the U.S. Energy Information Administration
- Current Population Survey (CPS) from the U.S. Census
- American Housing Survey (AHS) from the U.S. Department of Housing and Urban Development.

A list of the data fields to be mined from these databases is provided in Table 2.1 below.

The entities that received WAP-ARRA period funding--all 50 states, the District of Columbia, and U.S. territories--will be asked to complete the S1 (All States Program Information Survey, see Appendix C) at the end of their PY 2010. As part of this survey, the following information on their PY 2010 and 2011 activities will be obtained from all states:

- general information on the characteristics of each state
- details on PY 2010 funding and expenditure
- characteristic data compiled at the state level on housing units weatherized in PY 2010
- characterization data on state staff experience and activity in PY 2010
- characterization data on training and monitoring performed at the state level in PY 2010.

All of the approximately 1000 agencies[2] (i.e., subgrantees) that have been or are being employed to implement the Program will be surveyed at the end of PY 2010, using the S2 (All Agencies Program Information Survey, see Appendix D), to collect information on

- PY 2010 funding and expenditure details
- agency-level compiled characteristic data on housing units weatherized in PY 2010.

Although agencies supply similar information to their respective states, this information will be collected from the agencies, not from the states, in order to get the information directly from the original source and to make sure the data are accurate and consistent across all states and agencies.

The 400 agencies included in the billing data sample (see Section 2.2.1) will be surveyed in the S3 (Subset of Agencies Detailed Program Information Survey, see Appendix E) at the end of their PY 2010. The following information will be obtained:

- general characteristic information on each agency,
- data characterizing agency staff experience and activity in PY 2010,
- data characterizing how the agencies implemented client selection in PY 2010, and
- data characterizing house audits, client education, training, and monitoring performed at the agency level in PY 2010.

[2] The number of local weatherization agencies increased to over 1000 during the ARRA period, from just over 900 in the pre-ARRA period.

Table 2.1. Data fields for this study from RECS, CPS, AHS databases

Data field	Definitions of data field terms
Low-income status	Defined by ARRA eligibility maximums (i.e., 200% of poverty level or 60% of state median income, whichever is higher)
State	
Census region	
Housing type	
Tenure	Ownership
Primary space-heating fuel type	
House energy features	Presence/absence of wall insulation, storm windows, etc.
Children	Presence of at least one child in household as defined by Program regulations
Elderly	Presence of at least one elderly person in the household as defined by Program regulations
Handicapped	Presence of at least one handicapped person in the household as defined by Program regulations
Single parent	
Ethnicity	
Income	Total household income
Source of income	
Nature of income	Fixed or not
Energy consumption	Total, heating, cooling, and baseload that are nominal and weather-adjusted
Energy expenditures	CPI adjusted; high energy expenditures as defined by Program regulations
Energy burden	Calculated from income and energy expenditures, with "high" energy burden as defined by Program regulations
Participation in public assistance programs	LIHEAP, Food Stamps, Temporary Assistance for Needy Families (TANF), Section 8, Public Housing, Medicaid, Supplemental Security Income (SSI)

For each weatherized housing unit or building included in the billing data sample (see Section 2.2.1), using the DF2 (Housing Unit Information Data Form, see Appendix F) or the DF3 (Building Information Data Form, see Appendix G), the following data will be collected from the agencies:

- detailed housing unit/building and occupant characteristics,
- identification of the diagnostics performed,
- diagnostic data measured by the agencies,
- identification of the measures installed, and
- costs for measures installed and other work performed.

The billing data sample includes data only on those housing units or buildings that use natural gas or electricity as their primary heating fuel. In order to fully characterize all housing units and buildings served by the Program (not just those heated by natural gas or electricity), information will be collected from the same 400 agencies used in the billing data sample on 25% of the housing units and buildings from each agency whose primary heating fuel is NOT natural gas or electricity. These data will be collected using DF2 (Housing Unit Information Data Form, see Appendix F) or DF3 (Building Information Data Form, see Appendix G).

The data requested in DF2 and DF3, above, are typically maintained in the records of each agency, so no additional information will need to be collected by the agencies. Agencies that store these data electronically will likely be able to provide it on all the housing units and/or buildings they weatherize rather than the 33% sample required for units and buildings heated by natural gas or electricity

(see Section 2.21.) or the 25% sample required for units and buildings heated by other fuels. These data will be collected just after the end of the agency's PY 2010.

2.1.2 Low-Income Weatherization Market Analysis

To get a broad picture of the low-income weatherization market, descriptive statistics on key attributes of the eligible population will be developed using data from RECS, CPS, and AHS. Households with incomes of 60% or less of their state's median income will be the focus of this analysis. The entire low-income population will be characterized, as well as the five subsets of the population allowed by DOE to receive priority service: households with elderly, children, or handicapped; and houses with high energy expenditures or high energy burdens. Other subsets of houses that may be studied separately if there are sufficient data in the databases include "low-efficiency" houses (e.g., houses with no attic insulation), houses of people on fixed incomes, and/or houses whose occupants receive a majority of their income from Social Security. The key attributes that will be studied include the following:

- housing characteristics (housing type, tenure),
- type of primary heating fuel,
- demographics (elderly, children, handicapped, single parent, and ethnicity),
- income,
- energy usage (total, heating, cooling, and/or baseload),
- energy burden,
- energy expenditures, and
- participation in other public-assistance programs.

These attributes will be presented nationally and by climate region in terms of means, medians, distributions, and other characteristics. They will also be cross-tabulated by other key attributes. Comparisons will be made between the low-income population and the national population, and among the findings from this evaluation, the retrospective evaluation, and the 1989 National Evaluation in order to identify changes since 1989.

A literature review will be conducted to explore the impact of energy expenditures on households eligible for the Program as well as on households with higher incomes that might also have difficulty paying their energy bills. This literature review will examine the issue of energy affordability across different income categories and will provide a description of the population in need of assistance in order to place the objectives of the Program in their appropriate context.

Using data collected from all states and agencies nationwide via the web-based survey, all the units weatherized by the Program in the program year will be characterized by the following key attributes:

- classification as DOE or non-DOE units,
- housing type,
- primary heating fuel,
- tenure,
- climate region,
- participation in other federal assistance programs,
- income,
- ethnicity,
- single-parent, and
- priority traits of occupants and houses for weatherization.

These attributes will be presented nationally and by climate region in terms of means, medians, distributions, and cross-tabulations with other key attributes. The results will then be compared to the characterization of the eligible population to identify the segments of the eligible population and eligible housing stock being served by the Program. Results will be presented in relative percentages and proportions nationally and by climate regions.

2.1.3 State and Agency Characterization Analysis

Local and state agencies will be characterized by key attributes, including the following:

- agency type and size,
- funding (both DOE and non-DOE),
- how funding is allocated by function (e.g., intake, auditing, training, weatherization, quality assurance monitoring),
- number of units weatherized (total and by funding source, with tagging to avoid duplicated counts),
- number of units on a waiting list,
- number of units referred to other programs,
- number of units receiving on-site services from non-energy programs, and
- number of staff/employees by role, tenure, training, experience, and those needing certification.

The scope and scale of agency involvement with other energy, housing, and low-income programs will be characterized and described. The location and status of the state agencies administering the Program within their state government organizations will be described, and the relationship of the state agencies to other energy, housing, and low-income programs will be characterized and described. Descriptive statistics will be presented nationally and by climate region in terms of totals, means, medians, and distributions, as appropriate.

2.1.4 Detailed Characterization of Program and Analysis of Implementation

The approaches used to select clients, audit houses, provide client education, train crews and agencies, and monitor agencies will be thoroughly characterized as part of the in-depth analysis to be performed on audits and client education under the impact assessment portion of this evaluation. Results from these characterization analyses will be used and integrated with the other characterizations being described in this section.

The client-selection process will be characterized by the outreach and marketing methods that are used to get clients to apply for the Program (i.e., how a waiting list is developed) and the methods used to select clients for weatherization from among the qualified applicants (i.e., from clients on a waiting list). These characterizations will be organized nationally and by climate region.

Using the detailed data collected on the housing units that will be used in the energy analyses, the houses and occupants weatherized under the Program will be further characterized by key attributes, including:

- building characteristics (e.g., building type, tenure, floor area, age, number of stories, condition/state of repair, health and safety problems present),
- equipment characteristics (e.g., primary and supplemental heating fuels, central heating system, air conditioning type), and
- occupancy characteristics (e.g., number of occupants; number of children, elderly, and/or handicapped; income; energy burden).

The key attributes will be characterized nationally and by climate region, primary heating fuel, and dwelling type. Distributions will be examined and reported as appropriate. Results will be integrated into the market analysis described in Section 2.1.2.

The frequency with which various weatherization measures are installed in houses under the Program will be reported and classified into eight major categories: air and duct leakage, insulation, window and doors, space heating equipment, cooling equipment, baseload, client education, and health and safety/repair. Subcategories will further refine these categories and will note different implementation approaches. For example,

- the insulation category will be broken down into attic, wall, and floor insulation, and wall insulation will be further divided into high-density and standard installation techniques;
- the baseload category will be broken down into specific water-heater measures, lighting, and refrigerators;
- the client education category will be divided by different client-education approaches; and
- health and safety/repairs will be classified as replacements of roofs, floors, doors, and windows; installation of smoke and CO detectors; electrical-system repairs; replacement of unsafe space heaters; replacement of broken air conditioners; and plumbing repairs.

These frequencies will be reported nationally and by climate region, and by primary heating fuel, dwelling type, and other subgroups. The frequency with which different measures are installed by contractors vs. crews will also be tabulated.

The frequency with which diagnostic techniques are used in weatherized houses will be reported for the various techniques (e.g., blower doors, infrared cameras). These frequencies will be reported nationally and by climate region, as well as by primary heating fuel, dwelling type, and other subgroups. For each technique, frequencies will also be tabulated on when the diagnostics were performed (e.g., during the audit, at time of measure installation, or during final inspection) and who performed the diagnostics (e.g., auditor, crew member, or inspector).

2.1.5 Program Funding and Costs Analysis

Using agency- and state-level data, financial resources used for weatherization at the local level (both DOE and leveraged, non-DOE) will be characterized, as well as how those resources are combined to weatherize individual units by unduplicated counts (i.e., units weatherized with funds from more than one funding source will not be double counted). These data will be presented nationally and by climate region. Performance requirements for non-DOE funding sources will be analyzed to determine how these compare and relate to requirements for the DOE program. A similar analysis has recently been performed for the Program by Economic Opportunity Studies (Power, 2003). This section will expand that study's analysis outside its formal evaluation budget form to meet the present needs of this evaluation.

Using house-level cost data collected for the energy savings analyses, the average installation costs (labor plus materials) per house will be determined nationally and by the following:

- climate region,
- building type,
- fuel type,
- tenure (ownership),
- type of installer (contractor or in-house crew),
- funding source, and
- possibly other categories.

Distributions will be examined and reported as appropriate. Prices paid for materials and measures will be assessed against market rates. Average per-house labor and material costs will be examined in a similar manner, as will material costs for individual measures (labor costs per individual measure will only be studied if consistent, high-quality data can be obtained from agencies; however, the availability of such data is not anticipated).

2.2. ENERGY AND COST SAVINGS

A major task for the impact evaluation is to estimate energy savings attributable to WAP in homes heated by natural gas and electricity; this study implements a quasi-experimental approach. It is understood that, all things being equal, a random control trial (RCT) approach would be preferred over a quasi-experimental approach. However, there are compelling reasons, explained in this subsection, why a quasi-experimental design has been chosen instead.

The retrospective study, which was also designed quasi-experimentally, was based on the WAP evaluation conducted two decades ago (when the last national evaluation of the Program was conducted).

The quasi-experimental design for the retrospective evaluation implemented probability-proportional-to-size sampling (PPS) to subsample 400 subgrantees (out of 1000) (discussed in more detail below). Sampling one-third of the units weatherized by these homes in a targeted program year (e.g., PY 2010) yields a treatment sample size of approximately 10,000 units (out of approximately 100,000 WAP weatherized per year pre-ARRA). The approach calls for an equal number of units to be in the control group. If the estimates in the variation in billing history data are found to be consistent over time, then the quasi-experimental design for the WAP-ARRA period evaluation will include about the same number in the local weatherization agency subsample and the same number of units in the treatment and control groups, but the sampling rates for the units will be about one-half that of the retrospective evaluation (i.e., one-sixth of units weatherized instead of one-third).

This choice of control group is reasonable because this group, like the treatment group, has self-selected to apply for weatherization services, and the two groups are likely to be similar in all variables correlated to energy use. (Historically, WAP has only served a small percentage of eligible homes [100,000 homes per year vs. a potential pool of approximately 35 million] and the observed homes going through the Program have had quite similar and constant characteristics for many years.

According to a recent GAO report, "program evaluation literature generally agrees that well-conducted randomized experiments are best suited for assessing effectiveness when multiple causal influences create uncertainty about what caused results."[3] The GAO report goes on to note, however, that randomized experiments "are often difficult, and sometimes impossible, to carry out," and that "requiring evidence from randomized studies as sole proof of effectiveness will likely exclude many potentially effective and worthwhile practices."[4] When randomized studies are impractical or impossible to carry out, quasi-experimental (QE) comparison group studies satisfactorily provide "rigorous alternatives to randomized experiments." For legal and practical considerations, we believe that a classical randomized control trial (RCT) approach cannot be implemented to evaluate WAP during the ARRA period.

[3] "Program Evaluation: A Variety of Rigorous Methods Can Help Identify Effective Interventions," GAO-10-30, November 2009.
[4] Ibid.

Additionally, the WAP is administered by States (i.e., grantees) through subgrantees who must prioritize WAP applicants in order to select them. The primary barrier to randomization in a WAP evaluation is in fact legislative priority constraints on how the subgrantees should prioritize WAP applicants. From the U.S. Department of Energy, Weatherization Assistance Program for Low-Income Persons, Title 10, Part 440 (Direct Final Rule, *Federal Register*, June 22, 2006)[5]:

> *Section 440.16 Minimum program requirements…(b) Priority is given to identifying and providing weatherization assistance to:*
> *(1) Elderly persons;*
> *(2) Persons with disabilities;*
> *(3) Families with children;*
> *(4) High residential energy users; and*
> *(5) Households with a high energy burden.*

Thus, Title 10, Part 440 essentially prohibits the purely random assignment of WAP applicants to control groups, meaning that the RCP approach is not possible.

In conjunction with Title 10, Part 440, there is also a practical and perceived moral obligation among subgrantees to provide services to all applicants—and particularly to high-priority applicants—as fairly and expediently as the Program will allow. This institutional resistance to random assignment to and the consequential delay of service to control groups would have to be overcome before an RCT could be correctly implemented. Changing existing practices would mean that the evaluation team would need to vigorously engage DOE WAP management and all the grantees and subgrantees to convince them all to change Program management processes to fit the needs of an RCT evaluation. This task is beyond the responsibilities of the evaluation team and would be virtually impossible to implement in time, given that we are already well into the ARRA period.

Despite the barriers to a classical RCT approach to WAP evaluation, we consider in Appendix S a hypothetical "split-winter" RCT that could be conducted in conjunction with the QE WAP evaluation study. By "split-winter," we mean that weatherization would be performed during one particular winter, and the total duration of the study would generally be less than in a full evaluation. Sample-size calculations for the split-winter RCT suggest that, even if the legislative and cultural barriers could be circumvented, this alternative RCT approach would still not be a good idea because of very large (and therefore expensive) sample-size requirements. This further supports the assumption that an RCT is not feasible in the WAP-ARRA context and that a carefully conducted QE study is a better approach.

The quasi-experimental approach that has been decided upon for this analysis includes these components:

- estimating variation in billing history data;
- estimating treatment and control group sample sizes;
- determining how many subgrantees (i.e., local weatherization agencies) need to be sampled;
- asking the subgrantees to provide lists of units weatherized during the program year under study;
- asking the sampled subgrantees to provide lists of units weatherized during the following program year to act as a control group;
- sampling units from these two lists to identify units for which billing histories will be collected; and

[5] See http://www.waptac.org/sp.asp?id=1812#minimum.

- contacting the appropriate natural gas and electricity utilities to collect the billing histories, one year pre- and one year post-weatherization.

Estimates of variation in billing history data were drawn from the retrospective study. For the WAP-ARRA period evaluation, estimates of variation can be drawn from analyses of billing histories from years 2006, 2007, 2008, and 2009. Currently, it is expected that billing histories will start to become available for analysis in Spring 2011. We expect to be able to have at least preliminary estimates of variation by the time ORNL submits its ICR and supporting statement for the WAP-ARRA period evaluation.

Adopting the quasi-experimental design approach, the evaluation will focus on estimating the following two aspects of energy and cost savings:

- total annual energy savings achieved from all units weatherized by the Program in PYs 2009, 2010 and 2011 (all fuels combined—natural gas, fuel oil, propane, electricity, etc.—representing a combination of all space-heating, cooling, and baseload energy uses in the houses); and
- average annual energy savings (calculated separately by electricity savings and energy savings for all non-electric primary space-heating fuels combined) achieved per household in PYs 2009, 2010 and 2011 nationally and by climate region, housing type, primary space-heating fuel type, and the five client groups that the Program is specifically instructed to focus on (i.e., the elderly, persons with disabilities, families with children, high residential energy users, and households with high energy burden).

The cost savings associated with the above energy savings will be calculated using regionally-dependent fuel costs; the estimated energy and cost savings for PYs 2009, 2010 and 2011 will be compared to results from the retrospective evaluation, the 1990 National Evaluation, and the meta-evaluations performed between 1990 and 2005. Although average energy and cost savings will be calculated in this study by region, housing type, and primary space-heating fuel type, a full analysis of factors affecting energy consumptions and savings will be performed (see Section 2.5).

Energy savings will be estimated based on a sample of housing units or buildings selected from each state in the nation. Billing data will be collected and analyzed on a majority of the housing units/buildings sampled. Energy savings estimated for individual housing units or buildings will be used to develop national estimates. Details are provided below.

2.2.1 Sampling Frame and Data

The following information will be needed to design and implement the energy analysis sampling frames described in this section:

- DOE funding received by each agency from ARRA;
- identification of agencies that weatherize a significant number of the following types of units: large multifamily units, large multifamily buildings heated by fuel oil, single-family houses heated by fuel oil, single-family houses heated by propane, or mobile homes heated by propane; and
- identification of agencies whose housing units or buildings are served by natural gas and electric utilities that will be cooperative in providing billing data for the evaluation.

This information will be collected as part of S1 (All States Program Information Survey, see Appendix C) administered to all states and territories and S2 (All Agencies Program Information Survey, see Appendix D) administered to all agencies just after the ends of PY 2010 and PY 2011.

Billing Data Sample—Natural gas and electricity billing data will be collected on a sample of the single-family houses, mobile homes, and both small and large multifamily housing units that were weatherized by 400 agencies in PYs 2009, 2010, and 2011. For each agency, all units whose primary heating fuel was natural gas or electricity will be sampled if utility account data and other information can be easily provided electronically by the agency; otherwise 16 percent of such units will be sampled (total number of units estimated to be approximately 10,000). Natural gas billing data will be collected on those units whose primary heating fuel was natural gas. Electricity billing data will be collected from all the sampled units. Billing data will be collected for at least 12 months before and 12 months after each unit's weatherization date. Billing data on a comparable number of control houses will also be collected.

The sample size of 400 agencies and 10,000 housing units was selected so that the nationwide total annual energy savings (and average energy savings per housing unit) attributable to the Program can be estimated to within ~15% of its actual value at a 90% confidence level after non-response and attrition are taken into account (see Appendix O for a detailed justification for this sample size). Agencies (and thus their housing units) are being sampled rather than sampling housing units directly from among all agencies nationwide because of the cost that would be involved in working cooperatively with ~1000 separate agencies. The 400 agencies will be selected in two steps: the number of agencies to be selected from each state will be determined, and then agencies within each state will be selected.

The selection of the 400 agencies will be stratified by state because such stratification

- controls for differences in geography, climate, housing stock, fuel types, and other factors;
- controls for the fact that each state administers its program differently (i.e., savings for homes or agencies are likely to be similar to other homes or agencies in the same state rather than a different state);
- ensures that each state will have at least one agency included in the sample; and
- ensures that data provided by states that wish to contribute resources to extend the survey in their states can be easily incorporated into the analysis, and the benefit to the state from doing so can be clearly seen.

The number of individual agencies that will be selected from each state will be in proportion to the amount (or "size") of the weatherization activity that occurs in each state. For the evaluation, "size" will be defined as the amount of DOE Program funding received by the state from ARRA funds. If, for example, a state received 10 percent of the Program's available ARRA funding, then 30 agencies (10 percent of 400) would be selected from that state. The number of agencies counted in a state will be rounded up to 2 even if its numerical proportion is 1.5 or less in order to ensure that an agency from each state is included in the sample, that standard deviations can be calculated for each state, and that the 14 hot-climate states are adequately represented (it is anticipated that this will be applicable in just three states). It should be stressed that the evaluation is not interested in comparing states, but that the method of stratification by states is being used to improve the sampling randomization and to minimize the sampling error.

Agencies will be selected within a state using PPS sampling, with "size" again defined as the amount of DOE Program funding received by the agency from ARRA funds. PPS sampling is a standard statistical method that will select agencies that are representative of the entire state but which preferentially selects larger agencies (i.e., agencies that receive more DOE Program funding) with a higher probability than smaller agencies. This sampling approach leads to estimates of totals that are more accurate than estimates based on simple random sampling (i.e., equal probability sampling).

In finalizing the selection of the 400 agencies, we believe it is advisable to consider input received from the agencies regarding the cooperation they expect from their local natural gas and electric utilities in providing billing data on weatherized houses. If an agency feels that the utilities with which it deals will not be cooperative, it is likely that inclusion of that agency in the evaluation would only lead to "loss" of houses counted because billing data will likely not be able to be collected. In this case, another agency will be selected in order to reduce the potential for non-response. Information on expected utility cooperation will be collected using S2 (All Agencies Program Information Survey, see Appendix D) administered to all agencies just after the ends of PYs 2010 and 2011.

In general, 16 percent of the housing units and buildings whose primary heating fuel is natural gas or electricity and that were weatherized by each agency will be randomly selected for inclusion in the sample. If an agency is able to provide in electronic form utility account information on all the natural gas and electrically heated units or buildings it weatherized in PYs 2009, 2010 and 2011, all such units and buildings weatherized by the agency will be included in the billing data sample (as long as no undue burden is placed on the agency). If, after the 400 agencies and the estimated 10,000 housing units are selected, it is determined that additional housing units or buildings are needed to ensure coverage of important subgroups (such as multifamily buildings, rural housing, or housing units from the 14 hot climate states), additional housing units will be selected from the 400 agencies as needed. At least seven housing units will be selected from each agency to ensure that three housing units remain for each agency after non-response and attrition are considered.

For each house and building included in the billing data sample, the names of the electric and gas (if applicable) utilities, account numbers, weatherization period, and waiver (release) forms will be collected from the agencies, along with the other housing unit and building information described in Section 2.1.1 using the DF2 (Housing Unit Information Survey, see Appendix F) or the DF3 (Building Information Survey, see Appendix G).

The evaluation team will collect the actual electricity and natural gas billing data directly from the utilities (at least 12 months of bills before weatherization and 12 months of bills after weatherization), although agency assistance may be needed in the collection of these data. Natural gas billing data will be collected on those housing units and buildings whose primary heating fuel was natural gas. Electricity billing data will be collected on all housing units and buildings sampled (i.e., both those whose primary heating fuel was electricity and those whose primary heating fuel was natural gas). For multifamily buildings, natural gas and electricity bills will be collected for all master meters as well as for all meters serving the individual apartment units. Utilities will be asked to provide data for each address regardless of occupancy changes and to note when occupancy changes occurred, as these data will be used in the study of non-energy impacts (see Section 2.3.1). The following will be done in order to improve the response rate for the billing data requests:

- an appropriate person at each utility will be contacted to smooth out the process,
- the billing data requests will be planned so that data for multiple housing units and buildings are requested from a utility at one time,
- billing data will be requested at regular intervals to reduce the chance that the utilities will not be able to provide data that have already been archived and no longer readily accessible, but the number of such requests will be limited so that utilities have to provide data a limited number of times during the course of the evaluation, and
- assistance from utility regulatory commissions and similar organizations will be solicited as needed.

A control group for the billing data sample will be developed using housing units and buildings weatherized by the same agencies in the PY immediately following. So for example, the control group for homes weatherized in PY 2010 would be homes weatherized in PY 2011. Such a control group will have characteristics that are similar to the weatherized group because they are houses and buildings served by the same agencies; in addition, the client self-selection that led to clients' applying for weatherization assistance will be the same, and the selection process used by the agencies will be the same. The number of control housing units and buildings selected from each agency will be approximately the same as the number of weatherized units sampled from that agency. Controls will be selected from each agency throughout the PY so that pre- and post-weatherization periods for the control units will be similar to those for the weatherized units. Controls will be randomly selected within each agency after building type and primary heating fuel are considered, so that these general characteristics closely match those for the weatherized group. The use of Low Income Home Energy Assistance Program (LIHEAP) participants who received benefits is not recommended because occupant, housing, and other characteristics of these participants may be quite different from the housing units and clients served by the Weatherization Assistance Program.

2.2.2 Energy Analysis

For the energy analysis, energy savings for individual housing units and buildings, normalized to a typical-weather year, will be estimated using data and approaches that depend on the building type (see Appendix P for a detailed definition and description of the building types that will be used in the evaluation) and on whether billing data or sub-metered data were collected. Weather-normalized savings estimates for individual houses and buildings will then be used to estimate the total annual energy savings or average annual per-household energy savings for the Program. Energy-savings estimates will be converted to cost savings using known fuel costs.

Energy Analyses Using Billing Data—Billing data collected on housing units or buildings will be analyzed using three different methods:

- the Princeton Scorekeeping Method (PRISM) as outlined in more detail in Appendix R;
- the ORNL Aggregate Method as outlined in Appendix R; and
- a third method based on a review of the state-of-the-art techniques such as Statistically Adjusted Engineering (SAE) models, Analysis of Covariance (ANOVA) models, Conditional Demand Analysis (CDA), and fixed-effect models (Hall, 2006; Hall 2004).

For houses or buildings using natural gas as the primary space-heating fuel, two analyses will be performed using each of the three methods: one analysis to determine the weather-normalized savings in the space-heating fuel and another analysis to determine the weather-normalized electricity savings.

PRISM, one of the analysis methods used in the retrospective evaluation, was also the primary method used in the 1989 National Evaluation. It has been recommended that methods other than PRISM be used to supplement and/or serve as an overall check on the PRISM analysis (especially in the hot-climate region, where attrition has been high in previous studies and statistically significant savings have been difficult to measure). Simple methods, such as using simple degree-day adjustments or summing up seasonal usage, have been suggested to reduce model failures when PRISM is used and to avoid the subsequent bias that can be introduced. The ORNL aggregate model was selected as a primary alternative method that will be used because, like PRISM, it identifies baseload consumption and allows uncertainties in estimated parameters and calculated values to be determined with a statistical basis. A second alternative method will be selected after a review of the most current methods.

Annual Program Energy Savings—The total annual energy savings achieved by the Program in PYs 2009, 2010 and 2011 will be estimated using the weather-normalized saving estimates for the individual houses and buildings sampled and a statistical approach based on how these houses and buildings were sampled. As outlined below, the total annual energy savings achieved by each state in PYs 2009, 2010 and 2011 will be estimated, and these state values will then be summed to calculate the total annual energy-savings estimate for the Program. State savings are being estimated as an intermediate value to estimating the Program savings because the selection of agencies (and hence housing units and buildings) was stratified by state. Also, the best estimator for savings achieved in housing units and by agencies within a state are savings measured in other housing units and by other agencies within that same state because of differences in how states implement the Program (e.g., what measures are installed, how measures are installed, etc.). The total energy-savings estimates for each state and the Program will be calculated on both a site and source basis.

For each state, the cells in Table 2.2 will be filled in and summed to calculate the total annual energy-savings estimate for the state as follows:

- The savings estimate for each cell involving natural gas or electricity use will be calculated using the weather-normalized savings estimates for the individual houses and buildings sampled in the state, along with appropriate weighting factors, which are based on how the agencies were sampled, the size of the agencies, the number of houses sampled, the number of houses weatherized in the state, etc. Weather-normalized savings estimates for the individual housing units and buildings will be those calculated using PRISM, the ORNL Aggregate Method, the third method chosen, or a combination of these, especially for cell entries based on normalized annual consumptions (NACs) that cannot be well determined, as, for example, analyzing the electricity use in homes where electricity is not the primary heating fuel or fuel use in homes in hot climates with little heating load).
- For cells involving fuel oil and propane, energy savings will be estimated based on the results of the fuel-oil and propane monitored samples from the retrospective evaluation.
- For the "other" cells, engineering estimates will be made based on savings measured for other cells in that state. It is anticipated that engineering estimates will only be required for cells that represent a small percentage of the units weatherized in a state because of the breadth of the proposed sampling plan.

Electricity savings on all sampled houses will be estimated (in part to address space cooling, especially in the hot-climate region) and to include savings from baseload energy uses in the total Program energy-savings estimate. The analysis approach presented above accomplishes this. Electricity consumptions and savings will be estimated in all sampled houses and buildings (not just those that are electrically heated). The analysis of natural gas and electricity billing data will include baseload uses as well as space heating and space cooling.

The average annual energy savings per household achieved by the Program will be estimated in a manner similar to that for the total annual energy savings described above, except that savings will be normalized by the number of units weatherized. Average energy savings will be calculated on both an absolute and percentage basis, and separately by electricity and all other primary space-heating fuels combined. Average annual per household energy savings will be calculated by climate region, housing type, primary space-heating fuel type, and various combinations of these categories, as well as by the five client groups that the Program is specifically encouraged to focus on (i.e., the elderly, persons with disabilities, families with children, high residential energy users, and households with high energy burden). Four climate regions consistent with those used in the retrospective evaluation and 1989 National Evaluation will be used: cold climate, moderate climate, hot-humid climate, and hot-dry climate).

Table 2.2. Total annual Program energy savings

Building type/ Primary space-heating fuel	Number of units served by the Program	Non-electric fuels (Btu)	Electricity (kWh)	Total (Btu)	
				Site	Source
Single-family:					
Natural gas					
Electricity					
Fuel oil					
Propane					
Other					
Mobile home:					
Natural gas					
Electricity					
Fuel oil					
Propane					
Other					
Small multifamily:					
Natural gas					
Electricity					
Fuel oil					
Propane					
Other					
Large multifamily:					
Natural gas					
Electricity					
Fuel oil					
Other					
Total					

The total annual energy savings and the average annual per household energy savings described above will be calculated two ways when PRISM results are used. First, results will be calculated using only those houses or buildings that have typical indicators of model reliability (coefficient of determination (R^2) and coefficient of variance (CV) of the normalized annual consumption that pass standard PRISM criteria (or equivalent for the sub-metered models). This is consistent with past evaluations and is done to eliminate houses and buildings that have models with poor predictive ability from the analysis. Secondly, because of concerns that eliminating such houses and buildings may introduce bias into the results, additional results will be calculated using those houses that pass a more relaxed set of criteria and/or a minimum set of criteria (essentially all houses and buildings). In all cases, a "flatness index" available in PRISM will be used to pass additional houses and buildings that would otherwise fail the PRISM criteria. The flatness index identifies houses and buildings with neither a strong heating nor cooling signal (where R^2 is very low) but with a normalized annual consumption that is well determined. This occurs, for example, in examining the space-heating fuel use in a house in a warm climate that has little heating load, the electricity use of a house in a cold climate that has little cooling load, and the electricity use of a house in any climate without an air conditioner. Also, in all cases, outliers will be identified, data quality will be carefully checked, and outliers possibly screened.

In calculating the total annual energy savings and the average annual per-household savings as described above, occupancy changes (and the subsequent large fluctuation in energy consumption that may result) will not cause a house or building to be removed from the analysis. The Program is intended to increase the energy efficiency of low-income housing, and occupancy changes occur naturally in such houses. This is consistent with the approach taken in the retrospective evaluation and 1989 National Evaluation but somewhat atypical of other weatherization evaluations. If desired and deemed necessary, separate analyses with and without occupancy changes will be performed. One concern in automatically dropping such housing units is that large sample attrition may result because low-income housing can have high turnover rates. Another concern is that bias could be introduced because housing units with occupancy changes may have different energy-related characteristics than housing units without occupancy changes and the characteristics and behaviors of movers could be different from that of people who do not move.

The total annual energy savings and the average annual per household savings calculated above will be calculated with and without adjustments for savings in a comparable set of control homes and buildings (i.e., both gross and net results will be presented). Inclusion of a control group (i.e., adjustment of savings for weatherized housing units by the savings for the control group) allows estimation of energy consumption changes that would have occurred in the absence of the Program and controls for factors such as occupant behavior and fuel prices that influence housing-unit energy consumption.

It is desirable to help states that want to determine the savings in their specific state using both data collected under this evaluation and supplemental data collected specifically for that state. The evaluation approach presented in this section easily allows for this since data are being collected in each state and savings are built up by state. Additional funding will be provided by the states or from some other sources to (1) determine what additional data need to be collected needed to perform a state-level analysis, (2) develop the necessary sampling plans and survey instruments, (3) collect the additional data, (4) analyze the additional data together with information already collected under this evaluation in the state, and (5) write a report for the state. The supplemental information collected for an individual state will be incorporated into the analysis performed for the national evaluation by using it, together with data collected in that state under the evaluation, to develop state values.

Cost Savings—The energy savings estimated above will be converted to cost savings using the best available fuel-cost data, which are based on the actual costs incurred by the weatherized homes used in the analysis discussed in this section. Average published fuel-cost data are unlikely to match the

climate regions being used in the evaluation and are likely representative of all households rather than just low-income households. Therefore, fuel-cost data obtained for the homes in the energy analyses should be used to convert energy savings into cost savings. Special care will be taken in converting energy savings into cost savings if costs were especially volatile over the Program year.

Sensitivity Analysis—After all energy and cost savings are calculated, a sensitivity analysis will be conducted to see how out-year estimates of energy and costs savings might change in response to variation in key driving factors, such as changing demographics in the houses, loss of housing stock, volatility in fuel costs, new technology, and climate change. The results of this analysis will be used in the sensitivity analyses performed for non-energy impacts (see Section 2.3.1) and cost-effectiveness (see Section 2.4).

2.2.3 Measures Analysis

Lastly, an in-depth analysis of the measures installed will be conducted. This is a particularly important task for this WAP-ARRA period evaluation because during this time, the average investment in homes increased from $2500 to $6500. This task will answer the question: How did the packages of measures installed in homes change from PY 2008 to PY 2010?

Several analytical techniques will be applied. First, descriptive statistics that compare the absolute number of measures by type of measure installed in PY 2008 vs. PY 2010 will be produced. Second, percentages of each measure installed (out of all measures installed) will be calculated for both program years. Third, the average number of measures installed per home for both program years will be calculated. Fourth, the probabilities that any particular measure will be installed in a home will be calculated for both program years. Fifth, cluster analyses will be done to explore if there are regular groupings of installed measures and to assess whether the most common measure packages changed between program years. These statistics will be calculated nationally and also by climate region and house type (e.g., single family, mobile home). This information should provide a comprehensive picture of changes in measure installation from PY 2008 to PY 2010.

2.2.4 Attribution Methodology

While the Program is the major driving force behind the weatherization of low-income homes in the United States, the Program's resources are leveraged by several other parties and programs, including LIHEAP, PVE, public benefits funds, states, utilities, and non-profit organizations. It is important to properly attribute energy savings and energy cost savings to those parties that, along with DOE, contribute financial and in-kind resources to weatherize low-income homes.

This evaluation will develop a methodology to allow energy savings and energy cost savings to be attributed to the set of parties mentioned above based on well-known concepts found in the field of decision analysis. Generally, the methodology will be based on concepts used in multi-criteria decision-making, which includes such tools as decision matrices and evaluation criteria. More specifically, the methodology will categorize weatherization into a finite set of activities and functions (program management, outreach and marketing, client selection, audit and measure selection, measure installation, and training). The contributions of the parties to these activities and functions will be estimated using information collected from all the states as part of S1 (All States Program Information Survey, see Appendix C) and from the 400 agencies included in the billing data sample as part of S3 (Subset of Agencies Program Information Survey, see Appendix E). The influence of these activities and functions on energy savings and cost savings will be estimated by a panel of experts. Using the two sets of estimates and a decision-matrix approach, the accurate attribution of energy savings and cost savings appears to be fairly technically straightforward . If the panel of experts feels that the influences of the activities and functions on savings vary by known state characteristics (e.g., states with that have utility

weatherization involvement vs. those that do not), then the analysis could be performed by categories of states to build up the appropriate national attribution values.

The challenges to implementing an attribution methodology are likely not to be so much technical as related to the process. For example, one important question relates to who should be involved in making the two sets of estimates described above (although an approach is outlined above). How should the estimates be generated if several parties are involved? How should disagreements among the parties about the estimates be resolved? Lastly, the scale of the attribution methodology needs to be carefully considered. It is assumed that the methodology will be developed within a national context. However, various parties may request that the methodology be applied on a state-by-state basis. This latter approach may require considerably more data collection and would certainly require much more effort to generate the two sets of estimates for every state. Therefore, the process parameters must be clearly established in order to achieve a meaningful, accurate, and efficient survey.

2.3 NON-ENERGY IMPACTS

As part of the impact assessment, the non-energy impacts (NEIs) attributable to the Program that affect the clients served, the ratepayers, the utilities, and society will be ascertained. Table 2.3 shows the primary non-energy impacts that have been identified to date and that will be quantified in this evaluation. Schweitzer and Tonn (2002) identified most of these non-energy impacts as being applicable to the Program and provide a detailed discussion of each. It is important to note that the project team will have the flexibility to consider new impacts, new metrics, and new values for existing metrics, as long as such investigation does not involve the collection of primary data not previously approved by OMB under the terms of the Paperwork Reduction Act (PRA).

In addition to the non-energy impacts identified in Table 2.3, the number of actions taken by weatherization providers to improve health and safety (e.g., fix broken flues, replace cracked heat exchangers) will be reported as part of this evaluation.

Table 2.3 also quantifies each of the primary non-energy impacts as a monetized or non-monetized value. Definitions of these terms for the purpose of this evaluation follow.

- **Monetized value**—For most of the Program-generated non-energy impacts, a monetary value (annual dollar value and lifetime net present dollar value) will be calculated nationally (and possibly by climate region) from different perspectives (client, utility/ratepayer, and society) using a computer model or some other mechanism for performing the necessary calculations. The major inputs for these calculations include household-level data gathered for this national evaluation, a large set of performance metrics describing key Program outputs, and a set of monetized metrics that converts performance measures into dollar values. The dollar value of each monetized impact is calculated by taking the number of relevant household-level activities reported, multiplying that number by the appropriate performance metric, and multiplying that product by the matching monetized metric. Both a point estimate and a confidence interval are expected to be calculated for each impact, in recognition of the uncertainty surrounding these estimates. The "monetized value" will represent the net economic value of the impact, as both costs and benefits associated with the impact will be included. However, monetized values will be calculated only where a specific identifiable expense is avoided or incurred, or where a clear monetary impact is obtained. Subjective approaches to calculating the dollar value of non-energy impacts (e.g., using willingness-to-pay or relative-valuation approaches) will not be used in this evaluation.

- **Non-monetized value**—For a sizable minority of Program-generated non-energy impacts, all of which fall under the broad umbrella of "safety, health, and comfort," a non-monetary value will be calculated. Most of these non-monetary values will come from surveys of occupant perceptions, but some will come from the direct measurement of such key factors as indoor air temperature and humidity levels. In assessing the value of these non-monetized impacts, the performance metrics will be calculated directly from the relevant household-level data.

Table 2.3 shows the household-level data that will be used as a basis for calculating each non-energy impact, as well as for calculating the performance metric and the monetized metric (where applicable) associated with each specific impact.

Under the impact assessment, data will be collected to update some of the performance and monetized metrics needed from earlier estimates before calculating values for the monetized non-energy impacts. In updating these metrics, both costs and benefits will be considered so that net economic values are developed. In addition, household-level data will be collected and analyzed to directly calculate values for the non-monetized impacts. The required data collection and analyses are described more fully below.

Table 2.3. Non-energy impacts and the household-level data and metrics required to calculate their value

Impact Categories and Specific Impacts	Type of Value Calculated	Household-Level Data (used as basis for calculating the value of impacts)	Performance Metric (to be multiplied by household-level data for monetized impacts and calculated from household-level data for non-monetized impacts)	Monetized Metric (to be multiplied by Performance Metric unless the two are identical)
I. Utility/Ratepayer Impacts				
A. Payment-Related Impacts				
1. Rate subsidy payments avoided by state aid agencies	Monetized	Number of households weatherized	Average reduction in number of subsidized units of energy sold per weatherized household	Cost to utility per subsidized unit of energy sold
2. Lower rate of bad debt write-offs	Monetized	Number of households weatherized	Average reduction in amount of bad debt written off by utility per weatherized household	Same as Performance Metric
3. Reduced carrying cost on arrearages	Monetized	Number of households weatherized	Average dollar reduction in arrearage per weatherized household	Interest due utility per dollar of arrearage
4. Fewer notices and customer calls	Monetized	Number of households weatherized	Average reduction in number of notices sent and calls made to customers, per weatherized household	Average cost to utility per notice sent and call made
5. Fewer shut-offs and reconnections for delinquency	Monetized	Number of households weatherized	Average reduction in number of customer shut-offs and reconnections made by utility, per weatherized household	Average cost to utility per shut-off and reconnection
6. Reduced collection costs for delinquent payments	Monetized	Number of households weatherized	Average reduction in number of collections made by utility per weatherized household	Average cost to utility per collection
B. Service Provision Impacts				
1. Fewer emergency gas service calls	Monetized	Number of households weatherized	Average reduction in number of emergency service calls made per weatherized household	Average cost to utility per service call
2. Reduction in transmission and distribution losses	Monetized	Electricity savings (in kWh) in weatherized houses	Average amount of electricity lost in transmission and distribution, per kWh sold	Average cost to utility per unit of lost electricity
3. Insurance savings	Monetized	Number of households weatherized	Average reduction in utility's cost for insurance to cover household fires and explosions, per weatherized household	Same as Performance Metric

Table 2.3. Non-energy impacts and the household-level data and metrics required to calculate their value

Impact Categories and Specific Impacts	Type of Value Calculated	Household-Level Data (used as basis for calculating the value of impacts)	Performance Metric (to be multiplied by household-level data for monetized impacts and calculated from household-level data for non-monetized impacts)	Monetized Metric (to be multiplied by Performance Metric unless the two are identical)
4. Shifted fixed costs to utilities	Monetized	Number of households weatherized	Average energy savings in weatherized houses	Change in fuel cost per unit of energy savings to cover fixed costs
II. Impacts on Participating Households				
A. Affordable Housing Impacts				
1. Water and sewer service savings	Monetized	Number of water-saving devices installed in weatherized houses	Average water savings (in gallons) per device installed	Cost of water and sewer service per gallon of water
2. Property value impacts	Monetized	Number of households weatherized	Average cost of structural repairs per weatherized household	Same as Performance Metric
3. Avoided shut-offs and reconnections	Monetized	Number of households weatherized	Average reduction in number of shut-offs and reconnections, per weatherized household	Average cost to customer per shut-off (for "lost rent" and restart fee)
4. Reduced mobility	Monetized	Number of households weatherized	Average reduction in number of moves per weatherized household	Average cost per move
5. Reduced transaction costs	Monetized	Number of households weatherized	Average number of hours required to become familiar with energy-saving products per household	Average cost per hour of time (use minimum wage for this calculation)
B. Safety, Health, and Comfort Impacts				
1. Fewer fires	Monetized	Number of households weatherized	Average reduction in number of fires per weatherized household	Average monetary loss to household (property, injury, and death) per fire
	Non-monetized	Occupant perceptions of household fire safety before and after weatherization	Perceived changes in safety of heating system and electrical wiring in weatherized houses	Not applicable
2. Changes in frequency of health problems	Non-monetized	Occupant perceptions of general health and safety before and after weatherization	Perceived change in health problems in weatherized houses	Not applicable

Table 2.3. Non-energy impacts and the household-level data and metrics required to calculate their value

Impact Categories and Specific Impacts	Type of Value Calculated	Household-Level Data (used as basis for calculating the value of impacts)	Performance Metric (to be multiplied by household-level data for monetized impacts and calculated from household-level data for non-monetized impacts)	Monetized Metric (to be multiplied by Performance Metric unless the two are identical)
	Monetized	Number of households weatherized	Average reduction in number of workdays lost due to health problems per weatherized household	Average cost to household per lost work day
	Non-monetized	Occupant reports on incidence of symptoms or occurrences of specific health problems before and after weatherization	Change in incidence of symptoms or occurrences of specific health problems in weatherized houses	Not applicable
3. Enhanced prevention and treatment of health problems	Non-monetized	Occupant reports on number of times food purchases were postponed or not made in order to pay utility bills before and after weatherization	Reduction in number of times food could not be purchased due to size of utility bill in weatherized houses	Not applicable
	Non-monetized	Occupant reports on access to health care and medication before and after weatherization	Change in access to and ability to pay for health care and medication in weatherized houses	Not applicable
4. Changes in indoor air quality	Non-monetized	Measured CO levels before and after weatherization	Measured change in CO levels in weatherized houses	Not applicable
	Non-monetized	Measured levels of indoor airborne mold spores relative to outdoor levels before and after weatherization	Measured change in level of indoor airborne mold spores relative to outdoor levels in weatherized houses	Not applicable

Table 2.3. Non-energy impacts and the household-level data and metrics required to calculate their value

Impact Categories and Specific Impacts	Type of Value Calculated	Household-Level Data (used as basis for calculating the value of impacts)	Performance Metric (to be multiplied by household-level data for monetized impacts and calculated from household-level data for non-monetized impacts)	Monetized Metric (to be multiplied by Performance Metric unless the two are identical)
	Non-monetized	Measured levels of indoor airborne pollen relative to outdoor levels before and after weatherization	Measured change in level of indoor airborne pollen relative to outdoor levels in weatherized houses	Not applicable
	Non-monetized	Occupant perceptions of odors that could indicate a problem with indoor air quality	Perceived change in frequency of odors within weatherized houses	Not applicable
5. Changes in household moisture levels	Non-monetized	Measured levels of indoor humidity before and after weatherization	Measured change in humidity levels in weatherized houses	Not applicable
6. Decreased incidence of hypothermia and hyperthermia	Monetized	Number of households weatherized	Average reduction in number of times emergency medical care is sought due to heat stress or overexposure to cold per weatherized household	Average cost of emergency medical care at hospital, emergency room, or urgent care facility
	Non-monetized	Occupant reports on incidence of students' disrupted study due to excessive heat or cold before and after weatherization	Change in incidence of students' disrupted study in weatherized houses	Not applicable
7. Improved food safety	Non-monetized	Measured temperature in refrigerator before and after weatherization	Measured change in refrigerator temperature in weatherized houses	Not applicable

Table 2.3. Non-energy impacts and the household-level data and metrics required to calculate their value

Impact Categories and Specific Impacts	Type of Value Calculated	Household-Level Data (used as basis for calculating the value of impacts)	Performance Metric (to be multiplied by household-level data for monetized impacts and calculated from household-level data for non-monetized impacts)	Monetized Metric (to be multiplied by Performance Metric unless the two are identical)
	Non-monetized	Occupant reports on number of incidents of gastrointestinal problems and food poisoning before and after weatherization	Change in incidence of gastrointestinal problems and food poisoning in weatherized houses	Not applicable
8. Improved household safety and security	Monetized	Number of households weatherized	Average reduction in number of times emergency medical care is sought for injuries from tripping and falling in the home	Average cost of emergency medical care at hospital, emergency room, or urgent-care facility
	Monetized	Number of households weatherized	Average reduction in number of times emergency medical care is sought for burns from scalding from domestic hot water	Average cost of emergency medical care at hospital, emergency room, or urgent-care facility
	Non-monetized	Occupant perceptions of security of home from criminal intrusion before and after weatherization	Perceived change in security from criminal intrusion in weatherized houses	Not applicable
	Monetized	Number of households weatherized	Average reduction in number of break-ins per weatherized household	Average value of items stolen in break-in
9. Change in presence of environmental hazards	Non-monetized	Measured levels of asbestos and radon in houses before and after weatherization	Measured change in levels of asbestos and radon in weatherized houses	Not applicable
	Non-monetized	Reports on incidence of poisoning from household chemicals before and after weatherization	Change in number of poisonings from household chemicals in weatherized houses	Not applicable

Table 2.3. Non-energy impacts and the household-level data and metrics required to calculate their value

Impact Categories and Specific Impacts	Type of Value Calculated	Household-Level Data (used as basis for calculating the value of impacts)	Performance Metric (to be multiplied by household-level data for monetized impacts and calculated from household-level data for non-monetized impacts)	Monetized Metric (to be multiplied by Performance Metric unless the two are identical)
	Non-monetized	Occupant reports on level of household infestation with vermin before and after weatherization	Change in level of vermin infestation in weatherized houses	Not applicable
10. Improved comfort	Non-monetized	Occupant perceptions of indoor comfort (temperature and draftiness) before and after weatherization	Perceived improvement in indoor comfort (temperature and draftiness) in weatherized houses	Not applicable
	Non-monetized	Measured indoor air temperature before and after weatherization	Measured change in indoor air temperature in weatherized houses	Not Applicable
11. Improved appearance	Non-monetized	Occupant perceptions of appearance of dwelling before and after weatherization	Perceived improvement in appearance of weatherized dwellings	Not Applicable
12. Reduced noise inside dwelling	Non-monetized	Occupant perceptions of noise level within dwelling before and after weatherization	Perceived reduction in noise within weatherized dwellings	Not applicable
III. Societal Impacts				
A. Environmental Impacts				
1. Air emissions: CO2	Monetized	Units of energy saved in weatherized houses	Pounds of CO2 emitted per unit of energy saved	Value of CO2 emission reduction in dollars per pound
2. Air emissions: SOx	Monetized	Units of energy saved in weatherized houses	Pounds of SOx emitted per unit of energy saved	Value of SOx emission reduction in dollars per pound

Table 2.3. Non-energy impacts and the household-level data and metrics required to calculate their value

Impact Categories and Specific Impacts	Type of Value Calculated	Household-Level Data (used as basis for calculating the value of impacts)	Performance Metric (to be multiplied by household-level data for monetized impacts and calculated from household-level data for non-monetized impacts)	Monetized Metric (to be multiplied by Performance Metric unless the two are identical)
3. Air emissions: NOx	Monetized	Units of energy saved in weatherized houses	Pounds of NOx emitted per unit of energy saved	Value of NOx emission reduction in dollars per pound
4. Air emissions: CO	Monetized	Units of energy saved in weatherized houses	Pounds of CO emitted per unit of energy saved	Value of CO emission reduction in dollars per pound
5. Air emissions: CH4	Monetized	Units of energy saved in weatherized houses	Pounds of CH4 emitted per unit of energy saved	Value of CH4 emission reduction in dollars per pound
6. Air emissions: PM	Monetized	Units of energy saved in weatherized houses	Pounds of PM emitted per unit of energy saved	Value of PM emission reduction in dollars per pound
7. Air emissions: heavy metals	Monetized	Units of energy saved in weatherized houses	Pounds of heavy metals emitted per unit of energy saved	Value of heavy metal emission reduction in dollars per pound
8. Fish impingement	Monetized	Units of electricity saved in weatherized houses	Number of fish impinged at power plants per unit of electricity saved	Dollar value per impinged fish
9. Wastewater and sewage in electricity production	Monetized	Units of electricity saved in weatherized houses	Amount of wastewater and sewage (in gallons) produced per unit of electricity saved	Cost per gallon of treating wastewater and sewage
B. Social Impacts				
1.Jobs for unemployed workers	Monetized	Dollars spent to weatherize client homes	Average number of unemployed workers given jobs per dollar spent on weatherization	Average cost of unemployment benefits paid per unemployed worker
C. Economic Impacts				
1. Direct and indirect employment	Monetized	Dollars spent to weatherize client homes	Average number of direct and indirect jobs created per dollar spent on weatherization	Taxes paid (local, state, and federal) and dollars spent locally, per job created
2. Lost rental	Monetized	Number of rental households weatherized	Average amount of unpaid rent per weatherized rental household before and after weatherization	Same as Performance Metric

Table 2.3. Non-energy impacts and the household-level data and metrics required to calculate their value

Impact Categories and Specific Impacts	Type of Value Calculated	Household-Level Data (used as basis for calculating the value of impacts)	Performance Metric (to be multiplied by household-level data for monetized impacts and calculated from household-level data for non-monetized impacts)	Monetized Metric (to be multiplied by Performance Metric unless the two are identical)
3. National security	Monetized	Units of source energy saved in weatherized houses	Average proportion of source energy used for residential purposes that is normally imported	"Premium" paid in higher prices and disturbance to economy per unit of imported energy

Care will be taken to avoid double-counting any non-energy impact and to make sure that measured impacts are truly attributable to the Program (e.g., by use of control groups). In addition, the non-energy impacts addressed in this evaluation will not include the impact of market transformation, which can be thought of as additional energy savings that "spill over" from direct program effects. The possible differences between non-energy impacts achieved in urban and in rural areas are also not subjects of this evaluation.

2.3.1 Monetized Data Collection and Analysis

To calculate the monetary values of selected non-energy impacts, coefficients for the performance metrics and monetized metrics will be acquired either from previous research on non-energy impacts or from new primary and secondary data gathered for this evaluation The default values for the performance and monetized metric coefficients will be those used in ORNL's 2002 review of non-energy impacts of the Weatherization Program (Schweitzer and Tonn 2002). The default values will be replaced with new, updated values that reflect current conditions for the Program under the following circumstances:

- coefficients from newer studies or computerized models are judged to be superior,
- existing coefficients do not adequately represent program impacts nationwide or the net economic value of the impact, or
- the impact was quantified with a new household level variable.

To the extent possible, coefficients that disaggregate non-energy impacts by geographic and/or climate region should be used, and the coefficients used for this study, whether existing or newly developed, will be of this type. It is likely (and acceptable) that region-specific coefficients (such as the cost of water service) will be used for some non-energy impacts and not for others. In addition, the types of housing units to which the available data apply (e.g., single-family dwellings, mobile homes, multifamily units) will be tracked and, where appropriate (and data allowing), separate coefficients for the different housing types will be developed.

Table 2.4 identifies the monetized non-energy impacts for which new performance and/or monetized metrics will be developed in this evaluation. Table 2.4 also shows the factors to be considered in determining what new data are needed. The determination about what new data to acquire is guided by how much uncertainty surrounds current metrics, the potential magnitude of a metric's salience, and how closely the metric is tied to primary Program purposes. It is possible that after existing performance and monetized metric coefficients are examined, it will be concluded that other new coefficients are also

needed. As noted earlier, it is acceptable for new impacts, new metrics, and new values for existing metrics to be added as long as no data are collected that have not been previously approved by OMB.

For each monetized non-energy impact, the data to be collected to update its performance and/or monetized metric are described below, as well as the methods that will be used to collect and analyze those data:

Table 2.4. Impacts, metrics, and factors required to determine need for new data

Impact Categories and Specific Impacts	Performance Metric and Uncertainty (L, M, H)	Monetized Metric and Uncertainty (L, M, H)	Potential Magnitude of Monetized Value (L, M, H)	Metric is Closely Tied to Program Purposes (Y, N)	New Data to Collect for This Study
I. Utility/Ratepayer Impacts					
A. Payment-Related Impacts					
1. Rate subsidies avoided	Average reduction in number of subsidized units of energy sold per weatherized household (L)	Cost to utility per subsidized unit of energy sold (L)	L	N	None
2. Lower bad debt write-off	Average reduction in amount of bad debt written off by utility per weatherized household (L)	Same as Performance Metric (L)	M	N	None
3. Reduced carrying cost on arrearages	Average dollar reduction in arrearage per weatherized household (L)	Interest due utility per dollar of arrearage (L)	L	N	None
4. Fewer notices and customer calls	Average reduction in number of notices sent and calls made to customers, per weatherized household (L)	Average cost to utility per notice sent and call made (L)	L	N	None
5. Fewer shut-offs and reconnections for delinquency	Average reduction in number of customer shut-offs and reconnections made by utility, per weatherized household (L)	Average cost to utility per shut-off and reconnection (L)	L	N	None
6. Reduced collection costs for delinquent payments	Average reduction in number of collections made by utility per weatherized household (H)	Average cost to utility per collection (M)	L	N	None
B. Service Provision Impacts					
1. Fewer emergency gas service calls	Average reduction in number of emergency service calls made per weatherized household (L)	Average cost to utility per service call (L)	M	N	None

Table 2.4. Impacts, metrics, and factors required to determine need for new data

Impact Categories and Specific Impacts	Performance Metric and Uncertainty (L, M, H)	Monetized Metric and Uncertainty (L, M, H)	Potential Magnitude of Monetized Value (L, M, H)	Metric is Closely Tied to Program Purposes (Y, N)	New Data to Collect for This Study
2. Trans-mission and distribution loss reduction	Average amount of electricity lost in transmission and distribution, per kWh sold (L)	Average cost to utility per unit of electricity lost (L)	L	N	None
3. Insurance savings	Average reduction in utility's cost for insurance to cover household fires and explosions, per weatherized household (M)	Same as Performance Metric (M)	L	N	None
4. Shifted utility fixed costs	Average energy savings in weatherized houses (L)	Change in fuel cost per unit of energy savings to cover fixed costs (M)	L	N	Monetized Metric
II. Impacts to Participating Households					
A. Affordable Housing Impacts					
1. Water and sewer savings	Average water savings (in gallons) per device installed (M)	Cost of water and sewer service per gallon of water (H)	M	N	Performance and Monetary Metrics
2. Property value impacts	Average cost of structural repairs per weatherized household (L)	Same as Performance Metric (L)	M	N	Performance Metric (data collected in samples)
3. Avoided shut-offs and reconnections	Average reduction in number of shut-offs and reconnections, per weatherized household (L)	Average cost to customer per shut-off (for "lost rent" and restart fee) (L)	L	Y	
4. Reduced mobility	Average reduction in number of moves per weatherized household (H)	Average cost per move (M)	M	N	Performance and Monetary Metrics
5. Reduced transaction costs	Average number of hours required to become familiar with energy-saving products per household (L)	Average cost per hour of time (use minimum wage for this calculation) (M)	L	N	
B. Safety, Health, and Comfort Impacts					

Table 2.4. Impacts, metrics, and factors required to determine need for new data

Impact Categories and Specific Impacts	Performance Metric and Uncertainty (L, M, H)	Monetized Metric and Uncertainty (L, M, H)	Potential Magnitude of Monetized Value (L, M, H)	Metric is Closely Tied to Program Purposes (Y, N)	New Data to Collect for This Study
1. Fewer fires	Average reduction in number of fires per weatherized household (M)	Average monetary loss to household (property, injury, and death) per fire (M)	M	Y	Performance and Monetary Metrics
	Perceived changes in safety of heating system and electrical wiring in weatherized houses (H)	Not applicable	Not applicable	Y	Household-level Data
2. Changes in frequency of health problems	Perceived change in health problems in weatherized houses (H)	Not applicable	Not applicable	Y	Household-level Data
	Average reduction in number of workdays lost due to health problems per weatherized household (H)	Average cost to household per lost work day (L)	M	Y	Performance Metric
	Change in incidence of symptoms or occurrences of specific health problems in weatherized houses (H)	Not applicable	Not applicable	Y	Household-level Data
3. Enhanced prevention and treatment of health problems	Reduction in number of times food could not be purchased due to size of utility bill in weatherized houses (H)	Not applicable	Not applicable	Y	Household-level Data
	Change in access to health care and medication in weatherized houses	Not applicable	Not applicable	Y	Household-level Data

Table 2.4. Impacts, metrics, and factors required to determine need for new data

Impact Categories and Specific Impacts	Performance Metric and Uncertainty (L, M, H)	Monetized Metric and Uncertainty (L, M, H)	Potential Magnitude of Monetized Value (L, M, H)	Metric is Closely Tied to Program Purposes (Y, N)	New Data to Collect for This Study
4. Changes in indoor air quality	Measured change in CO levels in weatherized houses (H)	Not applicable	Not applicable	Y	Household-level Data
	Measured change in level of indoor airborne mold spores relative to outdoor levels in weatherized houses (H)	Not applicable	Not applicable	Y	Household-level Data
	Measured change in level of indoor airborne pollen relative to outdoor levels in weatherized houses (H)	Not applicable	Not applicable	Y	Household-level Data
	Perceived change in frequency of odors within weatherized houses (H)	Not applicable	Not applicable	Y	Household-level Data
5. Changes in household moisture levels	Measured change in humidity levels in weatherized houses (H)	Not applicable	Not applicable	Y	Household-level Data
6. Decreased incidence of hypothermia and hyperthermia	Average reduction in number of times emergency medical care is sought due to heat stress or over exposure to cold per weatherized household (H)	Average cost of emergency medical care at hospital, emergency room, or urgent care facility (L)	M	Y	Performance and Monetary Metrics
	Change in incidence of students' disrupted study in weatherized houses (H)	Not applicable	Not applicable	Y	Household-level Data

Table 2.4. Impacts, metrics, and factors required to determine need for new data

Impact Categories and Specific Impacts	Performance Metric and Uncertainty (L, M, H)	Monetized Metric and Uncertainty (L, M, H)	Potential Magnitude of Monetized Value (L, M, H)	Metric is Closely Tied to Program Purposes (Y, N)	New Data to Collect for This Study
7. Improved food safety	Measured change in refrigerator temperature in weatherized houses (H)	Not applicable	Not applicable	Y	Household-level Data
	Change in incidence of gastrointestinal problems and food poisoning in weatherized houses (H)	Not applicable	Not applicable	Y	Household-level Data
8. Improved household safety and security	Average reduction in number of times emergency medical care is sought for injuries from tripping and falling in the home (H)	Average cost of emergency medical care at hospital, emergency room, or urgent care facility (L)	M	Y	Performance and monetary Metrics
	Average reduction in number of times emergency medical care is sought for burns from scalding from domestic hot water (H)	Average cost of emergency medical care at hospital, emergency room, or urgent care facility (L)	M	Y	Performance and Monetary Metrics
	Perceived change in security from criminal intrusion in weatherized houses (H)	Not applicable	Not applicable	Y	Household-level Data
	Average reduction in number of break-ins per weatherized household (H)	Average value of items stolen in break-in (H)	M	Y	Performance and Monetary Metrics
9. Change in presence of environmental hazards	Measured change in levels of asbestos and radon in weatherized houses (H)	Not applicable	Not applicable	Y	Household-level Data

Table 2.4. Impacts, metrics, and factors required to determine need for new data

Impact Categories and Specific Impacts	Performance Metric and Uncertainty (L, M, H)	Monetized Metric and Uncertainty (L, M, H)	Potential Magnitude of Monetized Value (L, M, H)	Metric is Closely Tied to Program Purposes (Y, N)	New Data to Collect for This Study
	Change in number of poisonings from household chemicals in weatherized houses (H)	Not applicable	Not applicable	Y	Household-level Data
	Change in level of vermin infestation in weatherized houses (H)	Not applicable	Not applicable	Y	Household-level Data
10. Improved comfort	Perceived improvement in indoor comfort (temperature and draftiness) in weatherized houses (H)	Not applicable	Not applicable	Y	Household-level Data
	Measured change in indoor air temperature in weatherized houses (H)	Not Applicable	Not applicable	Y	Household-level Data
11. Improved appearance	Perceived improvement in appearance of weatherized dwellings (H)	Not Applicable	Not applicable	N	Household-level Data
12. Reduced noise inside dwelling	Perceived reduction in noise within weatherized dwellings (H)	Not applicable	Not applicable	Y	Household-level Data
III. Societal Impacts					
A. Environmental Impacts					
1. Air emissions: CO2	Pounds of CO2 emitted per unit of energy saved (M)	Value of CO2 emission reduction in dollars per pound (H)	H	N	Performance and Monetary Metrics

Table 2.4. Impacts, metrics, and factors required to determine need for new data

Impact Categories and Specific Impacts	Performance Metric and Uncertainty (L, M, H)	Monetized Metric and Uncertainty (L, M, H)	Potential Magnitude of Monetized Value (L, M, H)	Metric is Closely Tied to Program Purposes (Y, N)	New Data to Collect for This Study
2. Air emissions: SOx	Pounds of SOx emitted per unit of energy saved (M)	Value of SOx emission reduction in dollars per pound (H)	M	N	Performance and Monetary Metrics
3. Air emissions: NOx	Pounds of NOx emitted per unit of energy saved (M)	Value of NOx emission reduction in dollars per pound (H)	H	N	Performance and Monetary Metrics
4. Air emissions: CO	Pounds of CO emitted per unit of energy saved (M)	Value of CO emission reduction in dollars per pound (H)	M	N	Performance and Monetary Metrics
5. Air emissions: CH4	Pounds of CH4 emitted per unit of energy saved (M)	Value of CH4 emission reduction in dollars per pound (H)	M	N	Performance and Monetary Metrics
6. Air emissions: PM	Pounds of PM emitted per unit of energy saved (M)	Value of PM emission reduction in dollars per pound (H)	M	N	Performance and Monetary Metrics
7. Air emissions: heavy metals	Pounds of heavy metals emitted per unit of energy saved (M)	Value of heavy metal emission reduction in dollars per pound (H)	H	N	Performance and Monetary Metrics
8. Fish impingement	Number of fish impinged at power plants per unit of electricity saved (L)	Dollar value per impinged fish (L)	L	N	
9. Wastewater and sewage in electricity production	Amount of wastewater and sewage (in gallons) produced per unit of electricity saved (M)	Cost per gallon of treating wastewater and sewage (M)	M	N	Performance and Monetary Metrics

Table 2.4. Impacts, metrics, and factors required to determine need for new data

Impact Categories and Specific Impacts	Performance Metric and Uncertainty (L, M, H)	Monetized Metric and Uncertainty (L, M, H)	Potential Magnitude of Monetized Value (L, M, H)	Metric is Closely Tied to Program Purposes (Y, N)	New Data to Collect for This Study
B. Social Impacts					
1. Avoided unemployment impact	Average number of unemployed workers given jobs per dollar spent on weatherization (L)	Average cost of unemployment benefits paid per unemployed worker (L)	M	N	
C. Economic Impacts					
1. Direct and indirect employment	Average number of direct and indirect jobs created per dollar spent on weatherization (M)	Taxes paid (local, state, and federal) and dollars spent locally, per job created (L)	H	N	Performance Metric
2. Lost rental	Average amount of unpaid rent per weatherized rental household before and after weatherization (L)	Same as Performance Metric (L)	L	N	
3. National security	Average proportion of source energy used for residential purposes that is imported (L)	"Premium" paid in higher prices and disturbance to economy per unit of imported energy (H)	H	Y	Performance and Monetary Metrics

- **Shifted utility fixed costs—Monetized Metric: Change in fuel cost per unit of energy savings to cover fixed costs.** Information from the literature will be collected on how fuel cost prices increase as a result of reduced consumption to cover utilities' fixed costs.

- **Water and sewer savings—Performance Metric: Average water savings (in gallons) per device installed; Monetized Metric: Cost of water and sewer service per gallon of water.** For the performance metric, information will be collected from the literature on the amount of water saved through the installation of low-flow showerheads and faucet aerators. From those secondary sources, average water savings per device will be calculated. For the monetary metric, primary data on the cost of water and sewer service (i.e., costs per unit of consumption) will be collected from a nationwide sample of 30 to 50 water utilities serving the houses used in the energy study by examining published information on their websites. From this, average costs will be calculated for the entire nation and, if possible, for individual geographic and/or climate regions. The rates of the utilities chosen will be representative of climate regions and housing types.

- **Property value impacts—Performance Metric: Average cost of structural repairs per weatherized household.** Information on the dollar value of the structural repairs performed for each unit weatherized in PY 2010 will be collected as part of the Program characterization study (see Section 2.1). The average cost of structural repairs per weatherized household will be calculated by summing the value of repairs performed on all units and dividing by the number of dwellings weatherized. An alternative Performance Metric for evaluating property value impacts might be to collect information from realtors or appraisers to determine the increase in property value based on the amount of structural repairs performed.

- **Reduced mobility—Performance Metric: Average reduction in number of moves per weatherized household; Monetized Metric: Average cost per move.** If the billing data gathered for the billing data sample indicate when the occupants of a dwelling move, the average number of moves per household will be calculated for the treatment group in the year following weatherization; that number will then be compared to the average number of moves during that same period for the control group (using an appropriate statistical procedure). If the billing data do not identify when occupants moved, program participants and a control group of non-participants will be surveyed via telephone regarding the number of times they changed residences in the year after the weatherization. As before, the mean number of moves for the treatment and control groups will be compared. Only the post-weatherization period will be studied because it is expected that prospective participants will move much less frequently than non-participants during the pre-weatherization period because of the process of applying for and awaiting the weatherization. The average cost of moving for a typical low-income family will be gathered from secondary sources.

- **Fewer fires—Performance Metric: Average reduction in number of fires per weatherized household; Monetized Metric: Average monetary loss to household per fire.** Data on weatherization-induced changes in the number of fires will be gathered using the Occupant Survey, which is being conducted by the retrospective evaluation during WAP-ARRA PYs 2011 and 2012 (Ternes et al. 2007). Additional data on the reduction in fires will be taken from reliable secondary sources. (It is important to augment survey findings through the use of national statistics when examining relatively rare events such as fires.) The average monetary loss per fire will also be gathered from secondary sources. The most difficult aspect of quantifying monetary loss is, of course, assigning an acceptable value to the loss of a human life.

- **Changes in frequency of health problems—Performance Metric: Average reduction in number of workdays lost per weatherized household due to health problems.** Occupants of the same weatherized and control units mentioned above will be surveyed over the phone using a portion of the Occupant Survey to determine the number of days they were absent from work during the pre- and post-weatherization periods due to health problems. Net change in number of lost workdays from the pre- to the post-weatherization period will be determined by comparing change for the treatment and control groups using an appropriate statistical procedure.

- **Decreased incidence of hypothermia and hyperthermia—Performance Metric: Average reduction in number of times emergency medical care is sought due to heat stress or overexposure to cold per weatherized household; Monetized Metric: Average cost of emergency medical care at hospital, emergency room, or urgent care facility.** A portion of the Occupant Survey will be used to determine the number of times a household member sought emergency medical care due to heat stress or overexposure to cold during the pre- and post-weatherization periods. Changes between the two periods will be compared for the treatment and control groups using an appropriate statistical procedure. The average cost of emergency medical care at a hospital, emergency room, or urgent-care facility will be gathered from secondary sources.

- **Improved household safety and security—Performance Metric: Average reduction in number of times emergency medical care is sought for injuries from tripping and falling in the home; Monetized Metric: Average cost of emergency medical care at hospital, emergency room, or urgent care facility.** Once again, the Occupant Survey will be administered to the same weatherized and control units described above. During the pre-weatherization period and again in the post-weatherization period, the subjects will be asked to report the number of times a household member has sought emergency medical care for injuries from tripping and falling in the home. Net change from the pre- to post-weatherization period will be determined by comparing change for the treatment and control groups using an appropriate statistical procedure. Additional data on the frequency of serious trip and fall injuries will be taken from reliable secondary sources. The average cost of emergency medical care at a hospital, emergency room, or urgent care facility will also be gathered from secondary sources.

- **Improved household safety and security—Performance Metric: Average reduction in number of times emergency medical care is sought for burns from scalding from domestic hot water in weatherized houses; Monetized Metric: Average cost of emergency medical care at hospital, emergency room, or urgent care facility.** The Occupant Survey will be administered to the same weatherized and control units described above. The subjects will be asked to report the number of times a household member sought emergency medical care as a result of burns from scalding water from a faucet or showerhead in their home during the pre- and post-weatherization periods. Changes between the two periods will be compared for the treatment and control groups using the same general approach described above. As noted previously, the average cost of emergency medical care at a hospital, emergency room, or urgent care facility will be gathered from secondary sources.

- **Improved household safety and security—Performance Metric: Average reduction in number of break-ins per weatherized household: Monetized Metric: Average value of items stolen per break-in.** Houses that are weatherized often get new windows and doors that have better security features such as locks and bolts than did the unweatherized original fixtures. This can result in better security and household safety. For both the performance and monetary metric, the necessary data will be collected through the previously described Occupant Survey. In both the pre- and post-weatherization periods, the subjects will be asked to report the number of break-ins to their residence during the previous year and the value of the items stolen during those incidents. An appropriate statistical procedure will be used to compare changes from the pre- to post-weatherization period for the treatment and control groups.

- **ALL air emissions—Performance Metrics: Pounds of substances (CO_2, SO_x, NO_x, CO, CH_4, PM, heavy metals) emitted per unit of energy saved; Monetized Metrics: Value of substances emitted in dollars per pound.** Necessary data pertaining to these metrics can be collected from secondary sources. Specifically, a literature review will be conducted regarding the amount of each relevant substance typically emitted per unit of energy saved. This review will focus on emissions for those households that are "on the margin," meaning that their fuel consumption is most likely to be cut when energy use is reduced. Getting region-specific numbers for these factors should be relatively straightforward, and emissions reductions will be able to be calculated from the energy savings findings (see Section 2.2). To determine the monetary value of the emissions reductions, information on the values established by the market through emissions trading for each substance will be gathered. It should be noted that getting good, up-to-date information on the monetary metrics is even more important than gathering data on the performance metrics because the former is surrounded by greater uncertainty.

- **Wastewater and sewage—Performance Metric: Amount of wastewater and sewage produced per unit of electricity; Monetized Metric: Cost per gallon of treating wastewater and sewage.** Necessary data pertaining to these metrics will be gathered through a literature review.

- **Direct and indirect employment—Performance Metric: Average number of direct and indirect jobs created per dollar spent on weatherization.** Secondary sources on economic multipliers will be used to calculate the average number of direct and indirect jobs created per dollar spent on weatherization in the geographic areas under study. Input/output models utilizing the best available data should be useful for this purpose. To the extent possible, the analysis will attempt to identify the net impact, which is the effect the Weatherization Program had on employment minus the employment effect that might have resulted from the same magnitude of expenditure on likely alternative projects.

- **National security—Performance Metric: Average proportion of source energy used for residential purposes that is imported; Monetized Metric: "Premium" paid in higher prices and disturbance to economy per unit of imported energy.** Data on energy imports will be derived from the most up-to-date secondary sources. The value of the imported energy "premium" will be taken from a study currently being performed by ORNL researchers.

Once the full data-collection effort is complete and new coefficients have been developed, an analysis will be performed to calculate values for all monetized non-energy impacts. In the final report for this study, each coefficient used to calculate the total monetized value of non-energy impacts will be described, and the reason it was selected will be explained. Impacts will be reported separately for each major category shown in Tables 2.3 and 2.4 (Utility/Ratepayer Impacts, Impacts to Participating Households, and Societal Impacts) and the *total* impact for all categories combined will also be given.

After all monetized impacts have been calculated, a quick sensitivity analysis will be conducted to see how out-year estimates of non-energy impacts might change in response to variation in key driving factors and assumptions made in the calculations, such as changing demographics in the houses, loss of housing stock, energy prices, discount rates, new technology, and climate change. This analysis will use the results of a prior sensitivity analysis of how energy savings may change in response to variance in the same driving factors (see Section 2.2.2). The results of this analysis will be used in the sensitivity analyses performed for cost-effectiveness (see Section 2.4).

Additional analyses will be performed to explore the effects of specific agency actions on various monetized health- and safety-related impacts. This can be done by (1) performing regression analysis to search for relationships between various impacts and agency actions (e.g., installation of smoke alarms, security measures) that have the potential to affect health and safety; and (2) doing a literature review on the relationships between selected agency actions and health effects.

2.3.2 Special IAQ Radon Remediation Cost Study

One of the tasks of the retrospective evaluation is to study the potential impacts of weatherization on indoor air quality. To accomplish this goal, a large-scale field study of approximately 550 homes (the IAQ study) is being implemented nationally. Homes for the study were selected based on a two-stage sampling strategy that first selected geographic areas of the country, and then sampled single-family households scheduled for weatherization by local agencies within each geographic region. The geographic sampling was based on areas defined by the U.S. Census Bureau, known as super-PUMAs (Public Use Microdata Areas), which are areas with a population of at least 400,000. The 532 super-PUMAs in the U.S. were stratified regionally and by radon level by the Census Bureau, and a national sample of 80 super-PUMAs was drawn with probability proportional to the Census 2000 population of

single-family, weatherization-eligible households and weatherization funding in PY 2008. High-radon areas were explicitly over-sampled in order to ensure that our sample contained enough homes to statistically explore relationships between the installation of various weatherization measures and changes in radon in the home. [6] Local weatherization agencies serving sampled super-PUMAs were then contacted to obtain lists of homes soon to be weatherized. Homes were randomly chosen from these lists and contacted to be part of the study. The goal was to enroll six to eight homes in this IAQ study from each sampled super-PUMA, with two to three of these homes randomly assigned to a control group of homes that will not be weatherized until the study is completed.

This study is measuring pre- and post-weatherization levels of the following indoor air pollutants: carbon monoxide (CO), radon, formaldehyde, and indoor humidity.

CO is produced by incomplete combustion from fossil-fueled heating systems, appliances, and other combustion sources and can be a serious problem in homes. Home-energy audits under WAP commonly assess CO production by combustion appliances in post-weatherization inspections to ensure that the installation of weatherization measures, especially those related to furnace work, have not caused CO problems.

Naturally occurring radon gas can accumulate in confined spaces in homes and, being radioactive, is often responsible for the majority of a person's exposure to background radiation. Radon and formaldehyde issues are not formally addressed by energy audits at the present time. Radon problems can be mitigated by weatherization measures that air-seal unheated basements and crawlspaces from the living areas; conversely, it can be exacerbated by overall home weatherization "tightening." At least one prior study found no relationship between weatherization and radon risks, although that study was conducted over two decades ago and involved a relatively small sample of homes.

Formaldehyde was included in this study to represent the larger class of VOCs that could be present in homes. Additionally, home-energy auditors regularly make note of moisture and mold issues in homes, and ventilation measures are often implemented to deal with these issues.

As mentioned above, the retrospective study's design called for over-sampling in high radon areas. This is because the impacts of weatherization on radon in the home are a point of emphasis of this study. The retrospective study will conduct analyses to identify any relationships between weatherization and changes in radon levels in homes from pre- to post weatherization. This study will also assess the relationships between various weatherization measures and changes in radon levels.

The WAP-ARRA period study will take this radon work one step further. The project team will remediate all homes that test for radon levels over the recommended federal threshold of 4pC/L post-weatherization and in a second test post-weatherization. Low-cost weatherization measures will be implemented first, and if after re-testing the threshold is still exceeded, standard remediation actions will be taken. Accurate cost information will be collected for all remediation work performed. This information will be useful in estimating the costs of radon remediation performed in the low-income weatherization context and providing insights as to whether there are any correlations between radon levels post-weatherization and the cost of radon remediation.

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[6] We used county-level estimates results from both Lawrence Berkeley National Laboratory's radon research and the Environmental Protection Agency to define four radon-level strata based on the estimated proportion of homes at the county level with radon levels exceeding 4 pCi/l: see http://eetd.lbl.gov/iep/high-radon/hr.html and http://www.epa.gov/radon/zonemap.html. County level data were then aggregated to the super-PUMA level using Census 2000 population counts.

2.3.3 Non-Monetized Data Collection and Analysis

Performance metrics to determine the value of all non-monetized impacts will be calculated directly from the relevant household-level data shown in Table 2.3. The appropriate performance metric for each non-monetized non-energy impact is identified in Table 2.4. The methods that will be used to collect and analyze the relevant data for each non-monetized impact are described below. As with the monetized non-energy impacts, to the extent possible, results will be developed that are specific to geographic region, climate region, and/or housing type.

For most of the non-monetized impacts described below, information will be obtained using a portion of the S4 Occupant Survey. The survey will be administered immediately after each house is audited and again a year after weatherization, and an incentive will be provided to improve the response rate.

The other main data-collection approach used for the study of non-monetized health, safety, and comfort impacts is the direct measurement of key indoor air quality factors. These data will be collected by means of the Indoor Air Quality study, part of the retrospective evaluation being conducted in PYs 2010, 2011 and 2012.

Non-monetized impacts include the following:

- **Fewer fires—Performance Metric: Perceived changes in safety of heating system and electrical wiring in weatherized houses.** Using the Occupant Survey described above, program participants and a control group of non-participants will be asked for their perceptions of the safety of their dwelling's heating system and electrical wiring before and after the period in which weatherization work is performed. Net change in perceptions from the pre- to post-weatherization period will be determined by comparing change for the treatment and control groups using an appropriate statistical procedure.

- **Changes in frequency of health problems—Performance Metric: Perceived change in health problems in weatherized houses.** Program participants and a control group of non-participants will be surveyed using the Occupant Survey regarding the perceived condition of their (and their family's) health in the pre- and post-weatherization periods. An appropriate statistical procedure will be used to compare the change from the pre- to post-weatherization period for the weatherized and control groups.

- **Changes in frequency of health problems—Performance Metric: Change in incidence of symptoms or occurrences of specific health problems in weatherized houses.** Through the Occupant Survey, program participants and non-participants will be asked to report the frequency with which they experience certain health problems or the principal symptoms of those problems during the pre-weatherization period and again during the post-weatherization period. Subjects will be asked specifically about occurrences of asthma and other respiratory problems, as well as colds and flu. They will also be asked to report symptoms of these and other conditions possibly resulting from exposure to allergens, mold, and CO. Such symptoms include wheezing, shortness of breath, coughing, congestion, headaches, and nausea.

- **Enhanced prevention and treatment of health problems—Performance Metric: Reduction in number of times food could not be purchased due to size of utility bill in weatherized houses.** The Occupant Survey will ask weatherization clients and a control group about the frequency with which they have foregone the purchase of food in order to pay utility bills and the frequency with which they have not paid utility bills in order to purchase food. The same questions will be asked

during the pre- and post-weatherization periods, and any changes from the former to the latter will be calculated. The net change from the pre- to post-weatherization period will be determined by comparing change for the treatment and control groups using an appropriate statistical procedure.

- **Enhanced prevention and treatment of health problems—Performance Metric: Change in access to health care and medication in weatherized houses.** The Occupant Survey will ask residents of weatherized and non-weatherized households questions similar to those described above for food purchases about the trade-offs they have made between paying utility bills and purchasing prescription medicines. Changes from the pre- to post-weatherization period will be compared for the weatherized and control groups. In addition, the weatherized and non-weatherized groups will be compared in terms of how their number of visits to emergency rooms, primary physicians, or other primary health-care providers changed from the pre- to post-weatherization period. The frequency with which respondents report not having a primary-care physician or other primary health-care provider will also be examined.

- **Changes in indoor air quality—Performance Metric: Measured change in CO levels in weatherized houses.** As part of the retrospective evaluation's Indoor Air Quality task, mentioned above, equipment will be installed in weatherized housing and control units to measure carbon monoxide (CO) levels during both the pre- and post-weatherization periods. The non-weatherized houses will be measured at the same time as the weatherized units to control for any possible changes in outdoor temperature or other climatic conditions. Net change in CO levels from the pre- to the post-weatherization period will be determined by comparing change for the treatment and control groups using an appropriate statistical procedure. In addition, descriptive statistics showing the frequency with which dangerously high levels of CO were found during the pre-weatherization period will be generated and an appropriate statistical test will be used to calculate the frequency with which those high concentrations were reduced to safe levels in weatherized units.

- **Changes in indoor air quality—Performance Metric: Perceived change in frequency of odors within weatherized houses.** The Occupant Survey will ask a sample of weatherization participants and non-participants for their perceptions of how often there are odors inside their home that could indicate a problem with indoor air quality. The occupants will be asked to describe the situation separately for the winter and the summer, and the survey will be administered both before and after weatherization. Net change from the pre- to post-weatherization period will be determined by comparing changes for the treatment and control groups using an appropriate statistical procedure.

- **Changes in household moisture levels—Performance Metric: Measured change in humidity levels in weatherized houses.** Relative humidity will be measured in the same housing units for which the concentrations of CO, indoor mold spores, and pollen will be examined, during both the pre- and post-weatherization periods. The non-weatherized units will be measured at the same time as the weatherized units, and careful attention will be paid to the season in which the measurements are taken. Net change in humidity levels from the pre- to post-weatherization period will be determined by comparing changes for the treatment and control groups using an appropriate statistical procedure.

- **Decreased incidence of hypothermia and hyperthermia—Performance Metric: Change in incidence of students' disrupted study in weatherized houses.** The Occupant Survey will ask how frequently household residents find it hard to study at home because of excessive heat or cold. The net change in frequency of study disruption from the pre- to post-weatherization period will be determined by comparing change for the treatment and control groups using an appropriate statistical procedure.

- **Improved food safety—Performance Metric: Measured change in refrigerator temperature in weatherized houses.** In the same housing units for which CO, indoor mold spores, pollen, and relative humidity are examined, the change in the internal temperature of refrigerators will also be measured. Temperatures will be taken inside the household refrigerator both before and after weatherization, and the net change in refrigerator temperature from the pre- to post-weatherization period will be calculated from both the treatment and control group data using an appropriate statistical procedure. In addition, descriptive statistics will be generated showing the frequency with which unsafe temperatures were found inside refrigerators during the pre-weatherization period, and an appropriate statistical test will be used to calculate the frequency with which those high temperatures were reduced to safe levels in weatherized units.

- **Improved food safety—Performance Metric: Change in incidence of gastrointestinal problems and food poisoning in weatherized houses.** The Occupant Survey will ask people in weatherized and non-weatherized households whether they have experienced serious gastrointestinal problems in the previous month or have suffered from food poisoning during the past six months. The same questions will be asked both before and after weatherization, and the changes will be compared for the weatherized and control groups.

- **Improved household safety and security—Performance Metric: Perceived change in security from criminal intrusion in weatherized houses.** Using the Occupant Survey, program participants and a control group of non-participants will be asked for their perceptions of how secure their home is from intrusion by criminals both before and after weatherization. The change over time will be compared for the weatherized and control groups using an appropriate statistical procedure.

- **Change in presence of environmental hazards—Performance Metric: Measured change in levels of radon in weatherized houses.** In the same dwellings for which CO and other factors will be measured, the levels of radon will be measured during both the pre- and post-weatherization periods; net change will be calculated as described previously. In addition, descriptive statistics will be generated showing the frequency with which unsafe levels of asbestos and radon were found during the pre- weatherization period, and an appropriate statistical test will be used to calculate the frequency with which those high concentrations were reduced to safe levels in weatherized units.

- **Change in presence of environmental hazards—Performance Metric: Change in number of poisonings from household chemicals in weatherized houses.** Through the Occupant Survey, subjects in both weatherized and non-weatherized dwellings will be asked to report whether the members of their household had been poisoned by household chemicals during the past year and, if so, to identify the substance with which they had been poisoned. Net change from the pre- to post-weatherization period will be determined by comparing change for the treatment and control groups using an appropriate statistical procedure. Additional data on the frequency of poisoning from household chemicals will be taken from reliable secondary sources.

- **Change in presence of environmental hazards—Performance Metric: Change in level of vermin infestation in weatherized houses.** The Occupant Survey will solicit information from both weatherization participants and non-participants on the extent to which their dwelling is infested with rats, cockroaches, and other vermin. This question will be asked both before and after weatherization. The net change in this factor from the pre- to post-weatherization period will be determined by comparing change for the treatment and control groups.

- **Improved comfort—Performance Metric: Perceived improvement in indoor comfort in weatherized houses.** A sample of Program participants and a control group of non-participants will

be asked about their perceptions of the indoor comfort of their dwelling unit during the pre- and post-weatherization period via the Occupant Survey. "Comfort" will include both indoor temperature and draftiness, as in the 1989 Weatherization Program national evaluation, as well as the floor area or number of rooms that can be conditioned. Responses will be solicited during both the heating and cooling seasons. Net change from the pre- to post-weatherization period will be determined using an appropriate statistical procedure.

- **Improved comfort—Performance Metric: Measured change in indoor air temperature in weatherized houses.** Equipment will be installed in the previously mentioned homes in the previously mentioned Indoor Air Quality study to measure indoor winter and, if possible, summer air temperatures during both the pre- and post-weatherization periods. The non-weatherized houses will be measured at the same time as the weatherized units to control for any possible changes in outdoor temperature or other climatic conditions, and careful attention will be paid to the season in which the measurements are taken. Net change from the pre- to post-weatherization period will be determined by comparing change from the treatment and control groups using an appropriate statistical procedure.

- **Improved appearance—Performance Metric: Perceived improvement in appearance of weatherized dwellings.** Using the Occupant Survey, a sample of Program participants and a control group of non-participants will be asked for their perceptions of the appearance of their dwellings both before and after weatherization. Changes from the pre- to post-weatherization period will be compared for the treatment and control groups.

- **Reduced noise inside dwelling—Performance Metric: Perceived reduction in noise within weatherized dwellings.** The Occupant Survey will ask a sample of weatherization participants and non-participants for their perceptions of the noise level within their dwellings both before and after weatherization. Once again, net change from the pre- to post-weatherization period will be determined by comparing change for the treatment and control groups using an appropriate statistical procedure.

As described above, the magnitude of each non-monetized impact will be calculated separately. In addition, the effects of specific agency actions on various non-monetized health- and safety-related impacts will be explored. This can be done by (1) performing regression analysis to search for relationships between various impacts and agency actions (e.g., plumbing repairs, improved ventilation) that have the potential to affect health and safety; and (2) doing a literature review on the relationships between selected agency actions and health effects.

2.3.4 Social Network Study

The non-energy benefits research described above addresses many additional ways that the Program can generate benefits to clients and society. This section addresses yet another potential benefit of the Program: the potential for two groups, clients and the weatherization staff, to influence energy savings beyond their homes and their day jobs. Every individual and every household has a network of social contacts that may be visualized as a map of nodes (individuals/households) and lines (connections). The analysis of social networks (Social Network Analysis or SNA) will be employed to explore linkages between individual households, weatherization staff, and agencies as nodes within a multi-level and multi-relational social system that could influence energy savings beyond the Program.

Taking advantage of the natural tendency to build social networks to create a system of information flow in which information about weatherization can be shared, SNA will allow evaluators to visually capture the structural attributes of the network and relational data in order to provide both statistical and visual analysis.

The clients will be studied to determine whether and how they communicate with neighbors, acquaintances, friends, and family about the results of their home audits, the measures installed, any changes in their energy bills, and any other energy and non-energy benefits.

In the case of weatherization staff, technicians have social networks of their own. This study will serve to identify and map ways in which the WAP program encourages secondary impacts on home energy savings through social networks. The timeframe for this project extends from March 2010 through September 2011 to allow time for culturally sensitive implementation plans for each agency, hiring and training of research staff, sampling, interviewing, and analysis.

The communities in our pilot, though economically marginal, are likely to be sophisticated in social media usage. Any network analysis must start with a population's access to modes of communication from letter writing to modern social media such as online forums, listservs, instant messaging, Twitter, and Facebook.

This project will leverage the results from a task being undertaken by the retrospective evaluation to conduct case studies on approximately six high performing local agencies. The retrospective evaluation's case studies will describe local agency operations, philosophies, and approaches, and how the local agencies reach out to surrounding communities to promote weatherization and other social services. In addition, these case studies will describe how the agencies act as nods of communication about energy efficiency within the community.

The SNA employed in this evaluation will add to the retrospective study's results, enhancing the description of the network by adding clients and weatherization staff as nodes in the community network.

Upon identification of the high performance agencies and communities to be assessed, census tracking, and other forms of structural data will be collected for the WAP-ARRA evaluation to reveal community demographics with regards to socio-economic status of the community as a whole, individual income levels within particular neighborhoods, racial or ethnic make-up, median age, disability rates, number of single parent homes, unemployment, population density, and education statistics. This information will provide potential factors relating to the high performance rate of the agency, as well as cultural implications related to social networking systems. Quantitative and qualitative data will be evaluated for a rich ethnographic understanding of the community as a whole. This reading of the community will help understand how information within the community is shared (possibly feeding a viral spread of interest in weatherization), and what the core values are in place that might support or hinder adoption of new energy practices.

To conduct the client-based SNA, a list of weatherized homes will be supplied from the agencies. A visual spatial map will be created using this list. This visual aid will assist with identifying high utilization clusters within the community and will assist with identifying initial client (i.e., household) nodes for this analysis. Upon selection of the preliminary household nodes to initiate the study of social networking around the household, in-person interviews will be conducted with the clients to collect information to build frameworks of their social networks. Snowball sampling methods will be used to contact people within the clients' social networks via telephone or in person. Researchers will talk with members of the client's network to learn more about their interest in weatherization. By soliciting broad information, rather than targeted "source of influence," the respondent may volunteer unanticipated

information beyond the scope of initial researcher knowledge. Researchers will attempt to determine the impact the clients' weatherization activities had on the behavior of other individuals, measured by the number of applications for Program services, household energy-use behavior, and influence on investment in energy-efficiency measures. Individuals one step away from the initial client nodes will be asked for a list of other nodes in their own social networks and a second round of snowball interviews will be conducted. The goal is to conduct approximately 100 interviews per agency.

To gather information about the household nodes and to create a social network map, local recipients of the program will be recruited and hired through the local agencies. This technique, known as participatory research, will allow information to be collected starting with the initial client as a node. Efforts will be made to recruit researchers who are well versed in the culture of the area, have good interpersonal skills, and are familiar with the WAP application process and with energy conservation. These researchers will be trained by research professionals before collecting data within their local areas, and once trained, will make contact with the initial client nodes, paying special attention to whether or not the household either may have served as a catalyst for energy change within the community or its own social network, or conversely, whether the household was influenced by another household that could better be identified as a catalyst. SNA of the household nodes will present a visual analysis at the conclusion of the study and will offer insight into program utilization process; this analysis will further provide data for a secondary impact analysis of the Program's influence on home energy conservation.

To conduct the SNA of the weatherization staff, local workers employed by the high-performing agencies within the retrospective study's Case Study Analysis will be interviewed to gain insight regarding the impact these local workers have on the rate of homes weatherized within their own social or professional networks or communities. Weatherization staff will be interviewed to initiate a second snowball sampling with follow-up telephone surveys. Additionally, the weatherization staff survey will be modified for this study to include questions related to communication of the program within social networks.

This approach (use of participatory techniques within client populations and partnering with community agencies) is reflective of OMB's Open Government Directive, which emphasizes the need to incorporate transparency, participation, and collaboration with multi-disciplinary approaches into the design, implementation and analysis of federal programs and projects. The participatory research technique also offers the benefit of empowering clients and workers and work experience that may extend those individuals' employment opportunities.

2.4. COST-EFFECTIVENESS

2.4.1 General Assessment

The impact assessment will determine the cost-effectiveness of the Program as implemented in PYs 2009, 2010 and 2011 on a national basis and by climate region, housing type, primary space-heating fuel type, and the five client groups that the Program is specifically instructed to focus on (the elderly, persons with disabilities, families with children, high residential energy users, and households with high energy burden). The cost-effectiveness of the Program in PYs 2009, 2010 and 2011 will then be compared to results from the retrospective evaluation (PYs 2007 and 2008) and the 1989 National Evaluation and from the meta-evaluations performed between 1990 and 2005. It should be noted that, although cost-effectiveness will be calculated by climate region, housing type, and type of primary space-heating fuel, a full analysis of factors affecting cost-effectiveness will be performed as described in Section 2.5.

The cost-effectiveness of the Program will be calculated using appropriate methods for coordinated programs (Brown and Hill, 1994; Hill and Brown, 1994). Specifically, cost-effectiveness for WAP-ARRA will be calculated using the total costs spent on the house from all funding sources as collected and analyzed in Section 2.1, the energy cost savings calculated in Section 2.2, and the monetary values of the non-energy impacts (which may include both benefits and costs) estimated in Section 2.3. Cost-effectiveness will be determined using savings-to-investment ratio (SIR), the same indicator as used in the retrospective and the 1989 National Evaluation. Standard formulas for this indicator will be used. Cost-effectiveness will be examined from three perspectives:

- **Installation perspective**—"savings" are limited to energy savings (all heating, cooling, and baseload energy savings combined), and "investments" (i.e., costs) are limited to installation expenditures (on-site labor and materials),

- **Program perspective**—"savings" are limited to energy savings as above, but "investments" are expanded to include management and overhead costs along with installation expenditures, and

- **Societal perspective**—"savings" include both energy savings and monetary values for non-energy impacts (which may include both benefits and costs and, therefore, are net economic values), and "investments" include installation, management, and overhead expenditures.

To calculate the SIR, it is necessary to include information about the average lifetime of measures, such as refrigerators or windows, that are implemented. This information will be determined by weighting the individual lifetimes of each measure (as determined from secondary sources) by the frequency of its installation and relative energy savings. The monetary values of the non-energy impacts used in the calculations will be the net present value of the impact and, thus, will already have taken into account the lifetime of the impact and how the impact varies over time. Real discount rates and fuel escalation rates as recommended by the Department of Commerce will be used in the calculations.

A sensitivity analysis will be performed to determine the impact of key assumptions used in the calculation of SIR. These key assumptions include energy savings, fuel costs, measure lifetime, real discount rate, fuel escalation rate, and the monetary value of non-energy impacts. The risk analysis modeling approach to be used allows the uncertainty in model inputs to be defined by probability distributions, so that distributions of likely SIR outcomes can be developed. Results from the sensitivity analysis performed specifically for energy savings (see Section 2.2.2) and non-energy impacts (see Section 2.3.1) will be used in this analysis.

As part of the cost-effectiveness analysis, the impact that alternative per-household investment levels can have on Program cost-effectiveness and other key Program metrics, such as the number of units weatherized and average energy savings, should be examined (i.e., it should be examined whether there are investment levels that optimize the SIR at an agency or state level and, if so, how this subsequently impacts the number of units weatherized by the agency or state and the average energy savings per weatherized unit). The analysis method to determine this impact has not yet been determined. However, in addition to a review of the relevant research, insight into the impact of household investment levels might be obtained by two possible methods:

- Calculating SIRs for different expenditure categories of weatherization jobs (e.g., those costing between $1,500 and $2,000, between $2,000 and $2,500, up to $6500 etc.) and then comparing the means of each category using appropriate statistical methods. Information on the houses used in the billing data sample would be sufficient to perform such an analysis

- Using an audit program such as the Weatherization Assistant (Gettings, 2006). A significantly large number (perhaps 100 units) of real or typical houses could be modeled for a real or example agency to identify all the measures with an SIR greater than 1.0 for each house and then to estimate the cost and SIR for each of these individual measures. The cost-effectiveness and average investment level for this agency can be calculated for a fixed budget that is sufficient to install all the measures with an SIR greater than 1.0 in, perhaps, the first 50 houses, as well as to perform all administrative functions associated with these 50 houses (e.g., intake, auditing, and post-weatherization inspections). The cost-effectiveness and average investment level for the agency would then be recalculated as the SIR cutoff, which is used to determine which measures are installed in each house, is raised (or the average investment level per house is decreased), such that fewer measures are installed in these first 50 houses but measures with high SIRs are installed in additional houses until the same fixed budget is expended. If desired, houses used in the billing data sample could be modeled, and the model predictions could be calibrated to actual energy data. The analysis could be repeated using different costs to perform the administrative functions to gain insight into how the optimal SIR cutoff and average investment level changes as these fixed costs change.

2.4.2 In-Depth Cost Assessment of Weatherization Measures

It is possible that ARRA funding for weatherization and other energy-related programs (e.g., State Energy Program, Energy Efficient Community Block Grant Program) had an impact on the cost and availability of weatherization measures. This study will assess the changes in the costs of weatherization measures, as well as bottlenecks in their availability, during the ARRA period and related impacts on cost-effectiveness. This study will also compare the costs used in SIR calculations to those actually encountered in the field.

One way to perform this assessment is by using linear regression analysis to find the Total Installed Measures Costs (TIMC). The general form of the equation to be estimated is as follows:

$$TIMC_i = f(b_1*M_1 + b_2*M_2 + b_3*M_3 + b_4*M_4 + \ldots\ldots b_n*M_n)$$

where $TIMC_i$ stands for Total Installed Measures Costs for home, and M_i is a "dummy" variable indicating whether or not that measure was installed in any given $home_i$. Up to n different measures could be installed in a home. The beta coefficients represent estimates of each measure's cost.

Information about the Total Installed Measure Costs and the measures installed in each home will be available through the DF2 (Housing Unit Information Data Form), which local agencies will complete for each home (single-family detached, single-family attached, and mobile home) included in the national sample of weatherized homes heated with electricity or natural gas. The database is expected to include approximately 10,000 records, which is a database large enough to estimate regression models that are stratified by climate region at the very least and maybe also by housing type (e.g., single-family detached vs. mobile home by climate region).

Models will be estimated for PY2008 and PY2010. Beta coefficients for each measure will be compared between the models to estimate possible measure price changes. It is possible that the PY 2008 coefficients will also be adjusted for inflation.

Controls to make sure that the beta coefficients are valid as accurate estimates of measure prices will be done in three manners. First, specific coefficients for specific measures will be compared to prices for analogous measures compiled by the Producer Price Index (PPI) (http://www.bls.gov/ppi/) and possibly the Consumer Price Index (CPI) (http://www.bls.gov/cpi/). The PPI tracks prices related to air

conditioners, furnaces, lights, and insulation, and the CPI tracks prices related to such consumer goods as lights and energy. Second, the estimated regression models will be run on the data agency-by-agency to estimate total measure costs by sampled agencies. These results will be compared to total reported measure costs by agency. Third, a small number of questions about the cost of weatherization measures will be included in S3 (Subset of Agencies Detailed Program Information Survey, see Appendix E) to collect subjective estimations of changes in measure costs from PY 2008 to PY 2010.

A similar approach will be used to explore possible changes in labor costs. Regression models will be run with Total Labor Costs per home as the dependent variable and "dummy" variables for measure installation. The beta coefficients will represent the costs for installing each measure. Beta coefficients will be compared between PY 2008 and PY 2010 (the former may be adjusted for inflation). As a check on the validity of these beta coefficients, the database Occupational Employment Statistics (http://www.bls.gov/oes/), which has data on contractor wages, will be consulted.

Validated measure costs will be compared to measure costs used in SIR calculations during PY 2010, as appropriate by climate region and house type. NEAT will be used as the source of the SIR calculations. Bottlenecks in measure availability will be explored through the addition of several questions to S3 (Subset of Agencies Detailed Program Information Survey, see Appendix E).

2.5 EXPLANATORY FACTORS

Although average energy and cost savings will be calculated in the impact assessment by climate region, housing type, and primary space-heating fuel type (see Sections 2.2 and 2.4), a full analysis of factors that explain variations in energy savings and cost-effectiveness will also be performed. The impact assessment will assess how the energy savings achieved by the Program and the cost-effectiveness of the Program are affected by the various organizational features and operational processes of the Program, the households the Program serves, the measures installed, and the environment in which the Program operates. Some specific factors that will be examined include the following:

- household pre-weatherization energy consumption,
- installation of particular weatherization measures,
- key house characteristics (e.g., type, size),
- key occupant characteristics (e.g., age, disability),
- fuel prices,
- climate zone,
- training methods for weatherization crews,
- type of audit used,
- client education approach used,
- monitoring procedure employed,
- total investment levels,
- funding sources,
- low and high *material* expenditures (as opposed to total expenditures, which include labor costs),
- weatherization using only DOE funds vs. funds from multiple sources,
- air-leakage reduction,
- duct-leakage reduction, and
- increased furnace steady-state efficiency.

A broad range of potential explanatory variables will be examined using regression analysis. In addition, average savings associated with and without a single factor will be compared using all houses, and mean savings for explanatory factors will be compared between high-saving and low-saving houses.

Those factors that explain the most variation and are controllable by state and local weatherization agencies will be given the most attention, because results in those areas can suggest potentially valuable changes in program implementation. Special emphasis will be placed in these analyses on identifying variables that explain why the performance in the hot-climate region is unique. Details on these analyses are provided below in Section 2.5.1.

2.5.1 Regression Analysis

The primary analytical approach that will be used to study explanatory factors will be regression analysis. The regression analysis will explore the relationships between household energy savings and cost-effectiveness and a broad variety of factors; this form of analysis has the potential to explain variations in those two performance measures, including many of those identified above. By examining the possible influence of pre-weatherization energy use, it will be possible to identify whether any of the observed relationship is due to the regression-to-the-mean phenomenon (in which extreme measurements are subsequently followed by measurements closer to the norm).

Hypotheses will be developed concerning *a priori* expectations of the influences of each independent (explanatory) variable on the dependent variables (savings and cost-effectiveness). Energy savings will be measured first in absolute terms, secondly as a percentage of pre-weatherization whole-house energy use, and thirdly as a percentage of the pre-weatherization energy used for space heating. Cost-effectiveness will be defined as energy savings divided by the cost required to achieve those savings. The results of the regression analyses will be examined, and significant beta coefficients of the proper sign will provide support for the hypotheses. Insignificant variables will be dropped from the regression models.

Separate regression analyses will be run for houses heated by natural gas, electrically-heated houses, and houses heated by non-metered fuels (fuel oil and propane). Within those categories, the factors influencing energy savings and those influencing cost-effectiveness will be examined separately. For all dwellings other than those heated with electricity, further analyses will be performed to focus on factors affecting savings of the primary heating fuel only, baseload electricity only, and both fuels (heating and baseload electricity) combined.

Houses Heated by Natural Gas—As part of the regression analysis, a large multiple regression model that includes all potential explanatory variables will be run . It is likely that this will be a "stepwise" regression, in which independent factors are added to the model in the order of their explanatory significance. In addition, a series of simple regressions will probably be conducted using one independent variable at a time, and a factor analysis will likely be done to examine what sets of explanatory variables are associated with each other.

The above analyses will be run first using energy savings as the dependent variable and then again using cost-effectiveness as the dependent variable. Actually, the analysis of energy savings will consist of three different analyses, one for each of the above-mentioned definitions of savings (absolute household savings, household savings as a percentage of pre-weatherization whole-house energy use, and household savings as a percentage of the pre-weatherization energy used for space-heating). Further complexity will be added by the fact that energy savings will be first defined as savings of the primary heating fuel only, then as baseload electricity savings, and finally as savings of *both* fuels (heating and baseload electricity) combined.

Once the above analyses are run for *all* weatherized households, they will be run again for relevant subsets of households. These subsets will include, but are not limited to, different geographic and/or climate regions, agency sizes, and housing types.

Finally, regression analyses will be run using average household savings and cost-effectiveness *per weatherization agency* as the dependent variable. The same independent variables and analytical procedures listed above will be used. The theory behind undertaking this analysis is that using agency averages is likely to reduce the variability of results.

Electrically-Heated Houses—The regression analyses conducted for electrically-heated homes will be the same as those described above for gas-heated homes, except that they will be run only for the primary heating fuel because the dwellings involved use electricity both for heating and baseload purposes.

2.5.2 Cross-Tabulation Results

Average savings associated with a single factor (e.g., savings in houses that received wall insulation compared to houses that did not) will be compared for all houses and by subgroups of houses depending on primary heating fuel. Mean values for key explanatory factors (e.g., floor area, pre-weatherization energy use, installation of attic insulation) for high-saving and low-saving houses and for high-saving and low-saving agencies will also be calculated and compared.

2.5.3 Data

This analysis of explanatory factors will use pre-weatherization energy consumptions and energy savings as described in Section 2.2, and cost-effectiveness calculated for individual houses as described in Section 2.4. This analysis will also draw upon data relating to house, occupant, and program characteristics as described in Section 2.1. Information on some potential explanatory factors will be gathered for all weatherized houses, while data on other factors will be collected from a subset of houses if they are not available for all dwellings served by the program. Average data for a number of factors will be calculated for all weatherization agencies, and some additional information will be collected from a selected group of agencies.

3. PROCESS ASSESSMENT

The process assessment portion of the evaluation will address many of the questions that were identified in the evaluation design matrix (see Table 1.2), but which the impact assessment did not address:

- **Context**—Questions 1, 5, 7 and 9-11; and
- **Implementation**—Questions 3 and 5.

The above questions relate to identifying the missions and associated objectives of the Program and the organizations that the Program works with; understanding how the weatherization network works and the role of the Program in serving the low-income weatherization market; investigating the leveraging and partnership opportunities for the Program; and determining how well the Program is delivering services as well as how essential elements of the Program can be improved.

3.1 PROGRAM OPERATIONS AND IMPLEMENTATION

This assessment will aim to understand the context in which the Program operates by

- identifying the legislatively mandated goals (missions and associated objectives) of the Program and determining the Program's ability to meet these goals;

- identifying how states implement the Program relative to the logic model developed for the Program (see Section 1.1.2);

- determining how well DOE manages and administers the Program;

- determining how well the Program and the weatherization network are delivering services to the low-income weatherization market;

- identifying the leveraging and partnership opportunities the Program is exploiting (i.e., identifying the degree to which states and agencies coordinate the implementation of the Program with other federal, state, utility, and similar programs) and determining whether the Program's regulations are enhancing or inhibiting leveraging and partnership opportunities (or doing both); and

- determining the role the Program plays in the larger low-income energy-assistance effort.

3.1.1 Data and Surveys

Information on process improvement will be collected from all states as part of S1 (All States Program Information Survey, see Appendix C) and from the 400 agencies involved in the billing data energy-savings portion of the impact assessment (see Section 2.2.1) as part of S3 (Subset of Agencies Detailed Program Information Survey, see Appendix E). Both surveys will also ascertain states and agencies views of how DOE manages and administers the Program and will collect detailed input on how the states and agencies implement house audits, client education, training, and monitoring, as previously described in Section 2.1.1. The state survey will also collect information that defines state "implementation models." These surveys will be implemented after each state and agency completes PYs 2010 and 2011.

DOE will be surveyed using the DOE Survey (see Appendix B) to collect information on staffing, costs, and their enforcement of state and local agency data collection, storage, and data mining capabilities. This survey will be given when PYs 2010 and 2011 are complete for all states.

Open-ended interviews will be held with DOE and a subset of states and agencies via telephone or by means of one or more group meetings to solicit needed process information for this study. The sampling plan and survey instruments associated with this data collection will need to be developed; however, the survey instrument should include the following information:

- major strengths/positive traits at each implementation level (DOE, state, and agency),
- major weaknesses/negative traits at each level,
- major barriers to effective operation posed by each level and outside partners,
- adequacy of current resources,
- suggested reallocation of current resources,
- suggested allocation of additional resources,
- coordination,
- communications, and
- Program administration.

The Occupant Survey that is being implemented as part of the retrospective evaluation contains a customer satisfaction section, so this survey will collect information such as the timeliness of the work performed (e.g., audit, measure installation, inspection), whether agency staff reported at scheduled times, the condition in which workers left the house following their work (e.g., cleanliness, debris removal), and the courtesy of the agency personnel.

3.1.2 Analysis

The mission and objectives of the Program and DOE's management structure and responsibilities will be described. This will include a summary of:

- the Program's legal authority and its regulatory framework;

- the goals, objectives, and key performance measures as viewed by Congress, the Department, and the Administration; and

- Federal, state, and local responsibilities as described by both regulation and network participants.

In addition, particular attention will be paid to leveraging activities allowed under the Programs rules and regulations.

An analysis of the management structure, responsibilities, and resources for each of the Program's management levels (i.e., headquarters, regions, state, and local agencies) will be performed. This analysis will focus on operations at each management level, the allocation of human and funding resources to various functions, and whether each management level perceives the resources it has to perform its functions both within and between management levels. A secondary focus of this analysis will be the perceived barriers to effective operations imposed by each management level on other management levels and barriers at each management level to effective operations with outside partners.

Organizational activities relating to how well Program services were delivered will be identified, and a measurable indicator for each activity will be developed (e.g., whether an audit was performed on time, whether measures were installed when scheduled, etc.). Information collected from all agencies or a

subset of agencies on all houses or a subset of houses weatherized will be used to determine the average values for these indicators.

Approximately five typical models of how states administer and implement the Program will be developed based on information collected from the state survey and from reviewing state weatherization plans submitted to DOE. How well these models work, and how well they fit the theory and logic of the Program, will be discussed using the logic model developed for the Program (see Section 1.1.2) as a guide. Lessons learned from the various approaches, model dependencies, and key issues and administrative concerns affecting model effectiveness are expected to be identified.

Occupants' perceptions on how well Program services were delivered will be compared to the perceptions provided by the agency staff and crews and the comparisons analyzed.

The role of the Program in the overall low-income energy assistance effort will be assessed by drawing together information from the impact assessment on the Program characteristics (see Section 2.1) with information collected and analyzed in this study. Program characteristics that will be used include information on the national low-income population, the segment of the market currently being served by the Program, and the characterization of the local and state agencies and the scope of their programs.

3.1.3 Deferral Study

The Process Assessment for the WAP-ARRA Evaluation includes an exploratory study of federal, state, and local weatherization agencies' policies, procedures, incidence rates, and final weatherization service status regarding deferrals, (i.e., situations where agencies decide to postpone weatherization till a later date or ultimately where weatherization services are not provided). Reasons for deferral of weatherization treatment are generally categorized into two areas:

- Health and Safety – conditions in the home may pose health and/or safety risks to weatherization workers; and
- Cost-effectiveness – home may be in such disrepair that weatherization measures might not result in cost effective energy savings.

Regional and state field guides or manuals provide guidance for policy and acceptable reasons for deferment. OSHA standards for Health and Safety for weatherization auditors, contractors, and crew members must be adhered to and are referred to within the Health and Safety section of the OSHA field manual.

This exploratory research study will utilize information from the state, agency, weatherization staff/occupant surveys, the retrospective case-study process evaluation, and data collected from a sample of 10 states and 10 local agencies that describes the processes experienced by 200 occupants engaged in the deferral process. Appendix O, Section 5, contains an in-depth discussion of the sampling plan for this study.

The exploratory design involves documenting the accessibility and use of field manuals (which may have deferral guidelines, reported deferral frequency rates, and agency protocols and standards. The first task to be undertaken is to identify each state's deferral protocols for PY2010. Table 3.1 presents the structure for preliminary data collection in order to shape the exploratory design of the process assessment; this structure will be updated throughout the data-collection process.

Table 3.1 Deferral Protocol for All States and Territories

	State or Territory
Regional Guide Only	
State Guide	
Agency Guide	
Standard Forms	
Appeal Procedure	
Appeal Forms	
Grievance Forms	
Referral Plan	
Referral Documentation	
Tracking System for Deferral Incidence	

The conditions under which deferrals may be granted vary from state and state, and potentially, from agency to agency. The reasons that people abandon a housing unit will initially be categorized by the evaluators based on the list of deferral conditions posted by the Weatherization Assistance Program Technical Assistance Center (WAPTAC) and on additional conditions found in regional protocols. Additional conditions suggested by weatherization staff or surveyed occupants, or from state or agency survey instruments, may be added.

The retrospective evaluation's versions of S1 (All States Program Information Survey) and S2 (All Agencies Program Information Survey) will be modified to include requests for data designed specifically to capture tracking of deferral rates and to confirm sources for deferral policies and procedures nationally.

The weatherization staff survey, also being conducted as part of the retrospective evaluation, will be administered nationally to 240 auditors between Spring 2011 and Summer 2011. Specific questions about deferral policy, procedure, and frequency of specific conditions or reasons for deferring services have been included in a revised version of this staff survey. Responses collected from the survey will be compared to state deferral-protocol standards, while incidence rates reported (if they were in fact tracked) for PY2010.

Before beginning to collect data for the records analysis, evaluators will observe at least four deferrals in process. The four agencies selected for observation will be based on the criteria in Table 3.2. Evaluators will be instructed to note the following:

- cause of deferral,
- assessment of impact of accessibility to standard deferral plans,
- utilization of standard forms,
- auditor knowledge of community resources (e.g., other social services available to the household) targeting the specific cause(s) for the deferral,
- innovative techniques for preventing potential deferrals,
- range of subjective or ethnocentric responses to home conditions (i.e., auditors and/or clients judgments about conditions in the homes) or client behavior, and

- other characteristics of the homes and weatherization personnel. A case-study process evaluation will be conducted to record the overall assessment of the observed deferral occurrences; this process evaluation will entail interviews with clients and weatherization staff, review of available documentation, and analysis of collected data.

Table 3.2. Deferral Observation Assessment Criteria

Formal Deferral Plan; Low Incidence	No State Formal Deferral Plan; Low Incidence
Formal State Deferral Plan; High Incidence	No State Formal Deferral Plan; High Incidence

Assessment of the deferral process will follow a sequence of events during PY 2010, beginning with the home audit through to the final deferral decision. Figure 3.1 illustrates the potential actions within deferral processes and is subject to change according to differing processes among states, agencies, or households.

Data for analysis will be collected after the deferral decision is made. A sample of 10 states and 10 local weatherization agencies will be selected based on the varying levels of historical commitment to successfully resolving deferral situations and adoption of individual vs. regional deferral protocols. The technical aspects of this study are flexible due to these variables. Each state and agency is presumed to organize its deferral documentation differently, since there is no nationally accepted streamlined approach to tracking and monitoring in place. The sample of agencies and their corresponding state grantees will be stratified to allow for comparison between states that have written deferral policies and procedures codified in state field guides and states that rely only on regional field manuals. It is presumed that states with state field guides and protocols are also states with historical commitment to WAP; if so, a second comparison can be made between those states with established weatherization programs and states that have historically low levels of Program participation. The study will compare quality assurance, frequency rates, and documentation of deferrals between those sub-sampled states and agencies that have standard deferral plans and those that do not; additionally, the study will consider how unit or agency attributes correlate with adopted deferral plans (Table 3.3).

Figure 3.1: Deferral Action Tree

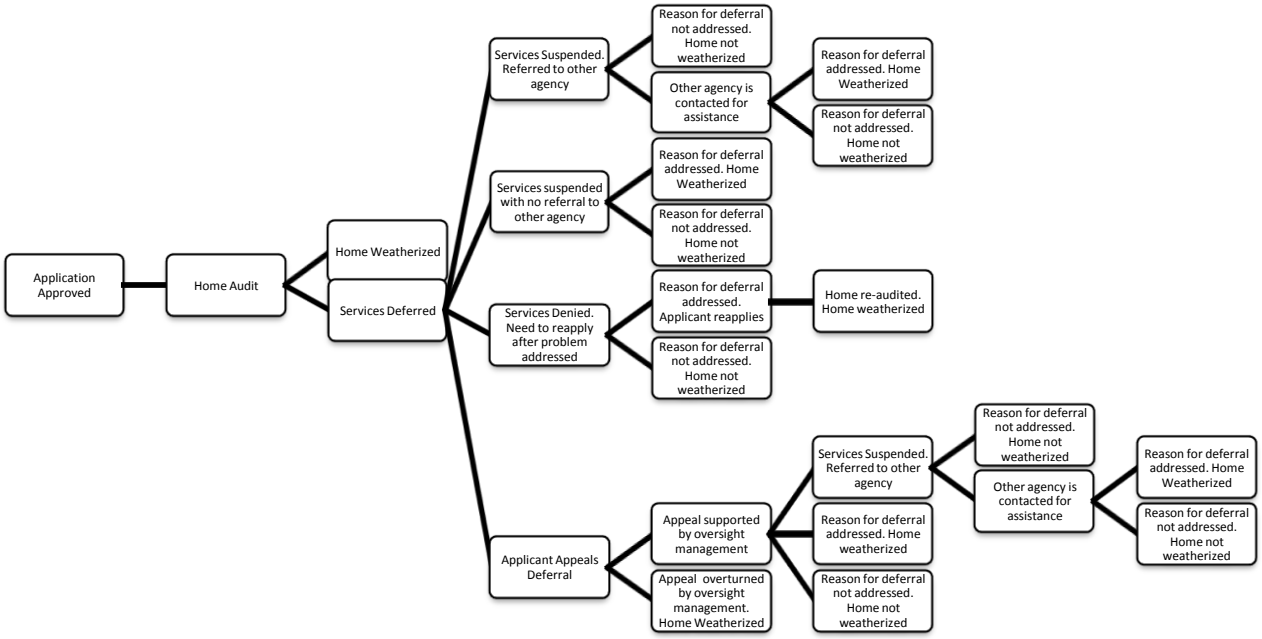


Table 3.3 Unit or Agency Attributes

	Urban vs Rural	Hot vs. Cold	Single Family vs. Multifamily vs. Mobile Home	Age of Housing Unit	Wx Agency Experience
Formal Plan					
No Formal Plan					

Evaluators will retrieve documents detailing deferral forms or deferral notes from individual applicant files or from agency data files organized either electronically or in paper form. Oversight and tracking processes, if observed, will also be documented. To reduce the burden on local weatherization agencies, methods of data collection may include site visits to the sampled agencies by evaluators, as well as the methods used to implement the staff survey.

Evaluators will follow the deferral process in real time for a sample of 200 households. This process assessment will involve phone interviews with occupants and weatherization staff, as well as records collection. The 200 households will not be randomly selected due to the unpredictable nature of deferrals and the value of collecting data in real time. The purpose of the household survey is to document the occupant's account of the deferral and his or her perception of the overall process. The evaluators will administer the survey as a pre-tested telephone questionnaire, which may require a one-time call or an initial call with additional follow-up if treatment has been deferred for a certain amount of time, or if an appeal is in process.

The following information will be collected from the sample of 10 local weatherization agencies and the 200 sampled households:

- Standard or informal deferral policy or protocol
- Documentation of deferral process
- Reasons for suspended and deferred treatment
- Incidence of suspended and deferred treatment
- Efforts to communicate with applicant
- Appeal process for deferred applicant
- Incidence of appeals
- Incidence of weatherization post-deferral
- Tracking mechanisms imposed by local agency or state office.

This study seeks to explore the ways in which agencies and states differ in their deferral strategies, and the limitations these differences place on the representativeness of results for the nation as a whole. The following attribute data will be collected and factored into the analysis of results across local, state, and federal systems:

- Variations in determination of health and safety standards
- Determination of what measures are deemed to be cost-ineffective
- Accessibility of state or regional field manuals and whether or not these field guides are consulted at the local agency level
- Whether there is a lack of a streamlined documentation and tracking strategy to effectively capture the incidence of walk-aways on both agency-to-agency and state-to-state levels
- Objectivity of the determinations made by auditors, contractors and crew members
- Cultural influence on home conditions
- Cultural or language barriers between auditor or crew members and occupants
- Prevalence of health and safety barriers specific to geographic areas
- Other attribute and relational data discovered though process assessment.

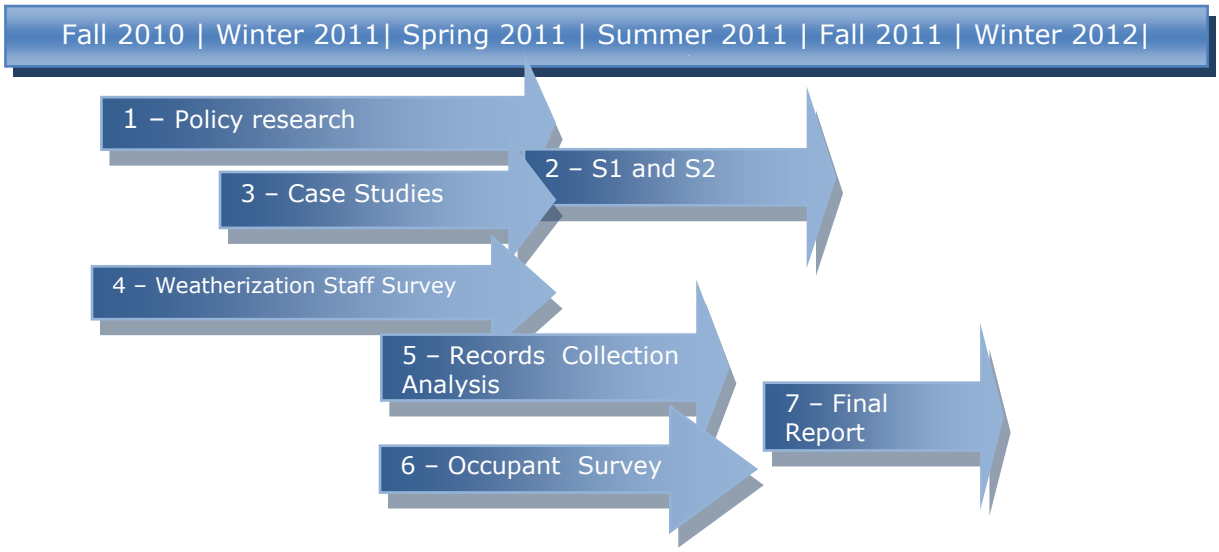
Because there is no current tracking system in place, the data that will be collected to provide insight into the frequency of deferrals will be reported as an estimation of the incidence of deferrals. Incidence estimates within the 10 states sampled will help determine the need for policy and for standardized procedures aimed at minimizing deferral rates within the states. The data collection and analysis aim to

- Calculate estimates of incidence rates of interrupted or suspended weatherization as a result of health and safety issues or cost-effectiveness concerns
- Provide estimates of the rate of final deferrals of treatment, in which the applicant is advised to reapply after addressing extensive concerns observed in the home
- Assess policy and protocols for deferral of treatment as defined in regional, state, and local field manuals or guides
- Compare deferral protocols and OSHA standards
- Assess the impact of standard deferral forms on incidence and documentation
- Review quality assurance issues regarding the deferral or suspended work phase to ensure fair treatment of applicants
- Assess the potential benefit of streamlining the deferral process and documentation on a national level to ensure the health and safety of weatherization auditors, contractors and crew members
- Assess policy and procedure with regard to documentation, tracking, and monitoring of individual deferral occurrences and collective incidents on state and national levels

- Identify effective model strategies for tracking deferrals for future studies aimed at seeking more accurate incidence records of deferrals on a national level
- Determine the incidence of referrals made to alternate resource(s) for assistance, with reasons(s) for deferred services
- Provide discussion of needed resources from government, private, and non-profit sectors to better address the underlying causes for home deferrals discovered through the data collection and analysis
- Ascertain whether reasons for deferrals are acceptable and are subject to appropriate management oversight
- Determine how "user-friendly" the appeal process is for deferred applicants
- Determine the impact of Program mandated limitations on weatherization funds allowable for health and safety conditions of the home

This study has two primary objectives. The first is to determine deferral incidence rates and to explore impacts on the Program The second is to identify both strengths and weaknesses in the deferral process at the local agency level, in the monitoring system established by the state grantees of WAP, and in oversight of the grantees by DOE Project Officers assigned to each state. It is hoped that existing and effective tracking mechanisms with the potential to serve as a model for state monitoring of local agencies or subgrantees will be identified. The timeline for tasks associated with the Deferral Process Evaluation is shown in Figure 1.2.

Figure 3.2 Deferral Process Assessment Timeline



3.1.4 Post-ARRA Weatherization Network Strategies

As mentioned above, ARRA funding required the national weatherization network to expand greatly in a short period of time, essentially doubling the annual number of homes weatherized during PY's 2009, 2010, and 2011. This increase in production required associated increases in training and manpower. As this document is being written, the activity of the national weatherization network is peaking and then is expected to plateau. States and agencies are already considering what to do when the WAP-ARRA period ends in March 2012.

The purpose of this task is to collect information for DOE and the national weatherization network on strategies being developed by grantees and subgrantees post-ARRA. It is envisioned that strategic decisions about in-house staffing will need to be made; equally, the existing leveraging

relationships, future implementation of innovative financing programs (e.g., revolving loan funds, participation in carbon markets), and ongoing maintenance of the weatherization training infrastructure (see 3.1.5) will have to be considered, among many topics. Suggestions about how the transition could be softened will also be collected. The following activities will be undertaken:

- Winter 2011 – ORNL will arrange for a national conference call with its National Weatherization Network Committee (see Appendix A) to discuss the types of information ORNL should attempt to collect to inform the Network and DOE about post-ARRA strategies. ORNL will use these inputs to develop new questions to be included in these two surveys: S1 (All States Program Information Survey) and S2 (All Agencies Program Information Survey). ORNL will take the opportunity during this call to also update the Network Committee on the progress that has been made on the retrospective evaluation and on the planning for the WAP-ARRA period evaluation.
- Winter/Spring 2011 – ORNL staff will meet with members of the national weatherization network in various forums to discuss evolving strategies. It is expected that ORNL will arrange for time to meet with network members at the NASCSP Mid-Winter Training Conference in early March 2011, and at a similar NCAF event. ORNL will also arrange conference calls with DOE/OWIP program officers to discuss what they may be seeing during their visits and discussions with grantees.
- Summer 2011 – The revised versions of S1 and S2 will be administered to all grantees and subgrantees.
- Fall 2011 – The survey results and inputs from various discussions will be summarized into a stand-alone report.

3.1.5 Post-ARRA Training Assessment

This task specifically focuses on strategies and plans that address the national weatherization training infrastructure. This infrastructure significantly expanded during the ARRA period (for example, the number of DOE-supported training centers increased from single to double digits). There is some evidence that spillover into related but separate endeavors may be occurring; for example, it has been reported anecdotally that the training centers may be serving purposes beyond training people to do low-income weatherization. Some of those who have received DOE-supported training may be equipping themselves to work in the non-low-income retrofit sector as well. Some high-school students are receiving training as part of after-school career development programs. The training centers may be able to play a role in supporting other federal home-retrofit initiatives, such as Home Score.

With these thoughts in mind, training issues will be integrated in the four tasks listed under 3.1.4. That is, training infrastructure issues will be addressed with the National Weatherization Network Committee, in meetings at NASCSP and NCF, and in revisions of S1 and S2. Information from grantees and subgrantees will be collected to anticipate training needs beyond the ARRA period. Use of the DOE-supported training centers by individuals not directly involved in low-income weatherization is being tracked by the Weatherization Staff survey which is being used in the retrospective evaluation. Results from this survey, along with discussions with appropriate national stakeholders, will be used to project those national weatherization training needs beyond low-income weatherization that could be met by the DOE-supported training infrastructure. A summary report on post-ARRA training strategies will also be prepared during Fall 2011.

4. SPECIAL STUDIES

4.1 UNDERPERFORMING WEATHERIZED UNITS

4.1.1 Introduction

In spite of the marked decreases in energy consumption and utility cost savings that low-income home weatherization has notably achieved, some weatherized units produce less-than-expected changes in levels of energy consumption after weatherization. Dubbed "underperformers," these cases occur across all building types (single-family, multifamily, and mobile homes) and regions. DOE, weatherization agencies, and ORNL evaluators have all identified the need for an investigation into multifamily units and the potential causes for their underperformance. Homes weatherized in PY 2009 and large multifamily buildings weatherized in PYs 2007, 2008, and 2009 will be included in this study.

4.1.2 Potential Causes of Underperformance and Over-performance

There are several possible causes for underperformance in weatherized units; these include

- Take-back or Rebound Effect – After weatherization, some households spend their energy cost savings on measures to increase the comfort of their homes (for example, buying new climate-control technology), thereby increasing their energy consumption to pre-weatherization levels.
- Change in Household Demographics – After weatherization, the size and/or composition of the household may change. For example, grandparents may take in grandchildren. Household members previously employed may become unemployed and, as a result, spend more time in the home. This could lead to increases in energy use during the day.
- More energy-consuming equipment may be bought or used after weatherization – It is possible that some households purchase or use more energy-consuming equipment (e.g. deep freezers, new televisions or computers, clothes dryers, etc.) after their home has been weatherized, thereby affecting the predicted energy performance of the home.
- Simple Regression to Mean – There is no reason to believe that every year's energy consumption by a household should be the same. There may be natural variations in energy use that would only become apparent through analysis of billing histories several years before and after weatherization. This hypothesis suggests, for example, that households might actually show savings two or more years after weatherization.
- Inaccurate Audit Tool – The variations in home designs, internal and external conditions, household energy consumption patterns, and household compositions are considerable. No computerized audit tool or priority list can be expected to accurately model energy savings associated with potential weatherization measures for every conceivable home situation encountered in the field. It is possible that some audits recommended less-than-optimal sets of measures to install in some homes.
- Poorly Done Audit – It could be that some auditors need additional training or that they tend to recommend measures that occupants want but that do not contribute much to the energy efficiency of the homes.
- Substandard Installation of Measures – Some weatherization measures may not be installed properly; recommended insulation levels may not be met; furnaces may not be properly tuned up; and some recommended measures are simply not installed. Such issues could reduce observed energy savings in homes.
- Failure of Measures – It is possible that some properly installed measures could fail during the one-year post-weatherization period during which bills are collected. In these cases, households may be forced to use old, inefficient technologies and/or revert to previous, energy-inefficient behaviors.

- Poor Operation of Measures – In the large multifamily building context, it could be that those responsible for energy management may not be operating new technologies as prescribed. For example, building supervisors may be neglecting to use inputs from new temperature sensors located in select apartments.
- Lack of Education – Anyone, from multi-family building owners and managers to residents in single-family units, may lack effective and comprehensive energy education.
- No significant Weatherization Measures Installed – If no major weatherization measures are installed in a house/unit, then expected energy savings will be small. A unit with a small level of expected savings could appear as multifamily when compared to all weatherized units.

It is useful to consider whether some of the causes of underperformance could, if reversed, lead to over-performance. There are several possible causes for over-performance in weatherized units, which include:

- Reverse take-back effect – Households extend their energy cost savings by changing behaviors within the home to reduce energy consumption (e.g. changing the thermostat settings).
- Less energy-consuming equipment – Some households may discard energy-consuming equipment after weatherization.
- Simple regression to the mean – "Over-performing" households could actually show less savings two or more years after weatherization.
- Reverse change in household demographics – If one or more residents moves out of a house or unit after weatherization, higher energy performance in the unit as compared to estimated savings could result.
- Inaccurate audit tool – The audit of a unit may have underestimated the potential energy savings after weatherization.
- High occupant education – Multifamily building owners and staff and residents of weatherized homes/units may have received a higher-than-expected level of client education.

The evaluation approaches discussed below are designed to test these types of hypotheses.

4.1.3 Evaluation Approach: Single Family and Mobile Homes

The evaluation methods discussed in this section are designed to assess major potential causes for underperformance among the three major types of weatherized units—single-family, multifamily, and mobile homes.

The first task is to define underperforming (and over-performing) homes. "Underperforming" homes are defined to be in the bottom 10% when audit-estimated energy savings are compared to measured energy savings post-weatherization as set out in Equation (1). "Over-performing" homes are defined to be in the top 10%.

Equation (1):

Level of performance = (weather-adjusted audit-estimated energy savings minus weather-adjusted measured energy savings)/
(weather-adjusted audit-estimated energy savings)

Distributions of the level of performance will be estimated for all of the approximately 400 sub-sampled agencies. The top and bottom 10% of homes will be identified, and a list of agencies with eight or more multifamily and four or more over-performing homes will be compiled. Twenty agencies will be randomly selected from this list to be part of this study. For each selected agency, the four multifamily homes and two over-performing homes, (a total of 120 homes) will be randomly selected for inclusion in

this study. The study will start with a larger sample and pre-screen to ensure that home inspections are warranted (i.e., that major demographic changes in the home are not the sole cause for under- or over-performance.

The project team will already have a good deal of information about these homes. In addition to the billing histories (only homes heated with natural gas or electricity will be included in this part of the study), the project team will have housing unit, installed weatherization measure information, and audit-estimated savings from the DF2 Housing Unit Information Dataform and additional information from the DF4b form. From S2 and S3, the project team will have retrieved information on how the agencies conduct their audits, the extent to which the agencies use contractors, and how client education is delivered. Each classification will be crossed-referenced against building and weatherization characteristics, identifying numbers of multifamily units of each building type and particular technologies present in multifamily units. Data on client-education measures will also be compared to unit performance classifications and building types to ascertain the effect that client education can exert on level of performance.

Each underperforming and over-performing home will be thoroughly inspected, and the inspectors will review audit procedures and recommended measures. In the cases of priority lists, the lists will be evaluated to determine the level of appropriateness for the multifamily unit. In instances of computer audit, the auditing process will be evaluated to determine whether the audit software made mistakes (such as overestimates), whether calculated savings estimates were unreliable, or whether auditors misused software. In addition to inspecting the auditing process, evaluators will inspect for incorrect installation of measures. Thoroughness of installation will be compared against the recommended list of measures to be installed, thus allowing evaluators to determine whether any measures were forgotten during installation.

Occupant surveys will also be administered to collect further data on those living in the weatherized units that have been identified as either poorly performing or over-performing. The occupant surveys will also show whether residents are correctly utilizing the newly installed measures. The survey data will expose any behavioral change resulting from the weatherization process, and if any change is noted, may provide insights into under- and over-performing units. Changes in household demographics and composition will be noted.

Lastly, this study will develop regression models to help explain variations in energy savings among weatherized homes. The regression models will contain variables such as installed measures and demographics. The 120 homes included in this study will be run through the appropriate regression models to ascertain their predicted savings and whether the models also predicted the homes to be under- and over-performers. The project team will address the significant variables in the models during its investigations to generate more detailed support or non-support for the inclusion of the variables in the models. Conversely, the project team may find in the field causal factors that might have been included in the models but were not.

4.1.4 Evaluation Approach: Large Multifamily Buildings

The complexities of large multifamily units require a different evaluation approach. This project will work with two organizations in the New York City region that routinely perform large multifamily building audits: Community Environmental Center (CEC) and the Association for Energy Affordability, Inc. (AEA). Each organization will identify five large multifamily buildings and two “over-performing” buildings, based on their audit results and post-weatherization energy-savings analyses, to be included in this study. The study will also include five multifamily and two over-performing buildings in the greater Chicago-Milwaukee region.

Each of the twenty-one buildings in the study will be treated as a case study. The project team will interview building owners and managers about the weatherization process and the operation of newly installed measures (including boilers and energy-management systems). The project team will collect information to ascertain whether the occupancy of the building changed from pre-weatherization to post-weatherization. Each building will be inspected to determine the quality of the weatherization measures' installation and will compare what was actually done in each building to the audit recommendations.

The case studies will aim to answer the following questions:

- How effective is the whole-building approach?
- What effect does poor implementation of installed measures have on the whole-building approach?
- How well is energy monitoring being implemented, and what effect does it have on the whole-building approach?
- Do any buildings utilize off-site energy management tools, and if so, how effective are they?
- How and to what level are building staff trained to use newly installed measures, and how effective is this training?
- Is building age a factor in performance?
- Are occupants correctly utilizing the newly installed measures?
- Are occupants educated in how to use the measures correctly?

4.2 TERRITORIES

4.2.1 Introduction

In March 2009, a Final Rule was published in the Federal Register amending DOE's definition of "state" to include the Commonwealth of Puerto Rico, Guam, the US Virgin Islands, the Commonwealth of the Northern Marianas Islands, and American Samoa. The new definition is consistent with modifications made to Section 411(c) of the Energy Independence and Security Act (EISA) of 2007. The final rule extended all federal regulations and guidances of the Weatherization Assistance Program (WAP) to these US territories under both regular and ARRA program years.

The proposed evaluation approach discussed in this document allows for a comparative analysis of the results achieved in the tropical and semi-tropical climates typical of the U.S. territories and the results from other US climate zones.

Table 4.1 shows the current WAP funding allocation for each US territory during the ARRA program years, along with the number of projected housing units to be weatherized, assuming a maximum cost allocation of $6500 as per WAP-ARRA guidance. Although households in hot-weather climates typically use much less energy than the average US household, residents of island states can pay up to double in electricity per kWh, resulting in a near comparable home energy cost burden.

Hot-climate weatherization projects tend to focus on base-load electric measures from household appliances and efficient cooling systems, both of which tend to be less costly than heating system replacements or installations. For example, approximately 24% of home energy use in Puerto Rico is attributed to air conditioning; heating system expenditures are not allowable in some territories' WAP program plans (www.energystar.gov, 2009). As a result, the per-unit cost of retrofits in the tropical and sub-tropical marine climate zones of these US territories could be lower than in the rest of the United States, allowing an increased number of local housing units to be weatherized. However, it is also possible that a greater number of housing units in the territories will be fitted with renewable energy technologies due to the ample availability of renewable energy in the forms of solar, wind, and

geothermal resources. Currently, two of the five US territories have placed solar hot-water heaters on their priority lists for weatherization (Table 4.1). The use of this technology could increase the cost per unit, creating the potential for those dwellings to reach the maximum allowable cost and resulting in the final number of homes weatherized being similar to initial projections.

4.2.2 Evaluation Methods

The evaluation methods for this study are designed to determine average energy and cost savings associated with weatherization and calculate program efficiency. Variations in technology priorities and the use of weatherization measures that are appropriate for these tropical and sub-tropical territories in light of possible increases in the frequency of extreme weather events due to climate change will also be assessed.

Prior to the implementation of evaluation tasks, members of the evaluation team will complete an on-site field visit to Puerto Rico. Puerto Rico was singled out for this because it is by far the most populous territory and its funding allocation under ARRA is more than 10 times that of all the other U.S. territories combined. This site visit is expected to allow evaluators the opportunity to accomplish the following goals:

- Introduce the evaluation team
- Observe the Program in process
- Collaborate with weatherization network members regarding selected aspects of the evaluation approach, methods and tasks
- Disseminate information regarding the proposed evaluation tasks impacting network members.
- Report anticipated burden of the evaluation on network members
- Allow network members the opportunity to ask questions in person regarding the evaluation process
- Complete a preliminary assessment of cultural factors which may enhance or challenge the evaluation process
- Complete a preliminary assessment of variations in priorities regarding weatherization technologies and measures for tropical marine climates.

All territories will receive the All State Program Information Survey (S1) for the WAP process evaluation and program characterization at the same time as other U.S. states participating in the National evaluation. The evaluation will collect additional information from representatives of both the Pacific and Caribbean island territories at various stages in PY 2010, 2011 and 2012 (Table 4.1). Guam has been selected to represent the Pacific islands and Puerto Rico has been selected to represent the Caribbean islands. Both are located in tropical climate zones. It is presumed that the geographic and cultural differences between the two regions may present varying logistical issues and possible variations in energy efficiency practices and results so both regions will be studied with equal amounts of rigor regarding energy and cost savings.

For both Puerto Rico and Guam, a sample of housing units will be selected for home energy savings analysis. For those households, monthly billing data will be collected and analyzed for the purpose of calculating energy and cost savings. As shown in Table 4.1, the Subset of Agencies Detailed Program Information Survey (S3), Housing Unit Information Surveys (DF2), and Building Information Surveys for Multifamily housing (DF3) (if applicable) will also be administered in those two territories.

4.2.3 Puerto Rico Case Study

A case study will be conducted for Puerto Rico only. Puerto Rico was selected for this based on the level of awarded funding, number of homes projected for weatherization services, eligible population size, and geographic location. The Case Study aims to answer the following questions:

- What are the measures taken by Puerto Rico and their one sub-grantee to manage over $65M in ARRA funding for the WAP?
- What challenges are the client, sub-grantee, grantee, and DOE project officer facing with the new eligibility and ARRA ramp up?
- What are the overall strengths and deficits of the Puerto Rico WAP?
- How well does the Puerto Rico State Plan for WAP under ARRA harmonize with the practical application of services and with expectations from DOE?
- What is the demand for services?
- How efficient and client friendly are the application and implementation processes from the agency and client perspectives?
- What is the inspection protocol for homes weatherized and does it assure quality
- What unique or innovative measures or technologies are installed addressing marine climate characteristics and how are these measures/technologies influenced and accepted by the client population?
- What client education techniques are being employed to ensure long-term impact on energy efficiency?
- Is the weatherization network taking advantage of available renewable or sustainable resources inherent to island characteristics?
- Are measures taken to create a cultural norm around home energy efficiency?
- What measures are being implemented to address the expected post-ARRA decrease in funding and resources?
- Does installation of solar water heaters in weatherized homes influence others in the household's social network or other moderate and high income families not eligible for the WAP services to invest in solar water heaters or other renewable resource technologies, especially those eligible for a federal tax credit or other economic incentives?

*S1, S3, DF2, DF3, and DF4 are surveys and data forms contained in the appendices.

Table 4.1. WAP funding allocations, key measures, and evaluation methods for U.S. territories under ARRA

US Territory	Funding Allocation under ARRA	Primary installations/measures	Evaluation Methods and Time Frames for Task Completion
American Samoa	$896,449	CFLs, solar water heaters, refrigerator replacement, window air conditioners, and low-flow faucets and showerheads	• Preliminary review of State Plan (Fall 2010) • Survey: S1 (Spring 2011)*
Puerto Rico	$65,262,581	Reflective films, air leakage in air conditioned areas, solar hot water heaters, Energy Star water heaters and air conditioners, refrigerator replacement, CFLs, shower head replacements, smart power strips, and mitigation of energy related health and safety concerns	• Preliminary review of State Plan (Fall 2010) • Surveys: S1, S2, S3, DF2, DF3, DF4 (if applicable) (Spring 2011) • Billing Data Collection (Summer 2011, 2012, and 2013) • 1 Week of QA Inspections (PY 2011) • Case Study (Spring/Summer 2011)
Northern Mariana Islands	$997,686	Baseload efficiency appliances, and cooling systems. (Details will need to be requested)	• Preliminary review of State Plan (Fall 2010) • Survey: S1 (Spring 2011)
Guam	$1,431,132	Weather-stripping and sealing of air leaks, CFLs, replacement of refrigerators and air conditioners with energy efficient appliances, shower head and faucet aerator replacement, installation of smoke and carbon monoxide detectors	• Preliminary review of State Plan (Fall 2010) • Surveys: S1, S2, S3, DF2, DF3, DF4 (if applicable) (Spring 2011) • Billing Data Collection (Summer 2011, 2012, and 2013) • 1 Week of QA Inspections (PY 2011)
US Virgin Islands	$1,827,182	CFLs, refrigerator replacement, timers on water heaters, low-flow showerheads and aerators	• Preliminary review of State Plan (Fall 2010) • Survey: S1 (Spring 2011)

4.3 WEATHERIZATION INNOVATION PILOT PROGRAM

4.3.1 Introduction

This piece addresses the evaluation of OWIP's Weatherization Innovation Pilot Program (WIPP). Recently, OWIP announced awards to sixteen grantees of approximately $30M, with another $90M of leveraged funding pledged by grantee partners. Table 4.2 summarizes the sixteen projects and funding levels.

Most of the sixteen projects contain multiple activities. Each separate activity could be the focus of specific evaluation activities. The next section identifies nine important project activities that are contained in the sixteen projects, proposes meta-evaluation questions (i.e., questions framed within the broader policy context), lists specific evaluation questions to be explored via a comprehensive evaluation, and the provides the evaluation activities that would be conducted to answer the evaluation questions. The following section summarizes the evaluation activities across the ten project activities.

Table 4.2. WIPP Funded Projects

	Organization	State	Type (Non-Profit, State, Private, Utility, etc)	Program Structure	DOE Funds Requested	Leveraged Funds
Financing Approaches (mostly Multifamily)	DEPARTMENT OF COMMERCE (Washington State)	WA	State / WAP Agency	Multifamily owner loans through CDFI's	$ 3,000,000	$ 9,386,008
	LEAP: Local Energy Alliance Program	VA(1)	Non-Profit	Multifamily ESCO approach	$ 1,898,938	$ 5,950,000
	UTAH DEPARTMENT OF COMMUNITY AND ECONOMIC DEVELOPMENT	UT	State / WAP Agency	Revolving Loan Fund and Performance Contracting to home owners	$ 850,000	$ 2,550,000
	COMMUNITY ENVIRONMENTAL CENTER INC	NY	Non-Profit, WAP Subgrantee	Low-rise multifamily approach with on-bill financing	$ 3,000,000	$ 9,000,000
	STEWARDS OF AFFORDABLE HOUSING	DC	Non-Profit	Multifamily ESCO approach	$ 2,590,523	$ 8,750,000
	ENERGY PIONEER SOLUTIONS	NE	Private Company	Private company offering 50% loans to customers, with on-bill repayment	$ 812,418	$ 2,959,150
	DANVILLE, CITY OF	VA(2)	City	City-wide collaboration with housing agencies for rental multifamily; smart meters; PACE or RLF	$ 1,015,746	$ 1,290,000
Workforce Development / Volunteer	YouthBuild USA, Inc.	CT, NY, MN, MD, WV, VA	Non-Profit	Geographically diverse pilots for workforce development and volunteer models	$ 1,374,020	$ 4,020,593
	HABITAT FOR HUMANITY INTERNATIONAL (HFHI)	AL, CA, DC, FL, IA, IL, ME, MI, MN, MS, NC, PA, TN, TX	Non-Profit	Geographically diverse pilots for workforce development and volunteer models	$ 3,000,000	$ 9,010,000
New Technologies	EFFICIENCY VERMONT	VT	Non-Profit	In-home metering and behavioral interventions	$ 719,380	$ 1,200,000
	Commission on Economic Opportunity	PA	Non-Profit, WAP Subgrantee	In-home metering	$ 2,449,607	$ 9,291,200
	UNIVERSITY OF NORTH CAROLINA CHARLOTTE	NC	College / University	Non-traditional provider with new technologies: ductless heat pump, whole house fan, in-home meter (Google/TED)	$ 2,005,945	$ 6,214,400
Green & Healthy Homes	The United Illuminating Company	CT	Private, Utility	Green and Healthy Homes Initiative led by Private utility	$ 3,000,000	$ 11,047,475
	Coalition to End Childhood Lead Poisoning	MD	Non-Profit	Green and Healthy Homes Inititiative, led by non-traditional provider	$ 1,287,598	$ 3,862,793
Other	P W C	OH	Non-Profit, WAP Subgrantee	Standard weatherization with volunteer element and freezers, solar PV technologies.	$ 1,500,000	$ 4,529,536
	New Hampshire Community Loan Fund, Inc.	NH	State / WAP Agency	Manufactured/mobile housing approach in targeted communities, leverage RGGI grant	$ 600,000	$ 2,500,000
					$ 29,104,175	**$ 91,561,155**

4.3.2. WIPP Programmatic Questions – For all grantees/approaches

Meta-Policy Questions

1. Evidence to answer public policy question: should we be using DOE dollars for multifamily buildings? Discuss effectiveness of single-family vs multifamily innovative approaches.

Statement of Project Objectives (SOPO) Questions

1. How does the project compare to formula WAP program in terms of: job quality, monitoring and quality assurance, cost effectiveness, energy savings per unit, low-income household benefits and non-energy benefits?
2. Did the leveraged resources perform as proposed?
3. What are the primary lessons learned in terms of project scalability and replicability?

4.3.3. WIPP Project Activities and Evaluation Questions and Approaches

Questions Associated with Finance Projects (Danville [VA2], UT, WA)

Loans and Loan Funds

Meta-Policy Questions – What is the current use of revolving loan funds for non-low income residential energy efficiency programs? How much money is out there in private sector financial markets that could be diverted to revolving weatherization loan funds? What is preventing money from flowing into revolving low-income weatherization loan funds? How much DOE money is needed to seed low-income weatherization loan funds?

Detailed Evaluation Questions –

a) What is an optimal size for a revolving loan fund?
b) How many weatherization jobs annually can be supported by what size of loan fund?
c) Do loan funds shrink or grow over time?
d) What happens when a loan recipient defaults?
e) How is loan worthiness judged?
f) How is the amount of the loan judged?
g) How are loan terms determined?
h) Do loan recipients fully understand the terms of the loans?
i) How much extra financial burden is placed on landlords because of the loan payments?
j) What are the benefits to renters in properties where the landlord has taken out a loan to pay for weatherization measures, and how certain are those benefits?
k) How are landlords involved and what are the benefits and risks (if any) to them?
l) What are the options when the client moves, is unable or unwilling to pay bills, or household size changes?
m) Should the funds be only focused on the multi-family sector or also include the single-family sector?
n) What is the average loan amount and repayment schedule?
o) What marketing approaches work best to attract clients to the loan program?

Evaluation Approaches – Conduct literature review of current status of use of revolving loan funds in the residential energy efficiency arena. Conduct case study process evaluation that includes interviews with key participants, examination of primary documents, and associated analyses. Survey loan program participants to ascertain their viewpoints on the program. Conduct detailed economic analyses of program operations to assess soundness of financial decisions. This will include billing analysis to ascertain energy savings and bill reduction in order to determine benefits and cash flows for all participants.

Carbon Offsets and RECS (LEAP [VA1], WA, CEO, PA)

Meta-Policy Questions – What investments are voluntary carbon markets currently making in non-low income energy efficiency projects? How much money is out there in the carbon offset markets that could be diverted to low-income weatherization investments? What is preventing money flowing from the carbon offset world into low-income weatherization? What investments must DOE make to catalyze this leveraging potential?

Detailed Evaluation Questions

a. How much money was attracted from the carbon markets for the project(s)?
b. What were the constraints and barriers to getting this money?
c. Who ultimately received the money from the carbon markets?
d. Who owns the carbon offsets?

Evaluation Approaches – Conduct literature review of current status of carbon offset market investments in energy efficiency projects. Conduct case-study process evaluation that includes interviews with key participants, examination of primary documents, and associated analyses. Conduct detailed economic analyses of program operations to assess financial feasibility and sustainability.

ESCOs (SAFH [DC], LEAP [VA1])

Meta-Policy Questions – What is the current involvement of ESCOs in the non-low income residential marketplace? How much money is out there in the ESCO world that could be diverted to low-income weatherization? What has been preventing this money from flowing into (multifamily) low income weatherization? What investments are needed from DOE to get ESCOs to enter this market?

Detailed Evaluation Questions –

a) How successful was the project in engaging ESCOs? What were the primary constraints and barriers?
b) What appear to be the financial thresholds that must be crossed in order to get ESCOs engaged?
c) What are the main barriers to ESCO engagement in (multi-family) low-income weatherization?
d) How do building owners view working with ESCOs? How do ESCOs view working with low-income building owners?
e) What are the most effective financial approaches to incentivize multi-family owners to invest in building retrofits?
f) What are the primary HUD barriers to engaging in multifamily retrofit work?
g) How are energy performance contracts best structured?

Evaluation Approaches – Conduct literature review of current status of ESCO involvement in the residential sector. Conduct case study process evaluation that includes interviews with key participants, examination of primary documents, and associated analyses. Survey ESCO program participants to ascertain their viewpoints on the program. Conduct detailed economic analyses of program operations to assess financial soundness and sustainability. This will include billing analysis to ascertain energy savings and bill reduction in order to determine benefits and cash flows for all participants.

Utility Bill Repayments (EPS [NE])

Meta-Policy Questions – What is the current status of utility bill re-payment programs outside of the low-income residential sector? How much money is out there in the utility world that could be diverted to weatherization/utility bill re-payment programs for low-income households? What is

preventing the spread of these programs? How much money might DOE need to invest to increase the number of these programs?

Detailed Evaluation Questions –

a) How are weatherization investment levels in homes optimally set?
b) How are monthly re-payment schedules optimally set for the client base?
c) How is client eligibility best determined to assure program sustainability?
d) How much does the program add to utility bills on average?
e) What happens when the client moves or is unable to pay bills?
f) How does the program adapt in the case of sharp utility prices changes during the re-payment period?
g) How does the program adapt in the case of fluctuating weather patterns year to year?
h) Do clients express clear understanding of the program?
i) What are the primary costs, benefits, and risks for clients?
j) What are the primary motivations for utility company involvement, and what are their primary concerns?

Evaluation Approaches – Conduct literature review of current status of non-low-income utility bill re-payment programs. Conduct case study process evaluation that includes interviews with key participants, examination of primary documents, and associated analyses. Survey utility bill re-payment program participants to ascertain their viewpoints on the program. Conduct detailed economic analyses of program operations to assess financial soundness and sustainability. This will include billing analysis to ascertain energy savings and bill reduction in order to determine benefits and cash flows for all participants.

Questions Associated with Alternative Weatherization Workforce and Workforce Building Projects (Habitat [national], YouthBuild [national], UNC ([NC])

Meta-Policy Questions – What are the costs and benefits of conducting weatherization work with non-professionals? What is the national capacity of the alternative weatherization workforce? What resources might DOE provide to train this workforce? Is the program replicable within other affiliates of the non-profit (i.e. can it become a new line of business)? Is the program replicable to other organizations, or is success specific to the nature of the implementing organization (i.e. Youthbuild, Habitat)? If so, does it require further DOE investment? Can DOE establish a standard that outside organizations, without DOE funds, would weatherize to and assure quality?

Detailed Evaluation Questions

a) What are best practices among the XX affiliates in terms of training and providing weatherization services?
b) What are the experiences of the youth and/or volunteers?
c) Does client satisfaction vary between XX and WAP clients?
d) Are there specific workforce issues with respect to XX-selected workers, and how are they best addressed?
e) What is the success rate of placing Habitat graduates into weatherization and home retrofit jobs?

Evaluation Approaches – Conduct case study process evaluation that includes interviews with key participants, examination of primary documents, and associated analyses. Collect billing histories for homes weatherized by non-professionals and compare energy savings to a control group of homes weatherized during the ARRA period and pre-ARRA. Inspect a sample of homes. Administer portions of the Weatherization Staff survey and attempt to track non-professional weatherization workers. Implement customer satisfaction portion of Occupant Survey. Have agencies provide detailed information about measures installed in each weatherized home.

Questions Associated with In-Home Metering Projects [CEO (PA), VEIC [VT], UNC [NC])

Meta-Policy Questions – How much energy is saved beyond the installation of weatherization measures in homes that have in-home energy meters/monitors? Should this measure be on Appendix A? If so, at what standard, and with what provisions? If not, why not? Do low-income clients see benefits equal to, greater, or less than other studies have shown for pilots/programs in the U.S.?

Detailed Evaluation Questions –

a) What types of meters were installed, and where?
b) Do any homes refuse to have meters installed and if so, why?
c) What are the most common client misunderstandings about the meters and the information being conveyed by them?
d) Are homes with meters installed different in some way from the larger population of weatherized homes?
e) Were there any technical issues associated with meter installation?
f) How do energy savings vary by a) presence of a simple and end-use in-home energy displays b) intervention strategy to groups of clients, c) type of meter, d) placement of meter within the home.

VEIC/CEO specific questions:

a) General questions
    a. Did the leveraged resources perform as proposed?
b) Meter questions
    a. What types of meters were installed, and where?
    b. Do any homes refuse to have meters installed and if so, why?
    c. Were there any technical or customer issues associated with meter installation?
    d. Are homes with meters installed different in some way from the larger population of weatherized homes?
    e. How do energy savings vary by: (a) presence of simple and end-use, in-home energy displays? (b) intervention strategy to groups of clients? (c) type of meter?
    f. Given the project's mix of low-income rural, suburban, and urban settings, and this project's implementation by different types of utilities, what—given

any lessons learned—are the limits and the potential for project scalability and replicability?

UNC-specific questions:

1. New technology project questions:
    a. What are the costs and energy savings associated with ductless heat pumps and whole house fans?
    b. What types of meters were installed, and where?
    c. Do any homes refuse to have meters installed and if so, why?
    d. What are the most common client misunderstandings about the meters and the information being conveyed by them?
    e. Are homes with meters installed different in some way from the larger population of weatherized homes?
    f. Were there any technical issues associated with meter installation?
    g. How do energy savings vary by a) presence of a simple and end-use in-home energy displays b) intervention strategy to groups of clients, c) type of meter, d) placement of meter within the home.

Evaluation Approaches – Collect billing histories for homes weatherized with meters and compare energy savings to a control group of weatherized homes. Inspect a sample of meter installations. Implement energy knowledge/behavior and meter portions of Occupant Survey. Have agencies provide detailed information about measures installed in each weatherized home.

Questions Associated with Client Outreach, Education and Follow-up Projects (CEC [NY], **NHCLF (NH), LEAP (VA1), PWC (OH), CEO (PA)]**

Meta-Policy Questions – How much more energy is saved beyond the installation of weatherization measures in homes that have had extensive client education? Should DOE mandate client education and additional contact with clients for a lengthy period of time post-weatherization? What type of client education works, and how can DOE ensure that a further rollout would continue to work? How do projects incentivize and empower building owners to engage in client education?

Detailed Evaluation Questions –

a) What client education methods were used?
b) How does the client outreach and education strategy affect energy savings?
c) How do demographic characteristics affect energy savings (with breakdown by outreach strategy, as appropriate)?

CEC further revised their plan as follows:

a) Community-based Outreach:
    a. What aspects of outreach can be streamlined through community-based outreach?
    b. Are there measurable benefits to the use of peer-led enrollment strategies?
    c. What particular outreach methods are most effective in low-income communities?
    d. Can program outreach efforts be effectively combined with environmental awareness campaigns
    e. How should strategies differ between rental properties and resident-owned properties?

NHCLF further revised their plan as follows:

a) Client education questions

   a. Are there characteristics of Resident-Owned Communities of manufactured homes that make them particularly fruitful places for public investments in weatherization? We will focus on the importance of two characteristics:

      i. shared ownership and community networks as a tool to mobilize homeowners to apply

      ii. relative density of eligible homes of similar construction as a means to achieve economies of scale in the application process and in the actual weatherization work.

The key measure of success will be energy saved per dollar of public subsidy: a function of efficiency in the sign-up phase, economies of scale in the weatherization work, and improvements in building performance per dollar invested in each home.

   a. Can neighborhood-based recruitment efforts increase the number of eligible residents seeking LIHEAP and weatherization services? If so, by what percentage?

   b. If a resident-owned community is organized and its residents well informed about the weatherization program, will CAP agencies respond to invitations to receive applications *in* those communities (possibly even within the eligible homes) and will that level of service increase participation and cost-effectiveness?

   c. What are the economies of scale in working on four or more homes sequentially in a single neighborhood? Labor, transportation, materials? Are the manufactured homes themselves sufficiently similar to permit savings in bulk purchase of materials?

   d. Does the neighborhood structure of most ROCs help make weatherization a community norm? NHCLF assumes that recruitment efforts will induce many—but not all—eligible homeowners to apply for weatherization. NHCLF also assumes that the resulting weatherization projects will be highly visible and benefits widely discussed within the community. We will try to determine if the first wave of weatherization generates a second wave of applications for weatherization services or private investments by homeowners who don't qualify for the federal program.

Evaluation Approaches – Conduct case study process evaluation that includes interviews with key participants, examination of primary documents, and associated analyses. Collect billing histories for homes weatherized by programs administering additional client education and re-contacts and compare energy savings to a control group of weatherized homes. Observe a sample of client education situations. Implement energy knowledge and consuming behavior portions of Occupant Survey. Have agencies provide detailed information about measures installed in each weatherized home.

Questions Associated with Consolidated, Coordinated, One-Stop Whole-House Projects [United Illuminated (CT), Coalition to End Childhood Lead Poisoning (MD), PWC (OH), WA]

This category of activities pertains to projects whose representatives are able to offer multiple public program services to households during one point-of-contact. Within this category are two distinct types of projects. The projects being conducted by The United Illuminating Company and the Coalition to End Childhood Lead Poisoning are primarily concerned with one-stop shopping of programs that address

healthy homes. The PWC and Washington State projects act primarily to bring multiple funding sources together to facilitate weatherization.

Meta-Policy Questions – Is it possible for local organizations to consolidate disparate federal and state programs into a coordinated program from the clients 'point-of-view'? What are the benefits to the clients? What are the benefits to DOE and WAP?

Detailed Evaluation Questions

a) Did the comprehensive approach to weatherization (and healthy homes) work? What worked and what did not work?
b) Does program consolidation lead to better outcomes in terms of client health and other non-energy benefits?
c) Are clients satisfied with the One-Stop program?

Evaluation Approaches – Conduct case study process evaluation that includes interviews with key participants, examination of primary documents, and associated analyses. Collect billing histories for homes weatherized by One-Stop programs and compare energy savings to a control group of weatherized homes. Observe One-Stop program delivery. Implement customer satisfaction and health portions of Occupant Survey. Have agencies provide detailed information about measures installed in each weatherized home.

Other (CEC [NY], UT)

CEC added the following questions to their evaluation plan:

a) Alternate cost-effectiveness rationale:
    a. How can meaningful measures of societal and community benefits be included in cost-effectiveness determination?
    b. How do building owners feel about pursuing non-direct weatherization benefits?
    c. Are local residents/organizations willing to support strategies that benefit entire communities?
    d. What is the benefit to overall WAP-delivery of using these rationales?
    e. How can the 'return on investment' needs of owners be balanced with societal benefits in WAP work scope determination?
    f. What renewable generation strategies become feasible with alternate cost-effectiveness determination?
    g. What societal and building-owner benefits do renewable energy generation strategies deliver?

b) Post-construction monitoring and technical support:
    a. How does the actual performance of energy efficiency measures compare to pre-construction projections?
    b. What are common causes of unmet savings potential?
    c. What level of post-construction investment is necessary to remedy problematic retrofits?
    d. Do building operators of multifamily buildings or homeowners have the requisite skills to maintain modern building systems?
    e. What energy monitoring and management systems are most effective in supporting post-retrofit support?
    f. How do client and tenant education strategies affect energy savings?

Utah added the following questions to their evaluation plan:

f. What are best practices regarding performance-based contracting?
g. What issues interfere with achieving expected levels of post-retrofit energy savings?

4.3.4 Evaluation Plans

Table 4.3 maps the eight types of evaluation methods listed in the evaluation approaches presented above to the nine types of activities that the WIPP grants are supporting, as organized above. The second column in the table indicates which states/projects fall into the ten types of activity categories. This evaluation plan can be considered a comprehensive approach to evaluating the most important aspects of WIPP. It will incorporate four literature reviews, eight case studies and four detailed economic analyses. Billing histories will be collected for a sample of homes weatherized associated with all activity areas (for approximately 4000 units), as would the associated data from the grantees about measures installed in the homes. Approximately 1000 of those receiving benefits from WIPP activities will be surveyed. Approximately 200 members of the alternative workforce will also be surveyed. A sample of approximately 50 homes of weatherized by the alternative workforce will be inspected for quality assurance purposes.

Table 4.3 Evaluation Methods Applied to Categories of WIPP Activities

		Lit. Review	Case Study	Econ Anal.	Home Inspect	Occupant Survey	Wx Staff Survey	Bills Anal.	Grantee Surveys
Loan Funds	WA, UT, VA2*	●	●	●		●		●	●
Carbon Offsets	WA, PA, VA1**	●	●	●				●	●
ESCOs	VA1**, DC	●	●	●		●		●	●
Utility Bills	NE	●	●	●		●		●	●
Alt. Workforce	YB***, HFHI, NC		●		●		●	●	●
In-home Meters	VT, PA, NC					●		●	●
Client Ed	NY, NH, VA1**, OH, PA		●			●		§	§
One-Stop Shop	CT, MD, OH, WA		●			●		●	●

* City of Danville, ** Local Energy Alliance Program, *** YouthBuild
§ Bills and other data will be collected as part of the in-home meters project analyses.

Table 4.4 outlines the schedule for the evaluation activities. The first evaluation activity to be undertaken will be the four literature reviews, which will be conducted during the 2nd quarter of 2011. Case studies will be initiated during the third quarter and will be completed early in the fourth quarter of 2011. Initial economic assessments that will focus on financial decision rules will also be conducted during this time period. Independent reports will be prepared to document the literature reviews, case studies, and initial economic assessments.

Units weatherized by the various projects through June 30, 2011 will be eligible for inclusion in the billing analysis study. This date was chosen to piggyback upon the larger WAP-ARRA period evaluation. Starting in July 2012, the larger project will ask utility companies nationwide for billing histories. Billing histories needed for the WIPP evaluation will be rolled into this much larger task and will yield tremendous cost efficiencies.

Given this timeframe, approximately 50 on-site inspections of homes weatherized by alternative workforces will be conducted during the third quarter 2011. Collection of detailed weatherization information from the grantees will also begin at this time and continue until all required information is

collected or until data collection ends on September 30, 2012. Billing history analyses will be conducted as the various project-based and activity-based data sets are completed. The goal of this project is to complete the energy savings analyses during the fourth quarter of 2012.

Occupant surveys and weatherization worker surveys will be conducted during the 2nd quarter 2012. These surveys are delayed somewhat in order to give occupants some time to experience program results (especially those participating in financial programs) and alternative weatherization workforce members some time to possibly change their employment situations. A final report will be completed by the end of CY 2012.

Table 4.4 Schedule of Evaluation Activities

	1st Quarter 2011	2nd Quarter 2011	3rd Quarter 2011	4th Quarter 2011	1st Quarter 2012	2nd Quarter 2012	3rd Quarter 2012	4th Quarter 2012
Lit Reviews		XXXX						
Case Studies			XX	XX				
Economic Analyses			XX	XX			XX	XX
Home Inspections			XXXX					
Occupant Surveys						XXXX		
Wx Staff Surveys						XXXX		
Grantee Surveys				XX	XX	XX	XX	
Billing Analyses				XX	XX	XX	XX	
Final Report								XXXX

Finally, it should be noted that the timely administration of the surveys and the collection of the weatherization information and billing data are contingent upon OMB approval. ORNL plans to submit to OMB an Information Collection Request (ICR) for the entire WAP ARRA period evaluation in early 2011. This request will include the already approved data forms (DF2/3 that collect weatherization measure information; DF4A/B, which collects utility account information; DF5, which collects billing histories from utilities) needed by this project and two surveys that are currently under OMB review (S4 [Occupant Survey] and S5 [Weatherization Staff Survey]). ORNL will be primarily asking to increase burden numbers and for approval of any new methodologies.

4.3.5 Technical Assistance

ORNL will provide technical assistance to grantees on an as-needed basis. ORNL will assist grantees implement appropriate data collection procedures. ORNL will also assist grantees implement program administration procedures in cases where evaluation plans require random control trial designs. Projects that might be appropriate for RCT designs include those involving in-home metering and installation of non-standard measures (e.g., solar PV technologies).

4.4 SUSTAINABLE ENERGY RESOURCES FOR CONSUMERS

This segment describes the evaluation approach designed to assess OWIP's Sustainable Energy Resources for Consumers (SERC) Grant authorized under the Energy Independence and Security Act of 2007 (EISA) Pub. L. 110-140, Section 411(b). In June 2010, OWIP requested funding proposals for projects focused on efficient, and renewable technologies, as well as innovative or evidence-based interventions aimed at reducing home energy consumption. The SERC grant gives 92 high-performing local weatherization agencies in 27 states the opportunity to employ alternative measures in the residential sector that may have otherwise been deemed lower priority as a result of low cost efficiency, or that may have been considered not allowable under current WAP standards due to the inherent risks involved with innovation. In selecting grantees, priority was given based on the following criteria outlined in EISA Section 411(b)(2):

> "(2) PRIORITY.—In selecting grant recipients under this subsection, the Secretary shall give priority to—
> (A) the expected effectiveness and benefits of the proposed project to low- and moderate-income energy consumers;
> (B) the potential for replication of successful results;
> (C) the impact on the health and safety and energy costs of consumers served; and
> (D) the extent of partnerships with other public and private entities that contribute to the resources and implementation of the program, including financial partnerships."

This section of the evaluation describes approved technology measures and outreach approaches, their attributes, and a selective evaluation methodology based on available funding allocated for analysis. Evaluation of OWIP's SERC Program should deliver answers to the following broad areas and more specific questions:

<u>Area 1: Quantitative Evaluation of Impacts</u>

- How do the projected energy savings compare to resulting savings upon application of the measures?
- What is the SIR for the measures rigorously evaluated?
- How can the weatherization community assist with raising the SIR of a measure to ≥ 1, and under what conditions?
- How does modification of occupant energy consumption behavior factor into home energy savings with sustainable energy technologies?
- Which technologies deserve inclusion on the approved installation measures list for WAP based on either SIR or cost-effectiveness?
- How do these technologies impact energy security (defined as household access to home energy and measured by total number of utility interruptions pre-and post installation) across socio-economic status of the populations served?

<u>Area 2: Process Evaluation</u>

- Were the approved agencies able to allot the proposed number of innovative or renewable technology units to willing households?
- What were the barriers to meeting project goals?
- What are the issues associated with implementing innovative strategies or measures for reducing home energy consumption?
- Did the technologies operate as expected? Were there any installation problems?
- How well did SERC projects harmonize with standard weatherization process and treatments offered under WAP?

- How much, if any, follow-up with occupants is necessary to promote maximum savings as a result of the new technology, measure, or outreach?
- Should WAP transition into the sustainable energy resources arena for home weatherization retrofits after the expiration of ARRA?

4.4.1. Comprehensive Evaluation Approach

The evaluation of SERC projects involves the assignment and application of a selected methodology with an associated level of rigor for each broad category of technology or outreach. The more innovative technologies or those projects infused with substantial amounts of funding will be placed in a highly rigorous category for statistical analysis based on energy billing data. Data collection for approximately 4000 homes will be used for determining home energy savings and SIR results. Although the selected technologies for this grant are not expected to meet the SIR of 1.0, SIR calculations will initiate discussion on future potential for cost-effectiveness and under what conditions, such as comparisons of the cost of replacement upon failure of technology vs. early replacement, or buy-downs created with secondary funding sources.

Those measures selected for moderate levels of rigor will be subjected to methodologies making use of a technique called "deemed savings analysis." For example, "deemed savings" for a household with newly installed LED lights would be determined by surveying agencies to get the total number of installed lights and then calculating energy savings based on their associated energy output as reported in the literature. Outreach activities and innovative technologies requiring process assessment will be evaluated through the use of structured interviews or field observations to get insight into the overall impact of the measure. TABLE 4.5 describes each category of evaluation by rigor and the associated tasks involved. TABLE 4.6 exhibits the approved technology, measure, or outreach by level of evaluation rigor.

The evaluation will focus on 10 categories of SERC technologies (15 technologies to be evaluated with high rigor, 29 measures to be evaluated with a moderate level of rigor, and two categories of technologies or interventions appropriate for process analysis). Process analysis questions pertaining to the other 44 (15 high rigor and 29 moderate rigor) technologies will require the use of structured interview tools.

Table 4.5 Evaluation Categories and Tasks

	High Rigor	• Administer DF2, DF3, and DF4 at agency level. Submit ICR for OMB approval. (Sampling based on scope of project/number of units treated/appropriateness of random assignment/ aggregate-level selection…) • Collection of billing data pre- and post –installation (one year of data to be collected Summer/Fall 2012) (DF5 to be administered at utility level) • Control group billing data pulled from sub-sample of agencies selected from general evaluation (impact analysis) • Post-treatment Quality Assurance review to ensure accurate installation/consumer use of technology • Develop and administer client satisfaction survey with focus on renewable technologies • Collection of cost of measures from agencies (projected and actual) • Calculate SIR • Final Report (Potential for RCT approach for unit assignment for approximately 6 projects)
	Moderate Rigor	• Administer DF2 and DF3 • Deemed energy-savings estimates (based on number and types of measures installed in unit, and recognized average energy savings derived from the literature with consideration for varying confounding variables: (climate region, housing characteristics, etc.) • Collection of cost of measures from agencies • Estimate of cost-effectiveness • Final Report
	Process Evaluation	• Develop and Administer Structured Interview addressing Evaluation Process Questions • Assess agency implementation strategies and obstacles to the intervention • Synthesize interview results with results from other high- or moderate-rigor evaluation tasks

Table 4.6 Technology Categories

Technology Category	Rigor Level
1.0 RENEWABLE ENERGY	
1.1 Solar PV	
1.2 PV: shingles	
1.3 Wind: small-scale residential	
2.0 HOT WATER SYSTEMS	
2.1 Solar HW	
2.2 Tankless/On-demand HW	
2.3 Condensing HW	
2.4 Heat Pump/Hybrid HW	
2.5 Combination HW and Boiler	
2.6 Other HW (specify)	
3.0 HVAC SYSTEMS	
3.1 Heat Pumps: Geothermal	
3.2 Heat Pumps: Air	
3.3 Heat Pumps: mini split-system ductless	
3.4 Replacement of improperly sized HVAC equipment	
3.5 Solar thermal (home heat)	
3.6 Wood Pellet Stoves	
3.7 Ultra Cooling Systems	
3.8 Central AC units	
3.9 Window AC units installed	
3.10 Micro-combined heat and power	
3.11 High-efficiency furnaces	
3.12 Heat recovery ventilators	
3.14 Evaporative Cooling System	
4.0 ROOFING:	
4.0 Cool roof technology installed	

Technology Category	Rigor Level
5.0 APPLIANCES	
5.1 Energy Star Clothes Washer	
5.2 Energy-Efficient Clothes Dryer	
5.3 Energy-Efficient Refrigerator	
5.4 Appliance Energy Meters	
6.0 INSULATION	
6.1 Insulation: Aerogel/super	
6.2 Insulation: foam injection technology	
6.3 Insulation: Masonry Foam	
6.4 Insulation: Radiant barrier attic	
6.5 Insulation: Spray Foam	
6.6 Insulation: Reflective attic insulation	
7.0 WHOLE-HOUSE RETROFIT	
7.1 Centralized building controls	
7.2 Deep energy retrofits	
7.3 High-performance space conditioning retrofits	
7.4 High-performance building envelope retrofits	
7.5 Cold Energy Retrofits	
7.6 Warm Energy Retrofits	
8.0 OUTREACH	
8.1 Home Energy Saver Workshops	
8.2 Households touched by behavioral change message	
9.0 EQUIPMENT	
9.1 Monitoring: In-home energy monitors	
10.0 OTHER	
10.1 Units with Window upgrades	
10.2 Outdoor solar security lighting	
10.3 Ceiling Fans	
10.4 LED Lights	

4.4.2 Technologies Selected for High-Rigor Approach

The proposed strategy for a highly rigorous evaluation of SERC projects involves analysis of 15 selected innovative or highly funded technologies. TABLE 4.6 displays the identified technologies selected for this evaluation strategy. The technologies were selected based on the following factors:

- Number of local agencies, number of projected installations, and estimated budget associated with the technology
- Potential for future inclusion in WAP
- Potential for Randomized Controlled Trials (RCTs)

Each of these technologies will be approached with statistical rigor requiring the selection of a random sample of households across projects. For example, approximately 550 geothermal heat pumps are slated to be installed by 12 agencies from eight states across the country. A random sample of households will be selected for evaluation from the eight states . Households selected to represent the impact of the measure will be stratified for conditions such as climate region, high energy usage, and housing characteristics. The evaluation will compare the national results of the impact analysis of the installed technology with a control sample offering baseline weatherization results, and with the impact analysis of the 14 other technologies selected to undergo highly rigorous evaluation.

Analysis of home energy billing data pre- and post- retrofit will be compared to a control group of weatherized homes selected from the WAP-ARRA Evaluation sample. Pre-tested survey instruments will be administered to agencies and occupants, and post-treatment quality assurance inspections will be completed. The Occupant Survey will be administered to a sample of households with installed renewable energy technologies, or in-home monitoring devises.

4.4.3 SERC Randomized Controlled Trials (RCTs)

Projects will be reviewed to identify likely candidates for randomized controlled trials (RCTs) or randomized trials between like technologies. For example, Colorado received approval for the installation of in-home energy monitoring devices as part of a 1600-household project. Project planners already intend to split the sample into 800 treatment homes, which will receive the monitoring device and 800 control homes, which will not receive the device. If an RCT method is adopted, households will be randomly assigned to either the treatment or control group, and the project's findings will be strengthened by the power of the statistical method used. As another example, two agencies in Arizona have been approved to install two different hot-water technologies, solar and heat pump, for a total of 470 units; this offers the potential for a randomized trial between the two interventions. In the randomized trial cases, household recipients of standard weatherization treatment would be sampled from the WAP-ARRA Evaluation to serve as a baseline comparison group. Randomized trials serve as an alternative to RCTs in projects or program areas with assignment challenges and still offer significant results. Evaluators would review these types of methodologies and then communicate with the grantees to determine any challenges regarding randomly assigning homes to either treatment or control groups. If the conditions prove ideal, then an RCT will be coordinated and implemented with follow-up training and technical assistance (T&TA) from the evaluation team for the duration of the study. RCT and randomized trial projects will be evaluated with statistical rigor. Approximately six projects will be selected for RCT experimental design. Upon identification of potential RCT projects by the evaluation team and DOE, implementation plans will be designed with the help of project leaders at the sub-grantee level.

Analysis of the SERC projects offers OWIP the ability to better inform WAP stakeholders of their options–clearly presented by strengths and deficits–for each of the evaluated SERC interventions, with successes and challenges associated during the stages of eligibility, implementation, and analysis of energy and cost savings. Detailed evaluation designs will be developed pending further information

received on project descriptions, implementation plans, and communication with the awarded local weatherization agencies.

4.5 ENCOURAGEMENT DESIGN

Given the legal and practical barriers at this time to implementing a classical RCT to estimate energy savings attributable to WAP, an alternative approach has been identified. The University of California-Berkeley (UC-B) has proposed what is known as an "encouragement design approach." Simply, this approach entails identifying a group of low-income homes that are eligible for WAP and "treating" them with intensive encouragement to apply for weatherization services. A similar number of homes that have similar characteristics are identified, but are not treated with any extra encouragement. This second group serves as the control group. UC-B has developed a theoretical approach to an encouragement design study. The study is expected to be implemented in one or two states during PY 2011.

4.6 GREENHOUSE GAS EMISSION ANALYSIS

4.6.1 Introduction

As individuals, nations, and corporations become increasingly aware of the environmental consequences of their actions and behaviors, there is more interest in reducing carbon footprints. Key phrases such as "reduce/reuse/recycle," "decrease consumption," and "lower the temperature on your thermostat" form part of this national conversation. For those people or organizations who will not or cannot reduce emissions themselves, carbon offset companies accept donations from concerned individuals, countries striving to meet their Kyoto Protocol targets, and companies trying to be socially responsible. The companies use these donations to create and/or invest in projects that will increase carbon sequestration or decrease greenhouse gases (GHGs) emissions, also known as carbon dioxide equivalents (CO_2e). Essentially, patrons of carbon-offset companies are attempting to mitigate the consequences of their own carbon emissions by buying "credits" in a program somewhere else.

Carbon-offset portfolios almost always contain investment projects involving reforestation/forest carbon sequestration, renewable energy, and industrial gases. Projects are very often located in developing countries because of lower implementation expenses, higher participation rates, and because the carbon offset projects themselves are "charismatic" ("charismatic" meaning that a project seeks to address other social goals or ills in addition to reducing carbon emissions or sequestering carbon. For example, if a project is also responsible for teaching job skills or curbing famine, it is considered charismatic).

The purpose of this subsection is, first, to explain the carbon-offset industry and its current conditions–who is participating, how it works, and what they are doing. It then it presents a research approach to estimating potential GHG reductions in low-income housing in the United States and costs per ton of GHG emissions reduced.

4.6.2 Carbon Offset Providers

Today, there are approximately 60 carbon-offset companies around the world, of which about 30 operate in the voluntary or commercial (OTC) carbon market.[7] Approximately 50% of voluntary market providers and 68% of voluntary market customers are based in the United States, while 43% of the carbon offsets sold in the voluntary market are sourced to projects located in North America (other locations for

[7] Kanter, James. "Carbon Footprint Offsets: False Sense of Satisfaction?" International Herald Tribune. February 19, 2007. http://www.iht.com/articles/2007/02/19/business/carbon.php. Accessed 10.10.07.

participation include England, Australia, Canada, Germany, Ireland, and the Netherlands).[8] Third-party evaluators endorse carbon-offset companies and have ranked non-U.S. companies the highest. This can probably be attributed to the fact that countries participating in the Kyoto Protocol have higher and universal standards for offsets and have generally been in business longer than most American offset companies. However, some companies can simultaneously rank very high on one third-party evaluation, and then receive an average ranking on another evaluation because of the lack of established standards in the voluntary carbon market.

Approximately half of the carbon-offset companies are non-profit organizations (NPOs).[9] NPOs are generally more transparent than for-profit companies; they are usually willing (if not legally obligated) to release information regarding their finances and project portfolios for evaluation. NPOs also tend to devote more of their revenues towards offset projects and less towards administrative overhead. The mean overhead for non-profit organizations is 18.4%, as opposed to a much higher 56.6% overhead in for-profit businesses.[10] According to Mark Trexler, however, higher overhead is not necessarily demonstrative of a poor-performing company or offset portfolio: "If a company is thoroughly investigating the carbon reduction projects and closely monitoring the progress to ensure that the carbon reduction occurs, then a higher administrative cost is acceptable."[11] It would appear that other voluntary carbon market experts agree, because third parties award higher rankings to for-profit businesses than to NPOs, despite the significantly higher overhead costs.

Companies in the carbon-offset market give individuals the opportunity to purchase carbon offsets in a retail environment, in much the same way corporations voluntarily participate in the Chicago Climate Exchange. Consumers can choose from more than 30 offset companies, but the process for participation is often very similar. At a company's website, consumers can use an online "carbon calculator" to estimate their annual carbon (equivalent) emissions based on the type and amount of vehicle travel, use of energy-efficient appliances, the type and amount of energy used in the home, the amount of air travel, and other factors. The calculator will then determine how many tons of CO_2e the consumer emits annually as a result of his or her lifestyle, establishing a basis for how many carbon offsets should be purchased. On average, consumers pay approximately $12.55 per ton of carbon offsets.[12] However, purchase prices can range from $5-$99 per ton of offsets.[13]Carbon-offset companies use their revenue from consumers to invest in carbon-offset projects, primarily forestry sequestration (36%), renewable energy (33%), and industrial gases (20%).[14] Other smaller projects can include methane reduction and energy efficiency.

Forestry sequestration (also called Land Use, Land Use Change and Forestry or LULUCF) is currently the most popular albeit the most controversial project type in the voluntary carbon offset market. Reforestation projects have several advantages that increase their appeal to carbon-offset companies. First, it is very inexpensive to plant and maintain these forests. According to the IPCC, mitigation costs through LULUCFs can cost as little as 1 penny per ton. Second, LULUCF projects are easy for the general public and consumers to understand because most Americans learn about the role of trees in the carbon and oxygen cycles in grade school.[15] Third, LULUCF projects are often "gourmet" or "charismatic," meaning the program is designed to accomplish more than simply to offset carbon; it is

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[8]Trexler Climate + Energy Services. "A Consumer's Guide to Carbon Offset Providers." December 2006.
[9]Tufts Climate Initiative. www.tufts.edu/tie/tci/pdf/TCI_Carbon_Offsets_Paper_April-2-07.pdf.
[10] Tufts Climate Initiative. Ibid.
[11] http://featured.matternetwork.com/2007/8/ranking-the-offset-providers.cfm
[12] Average based on figures from Ecobusinesslinks.com Carbon Offset Survey
[13] Ibid.
[14] Hamilton, Katherine et al. "Picking Up Steam: The State of the Voluntary Carbon Markets 2007."
[15] Hamilton. Ibid.

also expected to create job skills, promote gender equality, provide infrastructure, and, in the case of LULUCFs, improve community aesthetics and provide critical wildlife habitats.[16]

While LULUCF's advantages are both charismatic and important, there are critical disadvantages to the projects. First, it is difficult to measure carbon sequestration in forests because of varied tree types, changes in season temperature or precipitation, and the age of the forests. The amount of carbon sequestered is constantly changing as a result of these variables, and facilitators of these projects must be sensitive to these changes. Second, leakage in sequestration can easily occur. Leakage is the unanticipated loss of carbon reductions, which in this case might be the loss of trees due to disease, pests, drought, fire, or harvesting. Leakage is likely to occur in situations where the locals have not been taught how to sustain the project, non-native species were planted, or in communities where the political climate is unstable. Third, and most crucial, is the issue of permanence. If trees are lost through any of the situations previously mentioned, the estimates of carbon sequestration may be wildly overstated. The carbon stored in lost trees will consequently be released back into the atmosphere, ultimately resulting in little to no reduction in carbon emissions.[17]

Consumers who are more interested in obtaining large quantities of offsets and less interested in the "charisma" of an offset usually invest in industrial gas projects. Industrial processes accounted for 28 percent of total U.S. energy-related carbon dioxide emissions in 2005.[18] They were the third largest producer of greenhouse gases in the United States, emitting methane, nitrous oxide, and HFCs/PFC/SF6s.[19] More importantly, the gases produced by industrial processes have high global warming potential (GWP). The Environmental Protection Agency determines GWP by comparing "the radiative forcing or ability to trap heat of one metric ton of a greenhouse gas to a metric ton of CO2."[20] In other words, gases with a high GWP will create or intensify climate change faster than carbon dioxide would. For example, the GWP of methane is 21 times that of carbon CO2.[21] Industrial gas projects are considered the "low-hanging fruit" or easiest projects to implement of the carbon market. Sequestering or eliminating gases in industrial processes is a quick and effective offset because those gases with a greater ability to trap heat are removed from the byproducts, outputs, and life cycle of the industrial process. Investing in industrial gas projects gives consumers the maximum benefit for their purchase.

However, the use of industrial gas projects in the voluntary carbon market may decline in the near future because of Clean Development Mechanism (CDM) regulations for new facilities, the absence of sustainable development project co-benefits, and the supposed limited supply of these Verified Energy Reduction credits. As the CDM currently exists, it is more profitable for companies to invest in Kyoto Protocol compliance than it is to invest in new and clean energy sources. Compliance means companies spend a modest amount on initial investments and enjoy low operating costs. Investing in new energy sources means lower profits because of substantial initial investments and high operating costs. As a result, in the past, companies have only complied with demands to decrease their industrial gasses, but they have not gone the extra distance to invest in new energy technologies. Their compliance has yielded many industrial gas projects. But with the adoption of the Montreal Protocol, HFC emissions are to be phased out of industrial processes in any case.[22] As the number of projects declines and specific

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[16] www.begreennow.com

[17] Tufts Climate Initiative. "Voluntary Offsets for Air-Travel Carbon Emissions: Evaluations and Recommendations of Thirteen Offset Companies."

[18] Energy Information Administration. "Emissions of Greenhouse Gasses in the United States 2005." Released November 2006. http://www.eia.doe.gov/oiaf/1605/ggrpt/carbon.html. Accessed October 3, 2007.

[19] Environmental Protection Agency. "U.S. Greenhouse Gas Inventory." http://www.epa.gov/climatechange/emissions/usgginventory.html. Accessed October 14, 2007.

[20] EPA. Ibid.

[21] Tufts Climate Initiative.

[22] Rainer, Mark. "Kyoto's Clean Development Mechanism: Global Warming and Its Market Fix." World Socialist

emissions are phased out, the number of Verifiable Energy Reductions from those projects and compliance projects will decrease. Add to that the fact that these carbon offset projects are not charismatic, and their future in the carbon offset industry looks dim.

Renewable energy projects today exist in two different forms in the voluntary market. The first form is the simple investment in wind, biomass, or solar technologies to create clean methods of generating electricity, with the hope that we will slowly decrease our reliance on fossil fuels for electricity as a result. The second form is Renewable Energy Credits (RECs), "which represent the environmental attributes of 1 MWh of power generated from renewable sources."[23] Purchasing RECs means that the amount of electricity coming from renewable resources will increase and the amount provided by fossil fuels will decrease. In 2005, Americans purchased the equivalent of 3,890 million kWh in Renewable Energy Credits (RECs).[24] It is important to note that RECs are not currently measured the same way carbon offsets are measured. Therefore, a problem can easily arise in the conversion of RECs into carbon-offset equivalents; this may discourage some from investing in these projects. Legislation, local opposition to a project, and high initial capital costs also prove to be barriers in developing renewable energy projects.

Carbon-offset projects are evaluated based on "additionality," double counting, type of credit, and standards and verification. The first concept, additionality, is usually phrased as a question: Are the carbon offsets of the program "business as usual" or are they beyond business as usual? Would the project have happened, holding everything else constant, if the carbon offsets from it could not be sold? If in fact the carbon offsets are not so important that the project would have been canceled without them, carbon emissions are not actually being reduced and money is essentially being wasted. The project is "additional"—that is, worthwhile—only if the answer is "no."

The second point of evaluation, double-counting, occurs when companies claim one set of reductions as multiple sets. Unfortunately, double counting can occur very easily when companies invest in carbon-offset projects in other countries, especially if that country is held to reduction standards based on the Kyoto Protocol. All stakeholders have an incentive to claim those reductions for themselves, thereby creating an inaccurate figure of *actual* carbon reductions. Double-counting can be minimized by articulating clear legal ownership of emission reductions, retiring offsets once sold, ensuring that renewable energy project offsets are not also sold as RECs, and prohibiting utilities that sell RECs from using that project to quality for Renewable Portfolio Standards. While all these mechanisms increase the cost of an offset, they also help ensure that the offset provided is legitimate.

Carbon offset projects are often verified by third parties, which may utilize internationally recognized criteria, such as the type of project, the impact on local communities, additionality, and leakage. Well-known third party evaluators include Clean Development Mechanism (CDM), Gold Standard and Voluntary Gold Standard, the Chicago Climate Exchange (CCX), Green-E, and Environmental Resources Trust.[25]

The Clean Development Mechanism is the largest regulatory project-based mechanism and is involved in setting standards and verifying projects. Standards are extremely stringent, making the

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Website. January 13, 2007. http://www.wsws.org/articles/2007/jan2007/glob-j13.shtml. Accessed December 1, 2007.

[23]www.begreennow.com . Ibid.

[24]Bird and Sweezey. "Green Power Marketing in the United States: A Status Report." 2006.

[25]All information on third party verification systems, except the Environmental Resource Trust, is taken from the Tufts Climate Initiative.

transaction costs so high that normally, only large projects are registered. A project cannot be certified unless it meets strict requirements regarding additionality.

The Gold Standard and Voluntary Gold Standard was developed by a network of non-governmental organizations and is endorsed by 42 NGOs around the world. It does not accept sequestration projects, and certifies only renewable energy or energy-efficiency projects. It not only requires strict measures to address additionality, but it also monitors and verifies projects to ensure that the claims of companies and projects are true. It also evaluates co-benefits and negative externalities of projects. Certified projects are usually large because of the high transaction costs.

The Chicago Climate Exchange (CCX) is a voluntary, but legally binding, cap-and-trade emission trading system that has members from the United States, Canada, and Mexico. It traded just over 10 million tons of carbon dioxide in 2006. It had reached nearly 12 million tons of traded carbon dioxide by July 1, 2007. There are currently about 300 members in the CCX, including Ford Motor Company, DuPont, Bank of America, Rolls Royce, Safeway, several counties and municipalities, and many colleges and universities. Members join the CCX for several reasons: It is a proactive response to future governmental regulations, it streamlines the ease of doing business in Europe, it increases the profitability of being "green" in many instances, and generally, the companies participate either for good public relations or because they actually believe in the cause.[26] Members commit to reduce their emissions annually from their original baseline. Companies that exceed their committed reductions can sell the excess as CCX commodities called Carbon Financial Investments (CFIs). CCX has been criticized because it has loopholes, does not articulate its additionality criteria well, and is not effectively transparent. Furthermore, many companies have exceeded their reduction commitments, creating an excess of CFIs.

Green-e was created by the non-profit organization Center for Resource Solutions both to set standards for American renewable-energy projects and to verify those projects. Power plants built post-1997 can be certified with Renewable Energy Credits (RECs) as long as they are not also used to meet regulatory portfolio standards. Green-e is currently working on formulating stricter standards for the conversion of RECs into carbon offsets.

The Environmental Resource Trust is a non-profit organization in Washington, D.C. that works toward cost-effective emission reductions through a GHG registry which will define the exchanged commodity, establish an accounting language and protocols for measuring and verifying performance, provide documentation of third-party validation of emission reduction performance for offset companies, and create a credible mechanism for registration, trade, banking, and retirement of GHG emission reductions. It is designed explicitly to help build the GHG trading market and focuses on emissions performance.[27]

4.6.3 Voluntary Carbon Markets and Weatherization Assistance

Every year, Americans spend over $160 billion on heating, cooling, lighting, and otherwise powering their homes.[28] Residential energy use comprises nearly 21% of total energy consumption in the United States and contributes about 17% of our total greenhouse gas emissions every year. Most homes are not energy-efficient and lose energy in many ways. Because low-income families are less likely to be able to afford home improvements and upkeep than middle- or high- income families, they spend a higher

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[26] Aster, Nick. "Chicago Climate Exchange 101." Written May 19, 2006. http://www.treehugger.com/files/2006/05/chicago_climate.php. Accessed December 5, 2007.
[27] Environmental Resource Trust. "GHG Registry Program." http://www.ert.net/ghg/full.html#3. Accessed October 11, 2007.
[28] http://www.energysavers.gov/homeowners.html

percentage of their income on energy. Their homes often do not have proper insulation, energy-efficient appliances, or high-quality windows. Consequently, they pay relatively higher energy bills, especially with regard to percentage of total household income. Weatherization of low-income housing provides substantial and cost-effective economic, financial, and societal benefits.

Wasted energy should be regarded not only as a local problem but as a global problem in terms of GHG and carbon emissions. What are the effects of an under-weatherized home on the environment? The Harvard School of Public Health estimates that approximately 60 million American homes have attics that are under-insulated. Compared to adequately insulated homes, these under-insulated attics emit an additional half-ton of CO_2, or, cumulatively, 30 million tons of CO_2 annually.[29] Additionally, the amount of energy that slips through poorly insulated windows and doors in American homes is roughly equal to the amount of energy that we get from the Alaska pipeline.[30] If every American home replaced its five most frequently used bulbs with compact fluorescent light bulbs (CFLs), one trillion pounds of greenhouse gasses would be kept out of the air over the course of the bulbs' 5- to 8-year lives.[31] Replacing a 20-year-old refrigerator with a new, energy-efficient model reduces a home's CO2 contribution by about one ton per year.[32]

As discussed below, one important goal of this task is to estimate how much money needs to be invested in low-income homes to reduce GHG emissions (e.g., dollars per ton of carbon emissions reduced). However, it should be noted that investments in low-income weatherization through voluntary carbon markets have substantial charismatic value because these investments yield attractive energy and non-energy benefits as well. Of course, the retrospective and WAP-ARRA period evaluations will produce up-to-date energy-savings estimates. But for the sake of this discussion, according to a meta-evaluation by Martin Schweitzer[33], when low-income homes utilizing natural gas were weatherized, the per-household energy savings equaled 22.9% of the pre-weatherization consumption levels for all end uses of the primary heating fuel. Numerically speaking, the average home in the studies used 133 million site Btus annually prior to weatherization, and after subtracting their post-weatherization energy savings of 30.5 million site Btus, they were using 102.5 million site Btus each year. For every $1 the program spent on weatherization costs in homes using natural gas, an energy savings of $1.34 is realized.[34]

The non-energy benefits of weatherization have a ripple effect throughout society. Of course, weatherization can reduce carbon emissions when fossil-fuel use is reduced, but weatherization can also reduce emissions of sulfur oxides, nitrogen oxides, carbon monoxide, methane, and particulate matter. Other environmental benefits occur as well in the reduction of heavy metal contamination, fish impingement, and wastewater/sewage contamination. Utilities and their ratepayers benefit financially from avoided rate subsidies, lower bad-debt write-off, reduced carrying costs on arrearages, fewer notices and customer calls, fewer shut-offs and reconnections for delinquency, and reduced collection costs, fewer emergency gas service calls, transmission and distribution loss reduction, and insurance savings.

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[29] Owens Corning. "Under-insulated American Homes Cause Three Million Blimps-worth of CO2 Emissions Each Year, EVERY Year" Corporate Social Responsibility Press Release. 11/05/07. http://www.csrwire.com/News/10070.html Accessed November 7, 2007.

[30] PATH Partners. "Easy Energy Efficiency Upgrades." http://www.pathnet.org/sp.asp?id=15345. Accessed October 23, 2007.

[31] http://www.coolmayors.com/common/print_page.cfm?ClientID=11061&QID=4747&Type=ReportDetail&TopicID=0

[32] Ibid.

[33] Schweitzer, Martin, Estimating the National Effects of the U.S. Department of Energy's Weatherization Assistance Program with State-Level Data: A Metaevaluation Using Studies from 1993 to 2005, **ORNL/CON-493**, Oak Ridge National Laboratory, Oak Ridge, Tennessee. September, 2005.

[34] Good estimates for electrically heated homes are not available at the time of writing.

When low-income households do not have to spend as much on energy bills, they have more money available for other household expenses, which decreases involuntary mobility or frequent need to move as a result of affordability. Furthermore, they experience fewer disasters like fire, are generally more comfortable in their dwellings, and may become ill less frequently, resulting in fewer work and school absences, a benefit for both them and the greater community. Furthermore, weatherization can also have an impact on the avoidance of unemployment benefits, increases in employment and retention, decreases in lost rental, and better national security. The results of the retrospective and WAP-ARRA period evaluations will also allow better estimates of the non-energy benefit accruable from voluntary carbon investments in low-income housing.

In a low-income weatherization assistance program that leverages the participation of carbon-offset companies, the companies would contribute money directly to community-action agencies already in contact with low-income households. The community-action agency would determine which houses are eligible for weatherization assistance, perform the energy audits, and install the weatherization measures.

Overall, there are many arguments in favor of having voluntary carbon markets include investments in low-income weatherization in the United States in their portfolios.

Projects are located in many places around the world, and carbon-offset companies will invest primarily in projects where their nation's currency is very strong. For example, European Union companies may invest in American projects, whereas U.S.-based companies will invest in Latin American or African projects. However, from the U.S. viewpoint, there are many advantages to locating future projects domestically, especially those that focus on low-income American households--projects in low-income American households can be just as charismatic as those located in developing countries; in fact, as described above, there are numerous social goals that can be promoted by locating projects in the United States.

First, locating projects domestically improves the accountability factor. Project operations and efficacy can be monitored more easily and more often, and results such as less storm water runoff, lower energy bills, less household garbage, and healthier clients will be more immediately evident. However, if a local program isn't working, problems will be easier and faster to identify and correct because the carbon-offset coordinators will be nearby and in frequent communication with participants. In carbon-offset projects located in developing countries where oversight is necessarily more sporadic, there is an inherently higher risk for smaller and less verifiable CO_2e savings, double-counting, lack of additionality, and leakage. The person in charge of day-to-day operations may not completely understand the project or process, opportunities for political corruption may be higher, and there may be confusion over who actually owns the credit as different political entities attempt to meet their Kyoto Protocol goals. These factors can significantly impact the amount of carbon reductions that actually occur within a project located out-of-country, making such projects an undependable investment.

The retrospective and WAP-ARRA period evaluations will be able to provide up-to-date, statistically valid estimates for first-year energy savings attributable to low-income weatherization. The energy-savings persistence project discussed in the next sub-section (Section 4.7) will be able to show, roughly, how far into the future GHG emissions reductions could achieved. It should also be noted that additionality is not an issue with respect to investments in low-income weatherization because it can be strongly argued that these households do not have the financial resources to make such investments. Lastly, it needs to be stated that the needs for low-income weatherization far outweigh the resources available to the Program, even under ARRA. Annually, there are approximately 35-40 million U.S. households that are eligible for weatherization services compared to the ability of the Program to fund about 100,000 weatherization jobs per year normally and 600,000 jobs with ARRA funds.

4.6.4 Research Approach to Assessing GHG Emission Reductions

The retrospective evaluation will estimate national reductions in carbon emissions attributable to WAP. This WAP ARRA evaluation task will assess carbon emission reductions more in-depth. Emission reduction estimates will be prepared for several different climate regions in the United States. Additionally, a national map of emissions reductions by agency will be prepared along with a second map that estimates potential emissions reductions from weatherizing low-income homes by agency. Assessing emission reductions at the agency level is important because it is hypothesized that interactions between the weatherization network and the voluntary carbon reduction market would probably take place at the agency level.

The key tasks of this research are to estimate the number of low-income homes in each local agency jurisdiction that have not yet been weatherized, estimate the GHG emissions reduction potential achievable from weatherizing these homes, and then estimate average weatherization costs per ton GHG emissions reduced. The key research challenges are to 'downsize' estimates of low-income homes generated on the national, state and super-puma levels through the Program Characterization research discussed above to the local agency level and to do the same with estimates of GHG reductions. Average weatherization costs per ton of GHG emissions reduced will be estimated twice. The first instance will be based on results from the PY2008 evaluation and will represent typical weatherization jobs. The second instance will include results from the evaluation of SERC and WIPP projects, which will include costs, energy savings and GHG emission reductions also attributable to renewable energy measures.

EIA has calculated emissions reductions in metric tons of CO_2e/MWh across the entire U.S. and subdivided into 15 regions[35]. Their calculations have already taken into account transmission and distribution losses and intensity factors, thus making the figures essentially tailor-made for the needs of this study. Table 4.7 shows the calculations, and the far right column labeled "Indirect Emissions" are the specific regional data to be used for this study. When calculating data on the agency level, the regional figure for that agency will be used.

Table 4.7 Emission Factors

Domestic Electricity Emission Factors, 1999-2002					
	Emission Inventory			Emission Reductions	
Region	Carbon Dioxide (Metric tons/MWh)	Methane (kg/MWh)	Nitrous Oxide (kg/MWh)	Avoided Emissions (Metric tons CO_2e/MWh)	Indirect Emissions (Metric tons CO_2e/MWh)
(1) New York, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, and Maine	0.466	0.02647	0.00616	0.744	0.793
(2) New Jersey, Delaware, Pennsylvania, Maryland, West Virginia, Ohio, Indiana, and Michigan	0.782	0.01404	0.01281	0.900	1.002
(3) Illinois and Wisconsin	0.638	0.01231	0.01048	0.900	1.151

[35] http://www.eia.doe.gov/oiaf/1605/pdf/Appendix%20F_r071023.pdf

(4) Missouri, Kentucky, Virginia, Arkansas, Tennessee, North Carolina, South Carolina, Louisiana, Mississippi, Alabama, and Georgia	0.690	0.02556	0.01283	0.900	1.005
(5) Florida	0.678	0.02437	0.00856	0.788	0.840
(6) Texas	0.730	0.01351	0.00774	0.782	0.833
(7) Oklahoma and Kansas	0.867	0.01315	0.01236	0.900	0.990
(8) North Dakota, South Dakota, Nebraska, Minnesota, and Iowa	0.875	0.01392	0.01414	0.900	1.160
(9) Colorado, Utah, Nevada, Wyoming, and Montana	0.909	0.01158	0.01377	0.900	1.009
(10) New Mexico and Arizona	0.658	0.00762	0.00941	0.900	0.970
(11) Oregon, Washington, and Idaho	0.147	0.01345	0.00337	0.781	0.833
(12) California	0.350	0.01831	0.00299	0.618	0.659
(13) Hawaii	0.858	0.03443	0.00777	0.849	0.905
(14) Alaska	0.749	0.01163	0.00461	0.859	0.916
(15) U.S. Territories	0.858	0.03443	0.00777	0.849	0.905
U.S. Average	0.676	0.01815	0.01053	0.900	0.959

The estimate of potential weatherization-eligible homes will be calculated from U.S. Census Bureau data and information collected from the agencies. The number of homes that match the income requirements for weatherization will be calculated at the local agency jurisdiction level then the number of already weatherized homes will be subtracted from this total, showing the number of weatherization-eligible homes in each agency's jurisdiction. The agency totals can then be added to calculate regional numbers of eligible homes. An average of energy savings from weatherized homes, in MWh and on a per-agency level when possible, will be multiplied by the number of weatherization-eligible homes to determine the potential energy savings on the local agency jurisdiction and then regional levels.

Following these calculations, the indirect emissions from Table 4.7 will be multiplied by the calculated potential energy savings (in MWh) to determine the potential GHG emissions savings on regional and agency levels, measured in metric tons of CO_2e. These figures will be the actual potential GHG emissions reductions for each agency and each region.

Using GIS software, the potential GHG emission reductions will be mapped across the U.S. to show the areas with the greatest potential for emissions savings. Maps will be created on the national, regional, and local agency jurisdiction levels. This savings information can then be passed on to third parties in the carbon markets and will ideally draw interest from private industry to the low-income home weatherization market.

4.7 PERSISTENCE OF ENERGY SAVINGS

Almost two decades ago, Ed Vine wrote: "The persistence of energy and demand savings is an important issue to many stakeholders: building owners, architects and engineers, utility program managers and evaluators, regulators, utility shareholders, resource planners, forecasters, and researchers."[36]

4.7.1 Background

The U.S. Department of Energy, as well as states and utilities, has funded the weatherization of low-income homes for over three decades. As stated by Ed Vine in 1992 (see footnote above), it is important for many reasons and from many viewpoints to understand how energy savings persist in weatherized homes. With increasing concerns about global climate change, it is even more important to estimate persistence because of the carbon emissions benefits from weatherizing homes. Many are exploring how carbon credits can be generated from weatherizing low-income homes, and potential purchasers of carbon credits need to know what amount of carbon emissions will be reduced for what period of time.

Unfortunately, no credible persistence studies have been conducted in recent years and only a few have ever been conducted. Those studies that were conducted date back to the late 1980s and early 1990s[37] and only explored persistence two to three years after weatherization. Thus, the weatherization and voluntary carbon market communities have little information about how to estimate persistence of energy savings in weatherized low-income homes.

4.7.2 Research Design

Proposed herein is a pilot project to retrospectively estimate persistence of energy savings in approximately 125 weatherized single-family and low-income mobile homes. The project team will work with the State of Wisconsin (where several local weatherization agencies have been identified that have comprehensive historical weatherization records) and possibly one or two additional states to identify several hundred homes that were weatherized around 1995 by three to four different local agencies. From this sample, the goal will be to identify 125 homes that have good weatherization records and whose occupants will allow home inspections and will consent to participating in a short survey (see below).

Homes that were weatherized by the same agencies in Program Years 2007, 2008, and 2009 will be used as a control group for this study. Specifically, treatment and control homes will be matched by age. In other words, a fifteen year old home weatherized in 1995 of a general type and size would be matched with a twenty-eight year old home weatherized in 2008 of the same general type and size, making sure that the latter had not been weatherized previously. This matching technique allows researchers to track changes in air leakage rates over time. A blower door test done pre-weatherization on the 2008 home would represent the tightness not only of that home but what the tightness of the 1995 home might have been in 2008 had it not been weatherized in 1995. Since new blower tests will be performed for all homes weatherized in the 1995 period, one can then estimate the persistence of 1995 weatherization measures on air leakage rates by taking the difference between the blower door test results for the 2008 weatherized homes and the 2008 blower door test results for the 1995 weatherized homes. An added bonus would be if blower door test results were also available pre- and post-weatherization for the homes weatherized during the 1995 period.

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[36] Vine, E. 1992. Persistence of Energy Savings: What Do We Know and How Can It Be Ensured? Energy, Vol. 17, No. 11, 1073-1084.

[37] E.g., Brandis, P., and Haeri, H. 1992. The Persistence of Energy Savings Over Time: Two and Three Years After Participation in a Retrofit Program. Policy Studies Review, Vol. 20, No. 1, 68-75.

An essential part of this proposed project is home inspection. As detailed in Task 4, each treatment home will receive an on-site inspection to generate information about weatherization measures installed in the home years in the past. The inspections will reveal the condition of the measures and whether they have been replaced or discarded. Any changes in house structure and integrity will also be noted.

The last component of this research design is a short interview. The current occupants of the homes included in the study will be asked about their knowledge of the weatherization measures installed in their homes, the occupant history of the homes (to the extent possible), and any changes in house structure, integrity, occupancy, etc. that could be useful in understanding variations in energy use in the home over time.

4.7.3 Tasking Statement

The proposed project will be composed of the following nine tasks:

Task 1. Agencies for Retrospective Study – The first task is to identify three or four local weatherization agencies in Wisconsin to participate in this study. The focus of this pilot study will be in cold-weather regions, under the assumption that weatherization activities save more energy, and therefore reduce carbon emissions more, in cold regions. Future projects should balance this information by focusing on homes in hot climates. The study will focus only on single-family and mobile homes that heat with fossil fuels or electricity produced by fossil fuels. Any local agencies selected to participate in this project will be required to have excellent records of past weatherization activities the 1995 time period. Information needed will include home addresses, audit reports, and installed weatherization measures. The records need not be in electronic form, although that would be preferable.

Task 2. Collect Weatherization Records– Project members will visit the participating local agencies to collect weatherization records. The goal will be to collect records for approximately 400 homes that were weatherized in the 1995 period.

Task 3. Sample Development – This task entails matching homes weatherized in the 2007, 2008, and 2009 period to homes weatherized in the 1995 period. As mentioned above, each home in the former list needs to be matched with a home in the latter list that was build in exactly the same year and is essentially the same type and size. The goal is to end up with a matched sample of approximately 125 homes.

Task 4. Conduct Inspections – Households will be paid an incentive to encourage them to participate in this study. The incentive will encourage households, firstly, to allow their homes to be thoroughly inspected. With the audit reports and list of installed weatherization measures in hand, inspectors will visit the treatment homes to document the following:

- Measure degradation – Weather stripping and other air-sealing measures will be examined. Infrared technology may be used to measure any settling of insulation in the walls. Measurements of the depth of insulation in ceilings will be taken. The condition of insulation around water heaters and ducts will also be noted. It is understood that past records may not include infrared measurements, for example, but using expert judgment, some conclusions can be made about measure degradation in these cases;

- Measure replacement – It will be determined whether various installed measures were replaced and if so, whether they were replaced with measures that had better, worse or the same energy-savings characteristics. Examples of measures that could be replaced include furnaces, windows, doors, and refrigerators;
- Measure retention – It will be determined whether various installed measures were retained in the home. Examples of these types of measures include CFLs and low-flow shower heads;
- Change in the condition or size of the home – Inspectors will determine to the extent possible whether the size of the home has changed (e.g., whether there have been any additions). Also, the inspectors will note any possible changes in the condition of the home (e.g., broken windows, holes in the roof) that could significantly impact energy savings; and
- Any other changes in the home that may impact energy-savings persistence estimates will be noted. Such changes could include the addition of window air conditioners, portable heaters, and wood furnaces.

It is proposed that blower door tests be conducted on treatment homes. If available, these results can be compared to blower test results from 1995, allowing for the possibility that tests conducted in 1995 were less accurate that those conducted today. Blower door test results from pre-weatherization and immediately post-weatherization for recently weatherized homes can be used as benchmarks. Additionally, it is proposed that the efficiency of furnaces be measured, along with the emissions of CO in flu gases. Indoor temperatures and water-heater temperatures may also be recorded.

Task 5. Conduct Household Interviews – These will be conducted on-site by the inspectors. They will inquire about the occupancy history of the home and any major structural or other changes in the home that may have significantly changed energy consumption over the past decade and a half years.

Task 6. Collect Utility Bills – The project will attempt collect twelve years of billing histories for all homes enrolled in the study (i.e., both treatment and control). It is anticipated that these data will be available in various formats, from readily available electronic data bases to paper files residing in filing cabinets in the basements of utility buildings.

Task 7. Energy Savings Data Analysis – PRISM and one or two other methods will be used to weather adjust and analyze the billing histories. Energy use for each group of homes will plotted over time (pre-and post-weatherization). Comparisons will be made between weatherized and control homes and the persistence of gross and net energy savings will be estimated.

Task 8. Implications for Voluntary Carbon Markets – An exercise will be conducted to estimate carbon emissions reductions that could be associated with each group of weatherized homes. Costs associated with weatherizing the homes will be compared to typical prices for carbon credits found in representative voluntary carbon markets. The cost-effectiveness of home weatherization as a potential vehicle for voluntary carbon markets will be assessed.

Task 9. Develop a Forward-Looking Data-Collection Protocol on Persistence– The data collection procedures described above probably only represent a first try at the types of data one might actually wish to do in persistence studies. For example, thoroughly documenting the condition and structural characteristics of homes at the time of weatherization and every three or four years afterward, through complete inspection reports and photographic documentation, would be much preferable to relying only on anecdotal evidence or the memories of occupants. Also, more extensive testing and data collection at the time of weatherization could serve as benchmarks (blower door tests, even infrared analyses of insulation in walls immediately after weatherization) for future studies; those would then be supplemented by repeated testing and data collection repeated every three or four years in the same homes. The output of this task will be a comprehensive and detailed data collection protocol to be implemented on any homes chosen to be enrolled in persistence studies.

Task 10. Draft and Final Reports – A draft report will be prepared and peer-reviewed. The final report will be revised accordingly.

5. SYNTHESIS

After the impact assessment, process assessment, and special technical studies have been performed, results from these studies will be drawn together via a synthesis study to address remaining questions identified in the evaluation design matrix (see Table 1.2):

- **Context**—Questions 2 and 8,
- **Implementation**—Question 7, and
- **Outcomes**—Questions 11 and 15-16.

Specifically, the synthesis study will determine:

- whether the Program has the capacity and structure (e.g., funding, staffing) to meet its legislative missions and objectives,

- how well the Program is meeting its legislative missions and objectives,

- whether the states and local agencies are fulfilling their obligations under federal regulations and state plans,

- the extent to which the Program is serving the weatherization needs of the low-income community and meeting the needs of the national low-income weatherization market, and

- how the weatherization network's performance can be improved to guide the Program into the next decade.

The Program objectives as set by legislation will be identified in the impact assessment (see Section 3.1). One or more measurable indicators will be developed under the synthesis study for each identified objective and an expected value for each indicator will be established based on the legislative intent. Evaluation data and results from the previous studies will be used to determine an actual value for each indicator, and the actual value of each indicator will be compared to the expected value to determine whether the legislative intent is being met. The key Program objectives that will be examined include:

- the number of clients served by the Program,

- the extent to which the Program focused on low-income persons who are particularly vulnerable as defined by DOE (i.e., households with elderly or disabled persons, those with children, and those with high residential energy use and high energy burden), and

- the spending of Program financial resources according to federal regulations (e.g., adherence to spending limits for training, overhead, and weatherization measures ; following rules concerning materials purchased and measures installed with Program funds).

Using results from the impact and process assessments, a determination will be made as to whether states and agencies are fulfilling their obligations under Federal regulations and state plans (e.g., units weatherized, average household expenditures, expenditures for training and overhead).

The extent to which the weatherization needs of low-income households are being met by the Program will be assessed by examining (from the previous studies) the households being served by the Program compared to the larger low-income population, the breadth of activity performed nationally

under the Program and differences in this activity by climate region, and the energy impacts of this activity and the quality of the jobs performed.

The results and findings from the previous three study areas (i.e., impact assessment, process assessment, and special technical studies) will be brought together and examined to develop recommendations on how the Program and the weatherization network's performance can be improved. In addition to synthesizing and distilling findings about Program outcomes and processes concerning PYs 2009, 2010 and 2011, this study will develop insights useful for guiding the Program into the next decade. Future trends of many variables relevant to the Program will be assessed, including demographics, energy prices and availability, housing stock, residential energy technologies, possibly new energy and environmental legislation, restructuring of the electric utility industry, and workforce. Recommendations will address the full breadth of the Program and the network's operation, including the delivery of the Program, communications within the network, coordination with other programs, and reporting of this coordination to DOE. Recommendations should also be developed on how a longer-term, more continuous evaluation of the Program could be implemented by DOE so that the longer-term outcomes of the Program and the long-term persistence of energy savings could be more fully addressed (see Section 1.1.3). The standardized data collection needed to support such an effort should also be addressed. Two groups will be consulted to help develop the recommendations:

- **Network Committee**—The Network Committee will be re-convened to consider the evaluation's findings and trends into the future. The Committee will identify those trends that could most impact the Program in the next decade and will also make recommendations to the Program with respect to guiding the program into the next decade.

- **Expert Panel**—An Expert Panel will be formed to solicit the opinions of about a dozen policy and public administration experts (most are expected to be academics). Through an iterative process, the Expert Panel members will provide (1) their opinions and insights about the evaluation's findings and their reactions to the opinions and insights of others, (2) their responses to policy-oriented and program administration questions and their reaction to the responses of others, and (3) their recommendations and their reaction to the recommendations proposed by others. It is expected that a well-run expert-panel process will find areas of consensus and disagreement amongst the panel members. This expert panel process will be run virtually (i.e., without convening the participants in one physical place), both to minimize expenses and also to maximize the time allowed to the panelists to provide answers, consider the inputs of the other panelists, and provide their reactions to the opinions of the panel.

The results of the discussions of the Network Committee and the Expert Panel will be compiled into a separate report and delivered to DOE for its use.

6. SCHEDULE

A schedule for the evaluation is shown in Figure 6.1. It should be noted that the intent of the evaluation is to measure and evaluate PY 2009-2011 activities; PY 2009 starts in April 2009 and PY 2011 ends in June 2012.

The timely implementation of the data-collection aspects of this preliminary evaluation plan depends upon receiving approval of the national evaluation from OMB in a timely manner. DOE and the ORNL evaluation team are in the process of obtaining OMB's approval.

Figure 6.1. WAP-ARRA Period Evaluation schedule

Task Name	Calendar Year 2011				Calendar Year 2012				Calendar Year 2013				Calendar Year 2014			
	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
National Energy Savings Analyses																
States Survey (S1)																
Agency Surveys																
WIPP Study																
SERC Study																
Under-Performers Study																
GHG Emissions Study																
Deferral Study																
Social Network Study																
Weatherization Staff Survey Follow-ups																
Persistence Study																

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APPENDIX A. NATIONAL WEATHERIZATION NETWORK COMMITTEE

Adams, Robert	DOE/OWIP/WAP
Beachy, Bill	Virginia-Community Housing Partners Corporation
Bennett, Randy	State of IL, Dept. Commerce & Econ. Opp.
Bensch, Ingo	Apprise
Berger, Jackie	Apprise
Bethke, Jack	Community Action of Minneapolis
Bowmar, Kip	Community Action Kentucky
Brady, Eugene	Pennsylvania-Commission on Economic Opportunity
Carroll, David	Apprise
Choate, JoAnn	Maine State Housing Authority
Costello, Pat	NYS Division of Housing & Community Rene
Crisp, Jim	Michigan Community Action Agency Assoc.
Cutchen, Kelly	SMS
Diggs, Jean	DOE/OWIP/WAP
Doyle, Dawn	Texas Department of Housing and Community Affairs
Eisenberg, Joel	Oak Ridge National Laboratory
Foote, Katherine	DOE/GO
Gerardot, Ed	Indiana Community Action Association
Hamilton, John	Illinois – CEDA
Harmelink, Suzanne	WI Energy Conservation Corporation
Hepinstall, Dave	New York -Association for Energy Affordability
Jacobson, Elliott	Massachusetts-Action, Inc
Peterson, Mike	DOE/GO
Pitts, Keith	Ohio-Corporation for Ohio Appalachian Develop.
Power, Meg	NCAF
Quenemoen, Kane	Montana DPHHS
Ravesloot, Holly	DOE/OWIP/WAP
Sabree-Sylla,Clarice	NJ Department of Community Affairs
Schweitzer, Martin	Oak Ridge National Laboratory
Scott, Bob	NASCSP
Simonson, Cynthia	SMS
Smith, Carrie	Arizona – FSL
Sunday, Nick	State of Ohio-Office of Community Service
Tonn, Bruce	Oak Ridge National Laboratory
Van der Meer, Bill	SMS
Zamora, Christina	Idaho –CAPAI

APPENDIX B. DOE SURVEY

UNDER DEVELOPMENT

OMB Control Number: 1910-5151

APPENDIX C. S1: ALL STATES PROGRAM INFORMATION SURVEY

This data is being collected to conduct a process evaluation of the Weatherization Assistance Program at the state level. The data you supply will be used to characterize program activities during Program Year 2010.

Public reporting burden for this collection of information is estimated to average sixteen hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Records Management Division, IM-11, Paperwork Reduction Project (1910-5151), U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project (1910-5151), Washington, DC 20503.

All of the information obtained from this survey will be protected and will remain confidential. The data will be analyzed in such a way that the information provided cannot be associated back to your state, your agencies, or the housing units and clients that your state served. Again, please note that the questions refer to PY 2010 unless otherwise noted.

PROGRAM CHARACTERIZATION

1. Please identify your state: _____

2. It is important to collect information about the weatherization of homes beyond the standard single family homes that are heated with natural gas or electricity. Please review the following information for accuracy about each of the local agencies (subgrantees) that you fund to provide weatherization services in your state. Please add any additional grantees and funding amount in the extra space at the bottom of the table:

Local Agency (Subgrantee) Name	**Active Subgrantee (Y/N)**	**Amount of DOE Funds Received by Agency in Program Year 2010**	**Correct Amount (Y/N) If NO, Please Insert Correct Amount**

3. During Program Year 2010, was the director of your State's Weatherization Program (Check best answer):
_____ a civil servant
_____ political appointee
_____ elected official

4. During Program Year 2010, did the director of your State's Weatherization Program *report to* a (Check best answer):
_____ civil servant,
_____ political appointee
_____ elected official

5. For how many years had the current director of your State's Weatherization Program served in that capacity prior to PY 2010? _____

6. Did your State's Weatherization Program set annual performance goals for PY 2010?
_____ Yes
_____ No (go to Question 7)

6a. What agency, office, or department was responsible for reviewing the annual performance goals and achievement of goals of your State's Weatherization Program? _____

7. Please list other important housing and/or energy-related programs for low-income residents that were administered by the same office that is in charge of your state's Weatherization Assistance Program.
_____
_____

8. What weatherization program data did your state require its weatherization agencies to provide in PY2010? (Check all that apply)
_____ Number of homes weatherized
_____ Number of homes weatherized for high priority categories
_____ DOE weatherization funds expended
_____ Non-DOE weatherization funds expended
_____ Descriptive statistics on demographics of households weatherized
_____ Descriptive statistics on weatherization measures installed in households weatherized
_____ Descriptive statistics on energy use/savings of households weatherized
_____ Copy of audits performed on the households weatherized
_____ Results of certain diagnostic tests
_____ Number of homes deferred for weatherization
_____ Other _____

9. Does your state maintain an electronic state weatherization program data base?
a. Yes
b. No (Go to Q13)

10. If what does this database contain? (check all that apply)
a. number of homes weatherized
b. number of homes weatherized by type
c. costs???
d. billing records for weatherized homes
e. audit records
f. measures installed by unit
??????

11. Your database also contains these types of information: (check all that apply)
a. LIHEAP records
b. ???
c. none of the above

12. Who has access to this database? (check all that apply)
a. state weatherization office staff
b. other state employees
c. local weatherization agency staff
d. other _____

13. Please indicate the number of staff that supported your State's Weatherization Program and their work effort in Program Year 2010. In considering the number of staff, please include everyone who worked full- or part-time or who worked with the weatherization program as well as other state programs. Also include any non-agency staff supporting the state program that work under contract to the state.

Type of Administrative Function	**Number of Staff (# persons)**	**Total Staff Work Effort (# of FTE)**
Management/administration		
Agency monitoring		
Training and Technical Assistance		
Other (specify)		
TOTAL		

14. For the in-house staff working on your state's weatherization program in each of the following functional areas in Program Year 2010, please indicate their collective level of experience with the weatherization program:

	Very High	**High**	**Medium**	**Low**	**Very Low**
Management/administration					
Field monitoring/auditing					
Training and Technical Assistance					
Other (specify)					

15. For the in-house staff working on your state's weatherization program in each of the following functional areas in Program Year 2010, please indicate the amount of turnover in staff over a **two year period that included PY 2010**: Turnover is defined as the number of new staff in a functional area in the past three years divided by the total number of staff working in that functional area. If a particular position has had more than one new person during the past three years (e.g., Person 1 leaves, Person 2 is hired to take Person 1's position, then Person 2 leaves and a third person is hired), just count that as one new staff person. (Please check appropriate boxes)

	No Turnover	**1 to 10%**	**11 to 25%**	**26 to 50%**	**51 to 75%**	**76 to 100%**
Management/ administration						
Field monitoring/ Auditing						
Training and Technical Assistance						
Other (specify)						

16. The Federal Regulations governing the Weatherization Assistance Program define children as "dependents not exceeding 19 years or a lesser age set forth in the State plan." What age did your state use in your state's definition of children in PY 2010? _____

17. Did your state use a high energy burden category to prioritize the provision of weatherization services in PY 2010?

_____ Yes
_____ No (go to Question 18)

17a. How was 'high energy burden' defined? _____

18. Did your state use a high energy expenditure category to prioritize the provision of weatherization services in PY 2010?

_____ Yes
_____ No (go to Question 19)

18a. How was 'high energy expenditure' defined? _____

19. What were the income guidelines for households to be eligible for your state's weatherization program in PY 2010? (Check all that apply)

_____ 150% of Federal Poverty Guidelines
_____ 200% of Federal Poverty Guidelines
_____ More than 200% of Federal Poverty Guidelines
_____ 60% of state median income
_____ Other: _____

LEVERAGING RELATIONSHIPS

1. Please describe your state's leveraging relationships and funding pre-ARRA, for **PY 2008**. The first column provides the amount of leveraged funding received in PY 2008 as reported by your state. Please make any necessary edits to this column, including revising leveraging amounts, and adding previously left out leveraged sources. Also, please indicate when your state began to receive funding from this source and also how long your state worked to establish the leveraging relationship before it was put in place.

Source of PY 2008 Leveraged Weatherization Funding Administered by State		**Amount of Leveraged Funding PY 2008**	**Year That State Began to Receive Leveraged Funding From This Source**	**If known, number of years that state worked to achieve this leveraging relationship**
LIHEAP				
Petroleum Violation Escrow (PVE)				
Other Federal Programs				
State Public Benefit Funds				
Other State Programs (Please enter names ↓)				
Other Program 1.				
Other Program 2.				
Other Program 3.				
All Other Programs				
Utilities (Please enter names ↓)				
Utility 1.				
Utility 2.				
Utility 3.				
All Other Utilities				
Program Income				
In-Kind (Please describe ↓)				
In-Kind 1.				
In-Kind 2.				
In-Kind 3.				
All other In-kind				
Non-Profits (Please enter names ↓)				
Non-Profit 1.				
Non-Profit 2.				
Non-Profit 3.				
All Other Non-Profits				
Other (Please enter names ↓)				
Other 1.				
Other 2.				
Other 3.				
Third Party: (e.g., Foundation, Lender)				
All Others				

2. Please describe your leveraging relationships and funding during WAP ARRA **PY 2010** for each source listed in Question 1 and please add any new sources. Please provide the amount of leveraged funding received in PY 2010 by source. Please forecast leveraging relationship for the post-ARRA period, that is during PY 2012. If there are no leveraging relationships to report, please skip to Question 3.

Source of PY 2008 Leveraged Weatherization Funding Administered by State		**Amount of Leveraged Funding PY 2010**	**If leveraged funding from this source decreased from PY 2008, was the change attributable to increased ARRA funding? (Yes, No)**	**Do you expect leveraged funding from this source to increase (I), decrease (D) or stay the same (S) from the PY 2010 level post-ARRA, in PY 2012**
LIHEAP				
Petroleum Violation Escrow (PVE)				
Other Federal Programs				
State Public Benefit Funds				
Other State Programs (Please enter names ↓)				
Other Program 1.				
Other Program 2.				
Other Program 3.				
All Other Programs				
Utilities (Please enter names ↓)				
Utility 1.				
Utility 2.				
Utility 3.				
All Other Utilities				
Program Income				
In-Kind (Please describe ↓)				
In-Kind 1.				
In-Kind 2.				
In-Kind 3.				
All other In-kind				
Non-Profits (Please enter names ↓)				
Non-Profit 1.				
Non-Profit 2.				
Non-Profit 3.				
All Other Non-Profits				

Other (Please enter names ↓)				
Other 1.				
Other 2.				
Other 3.				
Third Party: (e.g., Foundation, Lender)				
All Others				

3. For each of the non-DOE sources of weatherization funds which your state administered in Program Year 2010, did you require local agencies receiving those funds to follow DOE rules when spending the money? If you did *not* require DOE rules to be followed for non-DOE jobs, what were the major differences in the rules governing those expenditures in comparison to DOE rules? If you did not administer funding from a particular source in Program Year 2010 for weatherization, please enter N/A. Survey answers from PY 2008 are included for comparison.

Source of non-DOE PY 2008 and PY 2010 Weatherization Funding Administered by State	**(A) Did you require local agencies to follow DOE rules when spending funds from this source? (Yes/No/NA)**		**(B) If the answer in Column (A) was no, what were the major differences in the rules governing the expenditure of funds from this source in comparison to the rules governing the expenditure of DOE funds?**	
	PY2008	PY2010	PY2008	PY2010
LIHEAP				
Petroleum Violation Escrow (PVE)				
Other Federal Programs				
State Public Benefit Funds				
Other State Programs				
Utilities				
Program Income				
In-Kind				
Non-Profit Organizations				
Third Party: (e.g., Foundation, Lender)				
Other				

4. Please indicate the amount of weatherization funding from each source that your state administered in Program Year 2010 that was spent on the different functions or applications shown below. The amount that you list in the right-most cell at the very bottom of the table should equal the total amount of weatherization funding from all sources that your state administered in Program Year 2010.

Source of PY 2010 Weatherization Funding Administered by State	Training and Technical Assistance (T&TA)		Program Management		Other (funds for weatherization, health and safety, and other measures passed on to local agencies)	Total
	Funds retained and spent by state	Funds passed on to local agencies	Funds retained and spent by state	Funds passed on to local agencies		
DOE						
LIHEAP						
Petroleum Violation Escrow (PVE)						
Other Federal Programs						
State Public Benefit Funds						
Other State Programs						
Utilities						
Program Income						
In-Kind						
Non-Profit Organizations						
Third Party: (e.g., Foundation, Lender)						
Other						
Total						

5. Of the Program Year 2010 funds retained by your State's Weatherization Program for Program Management, how much was used for each function listed below?

Type of Management Function	**Total**
Administration*	
Agency monitoring	
Other (specify)	
TOTAL	

* Includes planning, finance and accounting, clerical support, outreach, and evaluation.

6. How important were leveraged funds for your State's Weatherization Program in PY 2010 compared to program years without additional ARRA funding? (Check best answer)

_____Very important
_____ Important
_____ Not very important
_____ Not important at all

7. Did your state set aside funding to advocate for leveraged resources in PY 2010?
_____ Yes
_____ No (Go to Question 9)

8. What organizations advocated for leveraged resources in PY 2010? (Check all that apply)
_____ Your state office
_____ Your state's agencies
_____ Non-profit organizations funded by your state
_____ Other

9. How successful would you rate your state's efforts to acquire leveraged funds in PY 2010? (Check best answer)
_____ Very successful
_____ Successful
_____ Not very successful
_____ Not successful at all
_____ State does not seek leveraged funds

10. What factors limited the success of your state's efforts to acquire leveraged funding in PY 2010?
_____

11. Have you modified your state's weatherization program practices or regulations since PY 2008 to facilitate spending and reporting on leveraged resources?
_____Yes
_____ No

12. How has the influx of ARRA funding impacted previously existing leveraging relationships?
a. Extremely positive impact
b. Positive impact
c. No Impact
d. Negative impact
e. Extremely negative impact

13. Please describe the change in leveraging relationships between your state's low-income weatherization program and these partners during the ARRA period.

Partner	**Extremely positive**	**Positive**	**No change**	**Negative**	**Extremely Negative**
LIHEAP					
Other Federal Programs					
State Public Benefit Funds					
Other State Programs					
Utilities					
Non-profits					
Third Party: (e.g., Foundation, Lender)					
OTHER ____					

14. Can leveraging relationships damaged or lost during ARRA be re-built post-ARRA?
a. Yes, absolutely
b. Yes, probably
c. Uncertain
d. No, probably not
e. No, definitely not

15. Do you see state-level Renewable Portfolio Standards programs benefitting low-income weatherization? If so, how? If not, why not? _____

16. What aspects about your state's low-income weatherization program are most misunderstood by actual and potential leveraging partners? _____

17. How has your program worked to overcome these misunderstandings? _____

18. What information would your state's weatherization program like to have that could be used to overcome these misunderstandings?

19. What other information would your state's weatherization program like to have that could be used to 'sell' leveraging relationships? _____

20. Overall, what is your expectation for total state leveraged funding for low-income weatherization funding post ARRA in PY 2012 (post- ARRA) compared to PY 2008 (pre-ARRA)?
a. Greatly increased
b. Increased
c. Same level
d. Decreased
e. Greatly decreased

21. On balance, how beneficial do you think ARRA funding will prove to be over the longer-term on your state's ability to leverage DOE WAP-program funding for low-income weatherization?
a. Extremely beneficial
b. Beneficial
c. No long-term impact
d. Unbeneficial
e. Extremely unbeneficial

PROGRAM OPERATIONS AND IMPLEMENTATION

1. Using the following scale, how adequate was the Program Year 2010 funding received by your state from ALL funding sources for weatherizing the stock of eligible low-income dwelling units in your state in a timely fashion? (Check all that apply)

_____ Very Adequate
_____ Adequate
_____ Inadequate
_____ Very Inadequate

2. What was the quality of the management support that your state received from DOE and its contractors in Program Year 2010? (Check all that apply)

_____ very high quality
_____ high quality
_____ moderate quality
_____ low quality
_____ very low quality
_____ not applicable

3. What was the quality of the training that your state received from DOE and its contractors in Program Year 2010? (Check all that apply)

_____ very high quality
_____ high quality
_____ moderate quality
_____ low quality
_____ very low quality
_____ not applicable

4. What was the quality of the support and assistance on client education that your state received from DOE and its contractors in Program Year 2010? (Check all that apply)

_____ very high quality
_____ high quality
_____ moderate quality
_____ low quality
_____ very low quality
_____ not applicable

4a. If appropriate, why did you rate the quality very low or low? _____

5. What was the quality of the support and assistance on leveraging the Weatherization Assistance Program funding provided by DOE with other funding sources in Program Year 2010? (Check all that apply)

_____ very high quality
_____ high quality
_____ moderate quality
_____ low quality
_____ very low quality
_____ not applicable

5a. If appropriate, why did you rate the quality very low or low? _____

6. What was the quality of the *technical* support (e.g., measure selection and installation) that your state received from DOE and its contractors in Program Year 2010? (Check all that apply)

_____ very high quality
_____ high quality
_____ moderate quality
_____ low quality
_____ very low quality
_____ not applicable

6a. If appropriate, why did you rate the quality very low or low? _____

7. How flexible did you find the DOE program rules that governed the weatherization program in Program Year 2010? In other words, did the program rules allow your state to tailor your program to your needs (very flexible) or proscribe your program to only one way of operation (very inflexible)? (Check all that apply)

_____ Very Flexible
_____ Flexible
_____ Inflexible
_____ Very Inflexible

7a. Using PY 2010 as the reference point, how should the program rules change? (One)

_____ Become much more flexible
_____ Become more flexible
_____ Stay about the same
_____ Become more inflexible
_____ Become much more inflexible

7b. In what areas should the program rules become more flexible? _____

7c. In what areas should the program rules become less flexible? _____

8. Please describe any important political issues faced by your state's weatherization program in Program Year 2010.
_____
_____
_____
_____

9. At this point in time, does your state need the following (Check any needed items):
_____Additional administrative support and assistance from DOE
_____Improved training from DOE and its contractors
_____Additional assistance from DOE and its contractors with leveraging resources
_____Improved technical support from DOE and its contractors
_____Additional funding for the delivery of weatherization services
_____Improved data and information systems for the delivery of weatherization services
_____ Additional assistance to develop and administer client education programs

PROGRAM IMPLEMENTATION DURING THE ARRA PERIOD

1. During the ARRA period, has your state added any new local weatherization agencies (i.e., sub-grantees) to its low-income weatherization program?
a. Yes
b. No (Skip to Question 4)

2. How many new local weatherization agencies were added? _____

3.Why were these agencies added? (check all that apply)
a. To meet increased production targets
b. To replace non-performing subgrantees
c. To build synergies between the state weatherization program and other community service programs in community action agencies that did not provide weatherization services
d. Other _____

4. For many years, the national weatherization network and the state-level national weatherization networks had been relatively stable. During the ARRA period, beyond sub-grantees, did the composition of your state-level weatherization network change?
a. Yes
b. No (Skip to Question 8)

5. How would you characterize the magnitude of this change?
a. Extreme
b. Great
c. Moderate
d. Small

6. Using the table below, please list the names and contributions of up to ten major new players.

Name	**Description of Weatherization Related Contributions (e.g., provides training, sells energy efficient products)**

7. Please rate the quality of services and products provided by the new major players:
a. very high quality
b. high quality
c. fair quality
d. low quality
e. very low quality

8. Please provide your best estimate for how many new low-income weatherization-related businesses were created in your state during the ARRA period:
a. none
b. 1-10
c. 11-20
d. 21-30
e. 30+

9. How have private companies new to the weatherization network tried to change state and local weatherization procedures during the ARRA period? _____

10. On balance, how beneficial have these new players been to your state's weatherization program?
a. Extremely beneficial
b. Beneficial
c. Neither beneficial nor unbeneficial
d. Unbeneficial
e. Extremely unbeneficial

Please Explain _____

11. During the ARRA period, did organizational responsibilities for your state's weatherization program (e.g., reporting lines, organizational home) change?
a. Yes
b. No (Skip to Question 13)

12. How did the organizational responsibilities change? Please Explain _____

13. How have relationships changed between your state weatherization office and local weatherization agencies during ARRA?
a. become much more congenial
b. become more congenial
c. no changes
d. become more strained
e. become much more strained

14. Which statement best describes how the existing local weatherization agencies (i.e., subgrantees) dealt with program expansion during the ARRA period?
a. promoted existing weatherization staff to management positions and hired new entry level workers
b. hired new weatherization managers and hired new entry level workers
c. promoted existing weatherization staff to management positions and hired contractors to ramp up production
d. hired contractors to ramp up production

15. Were there any material, equipment or other supply chain bottlenecks during the ARRA period that negatively impacted weatherization production in your state?
a. No
b. Yes
If yes, what was in short supply? _____

16. To what extent have large DOE/OWIP programs, WAP, State Energy Program, and Energy Efficiency Community Block Grant Program competed for labor during the ARRA period?
a. Not at all
b. a small extent
c. a moderate extent
d. a large extent
e. a very large extent

17. During the ARRA period, how has state-level oversight of your state's weatherization assistance program changed?
a. Greatly increased
b. Increased
c. Stayed the same
d. Decreased
e. Greatly decreased

18. Has ARRA funding allowed your state program to purchase and implement new information technologies to improve program administration?
a. Yes
b. No
If yes, please describe these new information technologies. _____

19 During PY 2010, how much of a burden were your state program's administrative costs allocated to dealing with increased oversight during the ARRA period (e.g., from DOE IG, GAO)?
a. no burden
b. slight burden
c. moderate burden
d. substantial burden
e. extreme burden

20. Did your state change its audit approach during the ARRA-period from the approach used pre-ARRA (i.e., PY2008)?
a. Yes, went from priority list to computerized audit
b. Yes, went from computerized audit to priority list
c. Yes, changed from one computerized audit tool to another
d. No
e. Other _____

21. During the ARRA period, has your state passed any new laws and/or implemented any new regulations that have directly impacted your state's weatherization assistance program?
a. Yes
b. No (Skip to Question 25)

22. Please describe the new laws and/or regulations. _____

23. On balance, how beneficial have these new laws and/or regulations been to your state's weatherization program?
a. Extremely beneficial
b. Beneficial
c. Neither beneficial nor unbeneficial
d. Unbeneficial
e. Extremely unbeneficial

Please explain _____

24. Would these laws and/or regulations have been passed without the increased attention on the program attributable to ARRA?
a. No, Wholly due to ARRA
b. No, Primarily due to ARRA
c. No, Somewhat due to ARRA
d. Yes, Would have been passed anyway without ARRA

25. Did your state change the way it provides technical assistance to its subgrantees during the ARRA period?
a. No
b. Yes
If yes, how? _____

26. Has your state implemented new certification requirements for weatherization workers during the ARRA period?
a. No (go to Q28)
b. Yes
27. What new certifications are required? (Check all that apply)

a. BPI Building Analyst
b. BPI Envelope
c. BPI Residential Building Envelope Accessible Areas Air Leakage Control Installer
d. Residential Building Envelope Whole House Air Leakage Control Crew Chief
e. BPI Manufactured Housing
f. BPI Heating
g. BPI Air Conditioning and Heat Pump
h. BPI Multifamily
i. HERS
j. LEED
k. Lead Safe Weatherization
l. Lead Certified Renovator
m. NAHB Green Building
n. Other _____

28. Which statement best describes changes in the level of employment in your state resulting from Davis-Bacon?
a. large number of jobs created
b. small number of jobs created
c. no change in the number of jobs
d. small number of jobs lost
e. large number of jobs lost

29. Which statement best describes the impact of Davis-Bacon on wages paid to weatherization workers in your state?
a. large increase in wages (over 10% increase)
b. moderate increase in wages (between 5 and 10% increase)
c. small increase in wages (between 1 and 5% increase)
d. no increase in wages
e. small decrease in wages (between 1 and 5% decrease)
f. moderate decrease in wages(between 5 and 10% decrease)
g. large decrease in wages (over 10% decrease)

30. How much of a problem was there in your state in coordinating wages stipulated by Davis-Bacon for local weatherization agencies whose operations spanned multiple counties?
a. no problem
b. small problem
c. moderate problem
d. large problem
e. very large problem

31. In your state, on average, how much did Davis-Bacon rules increase the cost of weatherizing low-income multifamily buildings four stories and higher?
a. no increase
b. 1-10%
c. 11-20%
d. 21-30%
e. 31+%
f. N/A

32. Overall, how did Davis-Bacon impact the costs of weatherization in your state?

a. greatly increased costs
b. increased costs
c. no change in costs
d. decreased costs
e. greatly decreased costs

33. Does your state allow the weatherization of large low-income multi-family buildings?
a. yes
b. no
If not, why not? _____

34. What are the barriers to weatherizing large low-income multi-family buildings in your state? (check all that apply)
a. lack of trained auditors
b. lack of trained crew
c. too expensive
d. building owners are uncooperative
e. energy savings are not high enough
f. unclear guidance from DOE or other agencies on owner contributions
g. other _____

35. Does your state allow the weatherization of public housing, that is, housing owned by a public housing authority?
a. Yes
b. No
If not, why not? _____

36. Does your state allow the weatherization of HUD assisted housing?
a. Yes
b. No
If not, why not? _____

37. How many units of each type were weatherized in your state in PY 2010?

Type of Housing	**Large Multi-family (Not Public Housing or HUD Assisted**	**Public Housing Multi-family**	**HUD Assisted Multi-family**

38. Are there any DOE rules that could be changed to make it easier to weatherize large low-income multi-family buildings?
a. Yes. Describe:_____
b. No

39. Does your state's weatherization program have an agreement with your State Historic Preservation Office (SHPO)?
a. Yes
b. No

40. What percentage of units weatherized in PY 2010 fell under the SHPO agreement?

a. 0
b. 1-5
c. 6-10
d. 11-15
e. 15+

41. Has low-income weatherization had an impact in preventing home foreclosures in your state during the ARRA period?
a. no
b. little impact
c. moderate impact
d. great impact
e. very great impact

42. Does your state have a deferral policy?
a. Yes
b. No

43. Please estimate the number of units where weatherization was deferred during PY 2010?
a. 0%
b. 1-5%
c. 6-10%
d. 10-20%
e. 21-30%
f. more than 30%

44. Please estimate what percentage of units where weatherization was deferred during PY 2010 will eventually be weatherized?
a. 0%
b. 1-25%
c. 26-50%
d. 51-75%
e. 76-90%
f. 91-100%

45. Please describe your states deferral rates in PY2010 compared to PY2008:
a. very great increase
b. great increase
c. increase
d. no change
e. decrease
f. great decrease
g. very great decrease

46. How has the visibility of your state's weatherization program changed vis-à-vis state elected officials during the ARRA period?
a. greatly increased
b. increased
c. no change
d. decreased
e. greatly decreased

47. How has the visibility of your state's weatherization program changed vis-à-vis the general public during the ARRA period?
a. greatly increased
b. increased
c. no change
d. decreased
e. greatly decreased

48. Please rate the quality of the media coverage your state's weatherization program has received during the ARRA period?
a. very high quality
b. high quality
c. moderate quality
d. low quality
e. very low quality
f. N/A no media coverage

49. Please describe the overall media coverage of your state's weatherization program during the ARRA period:
a. very positive
b. positive
c. neither positive or negative
d. negative
e. very negative

50. What topics did the media mainly focus on? (check all that apply)
a. Jobs created
b. Energy saved
c. Helping low income households
d. waste, fraud and abuse
e. Lack of energy savings
f. Organizational mis-steps
g. Other _____

51. Will weatherization issues identified rightly or wrongly by the media during ARRA have lasting impacts on leveraging weatherization funding for your state in the future?
a. could substantially reduce funding
b. could reduce funding
c. no impact
d. could increase funding
e. could substantially increase funding

52. On balance, how beneficial has been the attention paid to your state's weatherization program during the ARRA period?
a. Extremely beneficial
b. Beneficial
c. Neither beneficial nor unbeneficial
d. Unbeneficial
e. Extremely unbeneficial

53. Please explain _____

TRAINING

1. For those staff working in your state's weatherization office who need to have knowledge about the following list of weatherization topics, how well trained were they in each area in PY 2010? Please use the following scale: 1– not at all well trained; 2 – not well trained; 3 – moderately well trained; 4 –well trained; 5 – very well trained; 6 – not applicable *Circle best answer*.

(1) Diagnostic procedures	1	2	3	4	5	6
(2) Insulation						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(3) Space heating, ventilation, air conditioning						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(4) Infiltration measures						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(5) Doors and windows						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(6) Hot water heating						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(7) Baseloads (e.g., lighting, refrigerators)						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6

1a. For those staff working in your state's weatherization office who need to have knowledge about the following list of administrative-related topics, how well trained were they in each area? Please use the following scale: 1– not at all well trained; 2 – not well trained; 3 – moderately well trained; 4 – well trained; 5 – very well trained; 6 – not applicable *Circle best answer.*

(1) Management	1	2	3	4	5	6
(2) Client education	1	2	3	4	5	6
(3) Auditing/estimating						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(4) Monitoring/quality control	1	2	3	4	5	6
(5) Financial topics	1	2	3	4	5	6
(6) Outreach and communications	1	2	3	4	5	6
(7) Other (please specify)	1	2	3	4	5	6

1b. For those staff working in your state's weatherization office who need to have knowledge about the following list of health and safety topics, how well trained were they in each area? Please use the following scale: 1– not at all well trained; 2 – not well trained; 3 – moderately well trained; 4 –well trained; 5 – very well trained; 6 – not applicable *Circle best answer.*

(1) Fire safety	1	2	3	4	5	6
(2) Indoor air quality	1	2	3	4	5	6
(3) Measures to increase security of housing unit	1	2	3	4	5	6
(4) Measures to reduce common household hazards	1	2	3	4	5	6
(5) Mold and mildew	1	2	3	4	5	6
(6) Lead	1	2	3	4	5	6
(7) Asbestos	1	2	3	4	5	6
(8) Vermiculite	1	2	3	4	5	6
(9) General crew safety	1	2	3	4	5	6
(10) Other health and safety	1	2	3	4	5	6
(11) Other (please specify	1	2	3	4	5	6

1c. For categories receiving answers of (1)-not at all well trained, or (2)-not well trained to the above questions, what were the barriers for receiving this training:
a. Funding
b. Time
c. Not a priority
d. Not available
e. Other_____

2. On which of the following weatherization subjects did staff working in your state's weatherization office receive training in Program Year 2010 from DOE, your state, or other entities? (Check all that apply*)*

(1) Diagnostic procedures _____
(2) Insulation _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(3) Space heating, ventilation, air conditioning _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(4) Infiltration measures _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(5) Doors and windows _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(6) Hot water heating _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(7) Baseloads (e.g., lighting, refrigerators) _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____

2a. On which administration-related topics did staff working in your state's weatherization office receive training in Program Year 2010 from DOE, your state, or other entities? (Check all that apply*)*

(1) Management _____
(2) Client education _____
(3) Auditing/estimating _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(4) Monitoring/quality control _____
(5) Financial topics _____
(6) Outreach and communications _____
(7) Other (please specify) _____

2b. On which health and safety topics did staff working in your state's weatherization office receive training in Program Year 2010 from DOE, your state, or other entities? (Check all that apply.)

_____ Fire safety
_____ Indoor air quality
_____ Measures to increase security of housing unit
_____ Measures to reduce common household hazards
_____ Mold and mildew
_____ Lead
_____ Asbestos
_____ Vermiculite
_____ General crew safety
_____ Other health and safety
_____ Other (please specify

3. For those staff working in your state's weatherization office who need to have knowledge about the following list of diagnostic topics, how well trained were they in each area in PY 2010? Please use the following scale: 1– not at all well trained; 2 – not well trained; 3 – moderately well trained; 4 – well trained; 5 – very well trained; 6 – not applicable *Circle best answer.*

Pressure diagnostics:						
• Blower door (house air leakage rate)	1	2	3	4	5	6
• Zonal pressure measurements	1	2	3	4	5	6
• Room-to-room pressure measurements	1	2	3	4	5	6
• Duct pressure pan measurements	1	2	3	4	5	6
• Duct blower measurements (duct air leakage rate)	1	2	3	4	5	6
Space-heating system:						
• Flue gas analysis (steady-state efficiency measurements)	1	2	3	4	5	6
• Heat rise measurements	1	2	3	4	5	6
• CO measurements in flues	1	2	3	4	5	6
• Draft/spillage (normal operation)	1	2	3	4	5	6
Air-conditioning system:						
• Refrigerant charge (e.g., superheat, subcooling)	1	2	3	4	5	6
HVAC components and cross-cutting diagnostics:						
• Air handler flow rate	1	2	3	4	5	6
• Thermostat anticipator current	1	2	3	4	5	6
• Worst case draft/spillage (CAZ)	1	2	3	4	5	6
Hot-water (water-heating) system:						
• Flue gas analysis (steady-state efficiency measurements)	1	2	3	4	5	6
• CO measurements in flues	1	2	3	4	5	6
• Draft/spillage (normal operation)	1	2	3	4	5	6
• Water flow rates (showerheads and faucets)	1	2	3	4	5	6
Other CO measurements:						
• CO measurements in equipment rooms	1	2	3	4	5	6
• Cooking stove	1	2	3	4	5	6
• CO measurements in living areas	1	2	3	4	5	6
Other diagnostics and inspections:						
• Refrigerator energy use	1	2	3	4	5	6
• Exhaust fan air flow rate measurement	1	2	3	4	5	6
• Infrared scanning (camera)	1	2	3	4	5	6

• Radon testing	1	2	3	4	5	6
• Lead testing	1	2	3	4	5	6
• Mold and mildew testing	1	2	3	4	5	6
• Moisture context testing	1	2	3	4	5	6
• Other (please specify) _____	1	2	3	4	5	6

3a. For categories receiving answers of (1)-not at all well trained, or (2)-not well trained to the above question, what were the barriers for receiving this training:
a. Funding
b. Time
c. Not a priority
d. Not available
e. Other_____

4. On which of the following diagnostic procedures did staff working in your state's weatherization office receive training in Program Year 2010 from DOE, your state, or other entities? (Check all that apply.*)*

Pressure diagnostics:

- Blower door (house air leakage rate) _____
- Zonal pressure measurements _____
- Room-to-room pressure measurements (distribution balancing) _____
- Duct pressure pan measurements _____
- Duct blower measurements (duct air leakage rate) _____

Space-heating system:

- Flue gas analysis (steady-state efficiency measurements) _____
- Heat rise measurements _____
- CO measurements in flues _____
- Draft/spillage (normal operation) _____

Air-conditioning system:

- Refrigerant charge (e.g., superheat, subcooling) _____

HVAC components and cross-cutting diagnostics:

- Air handler flow rate _____
- Thermostat anticipator current _____
- Worst case draft/spillage (CAZ) _____

Hot-water (water-heating) system:

- Flue gas analysis (steady-state efficiency measurements) _____
- CO measurements in flues _____
- Draft/spillage (normal operation) _____
- Water flow rates (showerheads and faucets) _____

Other CO measurements:

- CO measurements in equipment rooms _____
- Cooking stove _____
- CO measurements in living areas _____

Other diagnostics and inspections:

- Refrigerator energy use _____
- Exhaust fan air flow rate measurement _____
- Infrared scanning (camera) _____
- Radon testing _____
- Lead testing _____
- Mold and mildew testing _____
- Moisture context testing _____
- Other (please specify) _____ _____

5. For each broad subject listed in the left-most column of the following table, put a check mark in the appropriate cell(s) to indicate which training method(s) you believe were most effective for imparting key skills and information in that area to your state's in-house staff and any non-agency staff supporting the state program who work under contract to the state in PY 2010:

Subject	**Conferences**	**Primarily Classroom Training**	**Primarily Field Training**	**In-person expert visits**	**Web casts**	**Other (specify)**
Management						
Weatherization skills and methods						
Auditing/Estimating/ Measure selection						
Monitoring and quality control						
Financial topics						
Outreach and communications						
Health and safety						
Diagnostic procedures						
Client education						
Other (specify)						

6. For each broad subject listed in the left-most column of the following table, please indicate the quality of training received in Program Year 2010 at the training venues listed in the column headings. Please leave cells blank were your in-house staff did not receive training during this period of time. Please use the following scale: 1-very low; 2 - low; 3-medium; 4- high; 5-very high

	National Weatherization Program Conference	**Affordable Comfort Conference**	**Regional Weatherization Conference**	**State Weatherization Conference**	**State/ Regional Training Center**	**Training Provided by Your Own State**
Subject						
Management						
Weatherization skills and methods						
Auditing/ Estimating						
Monitoring/ quality control						
Financial topics						
Outreach and communications						
Health and safety						
Diagnostic procedures						
Procedures for selecting weatherization measures						
Client education						
Other (specify)						

7. On which of the following weatherization topics did your state provide training to your state's local weatherization agencies or their contractors in Program Year 2010? (Check all that apply)

(1) Diagnostic procedures _____
(2) Insulation _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(3) Space heating, ventilation, air conditioning _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(4) Infiltration measures _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(5) Doors and windows _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(6) Hot water heating _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(7) Baseloads (e.g., lighting, refrigerators) _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____

7a. On which of the following administrative-related topics did your state provide training to your state's local weatherization agencies or their contractors in Program Year 2010? (Check all that apply)

(1) Management _____
(2) Client education _____
(3) Auditing/estimating _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(4) Monitoring/quality control _____
(5) Financial topics _____
(6) Outreach and communications _____
(7) Other (please specify) _____

7b. On which of the following health and safety topics did your state provide training to your state's local weatherization agencies or their contractors in Program Year 2010? (Check all that apply)

_____ Fire safety
_____ Indoor air quality
_____ Measures to increase security of housing unit
_____ Measures to reduce common household hazards
_____ Mold and mildew
_____ Lead
_____ Asbestos
_____ Vermiculite
_____ General crew safety
_____ Other health and safety
_____ Other (please specify)

8. On which of the following diagnostic procedures did your state provide training to your state's local weatherization agencies or their contractors in Program Year 2010? (Check all that apply)

Pressure diagnostics:

- Blower door (house air leakage rate) _____
- Zonal pressure measurements _____
- Room-to-room pressure measurements (distribution balancing) _____
- Duct pressure pan measurements _____
- Duct blower measurements (duct air leakage rate) _____

Space-heating system:

- Flue gas analysis (steady-state efficiency measurements) _____
- Heat rise measurements _____
- CO measurements in flues _____
- Draft/spillage (normal operation) _____

Air-conditioning system:

- Refrigerant charge (e.g., superheat, subcooling) _____

HVAC components and cross-cutting diagnostics:

- Air handler flow rate _____
- Thermostat anticipator current _____
- Worst case draft/spillage (CAZ) _____

Hot-water (water-heating) system:

- Flue gas analysis (steady-state efficiency measurements) _____
- CO measurements in flues _____
- Draft/spillage (normal operation) _____
- Water flow rates (showerheads and faucets) _____

Other CO measurements:

- CO measurements in equipment rooms _____
- Cooking stove _____
- CO measurements in living areas _____

Other diagnostics and inspections:

- Refrigerator energy use _____
- Exhaust fan air flow rate measurement _____
- Infrared scanning (camera) _____
- Radon testing _____
- Lead testing _____
- Mold and mildew testing _____
- Moisture context testing _____
- Other (please specify) _____ _____

9. Which of the following types of personnel did your state use to provide training to your state's local weatherization agencies or their contractors in Program Year 2010? (Check all that apply)

- DOE staff _____
- DOE contractor _____
- State staff _____
- State contractor _____
- Staff from another state _____
- State training center staff _____
- Local agency staff from your state _____
- Agency staff from another state _____
- Manufacturer representative _____
- Utility staff _____
- Representative from trade organization _____
- Consultant _____
- Other (please specify) _____ _____

10. What types of credentials or experience were required of the personnel your state used to provide training to your state's local weatherization agencies or their contractors in Program Year 2010? (Check all that apply)

- Technical certification _____
- Extensive weatherization field experience _____
- Construction experience _____
- Extensive management experience _____
- Extensive experience with financial matters _____
- Other (please specify) _____ _____

10a. Using the scale below, please indicate how important each credential was for trainers to have in PY 2010?

1= Very Unimportant; 2=Unimportant; 3= Important; 4=Very Important

- Technical certification _____
- Extensive weatherization field experience _____
- Construction experience _____
- Extensive management experience _____
- Extensive experience with financial matters _____
- Other (please specify) _____ _____

11. How many of your state's weatherization office staff acted as instructors at the following training events that your state provided (e.g., funded, organized) to your state's local weatherization agencies or their contractors in Program Year 2010?

- State weatherization conference _____
- Other state conference _____
- State/regional training center class _____
- State-sponsored class taught at central location _____
- In-person expert visit (e.g., peer exchange, consultant) _____
- Instruction given to individual agency during an agency visit _____
- Web cast _____
- Other (please specify) _____ _____

12. For each broad subject listed in the left-most column of the following table, put a check mark in the appropriate cell(s) to indicate which training method(s) you believe were most effective for imparting key skills and information in that area to your local weatherization agencies or their contractors in PY 2010:

Subject	**State weatherization conference**	**Other state conference**	**State/ regional training center class**	**State-sponsored class taught at central location**	**In-person expert visit**	**Instruction given to individual agency**	**Web casts**	**Other (specify)**
Management								
Weatherization skills and methods								
Auditing/Estimating/ Measure selection								
Monitoring and quality control								
Financial topics								
Outreach and communications								
Health and safety								
Diagnostic procedures								
Client education								
Other (specify)								

13. On average, how well trained were local weatherization crews (both agency and contractor) in your state in the following weatherization topics in PY 2010? Please use the following scale: 1– not at all well trained; 2 – not well trained; 3 – moderately well trained; 4 –well trained; 5 – very well trained; 6 – not applicable *Circle best answer*.

(1) Diagnostic procedures	1	2	3	4	5	6
(2) Insulation						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(3) Space heating, ventilation, air conditioning						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(4) Infiltration measures						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(5) Doors and windows						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(6) Hot water heating						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(7) Baseloads (e.g., lighting, refrigerators)						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6

13a. On average, how well trained were local weatherization crews (both agency and contractor) in your state in the following administrative-related topics in PY 2010? Please use the following scale: 1– not at all well trained; 2 – not well trained; 3 – moderately well trained; 4 –well trained; 5 – very well trained; 6 – not applicable *Circle best answer*.

(1) Management	1	2	3	4	5	6
(2) Client education	1	2	3	4	5	6
(3) Auditing/estimating						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(4) Monitoring/quality control	1	2	3	4	5	6
(5) Financial topics	1	2	3	4	5	6
(6) Outreach and communications	1	2	3	4	5	6
(7) Other (please specify)	1	2	3	4	5	6

13b. On average, how well trained were local weatherization crews (both agency and contractor) in your state in the following health and safety topics in PY 2010? Please use the following scale: 1– not at all well trained; 2 – not well trained; 3 – moderately well trained; 4 –well trained; 5 – very well trained; 6 – not applicable *Circle best answer.*

(1) Fire safety	1	2	3	4	5	6
(2) Indoor air quality	1	2	3	4	5	6
(3) Measures to increase security of housing unit	1	2	3	4	5	6
(4) Measures to reduce common household hazards	1	2	3	4	5	6
(5) Mold and mildew	1	2	3	4	5	6
(6) Lead	1	2	3	4	5	6
(7) Asbestos	1	2	3	4	5	6
(8) Vermiculite	1	2	3	4	5	6
(9) General crew safety	1	2	3	4	5	6
(10) Other health and safety	1	2	3	4	5	6
(11) Other (please specify	1	2	3	4	5	6

13c. For categories receiving answers of (1)-not at all well trained, or (2)-not well trained to the above question, what were the barriers for receiving this training:
a. Funding
b. Time
c. Not a priority
d. Not available
e. Other_____

14. Overall, how well trained were your state's weatherization crews in PY 2010? (Check best answer)
_____ Very well trained
_____ Well trained
_____ Moderately well trained
_____ Poorly trained
_____ Very poorly trained

MONITORING

1. About how many state weatherization office staff went into the field to monitor local weatherization agencies in your state in Program Year 2010? *{Note: do not include people who do quality assurance at the local agency level for the local agencies.}*
    - State staff _____
    - State contractors _____
    - Other (please specify) _____ _____

2. Which of the following types of post-weatherization quality control inspection did your state perform on weatherized dwelling units in Program Year 2010? (Check all that apply)
    - Visual inspection of installed measures _____
    - Verification of insulation depths/quantities _____
    - Verification of operation of measures installed _____
    - Assessment of quality of measures installed _____
    - Identification of needed measures that were not installed _____
    - Blower door test _____

- Heating system efficiency test (flue gas analysis) _____
- Draft/spillage tests of heating systems _____
- Carbon monoxide (CO) monitoring _____
- Infrared scanning _____
- Identification of unresolved health and safety issues _____
- Discussion with occupants _____
- Other (specify)_____ _____

3. Please indicate which types of post-weatherization quality control inspection listed below were initiated since ARRA PY 2009. (Check all that apply)
   - Visual inspection of installed measures _____
   - Verification of insulation depths/quantities _____
   - Verification of operation of measures installed _____
   - Assessment of quality of measures installed _____
   - Identification of needed measures that were not installed _____
   - Blower door test _____
   - Heating system efficiency test (flue gas analysis) _____
   - Draft/spillage tests of heating systems _____
   - Carbon monoxide (CO) monitoring _____
   - Infrared scanning _____
   - Identification of unresolved health and safety issues _____
   - Discussion with occupants _____
   - Other (specify)_____ _____

4. Please indicate the cost, the amount of training needed, the amount of time needed and the effectiveness of the following types of post-weatherization quality control inspection procedures relative to each other for PY 2010. Please use the following scale: 1 – very low; 2 – low; 3 – medium; 4 – high; 5 – very high.

Type of Post-Weatherization Quality Control Inspection	**Cost**	**Training Needed**	**Time Needed**	**Effectiveness**
Visual inspection of installed measures				
Verification of insulation depths/quantities				
Verification of operation of measures installed				
Assessment of quality of measures installed				
Identification of needed measures that were not installed				
Blower door test				
Heating system efficiency test (flue gas analysis)				
Draft/spillage tests of heating systems				
Carbon monoxide (CO) monitoring				
Infrared scanning				
Identification of unresolved health and safety issues				
Discussion with occupants				
Other (specify)				

5. On average, how many hours were spent by state weatherization office staff on-site conducting post-weatherization quality control in a typical weatherized home in Program Year 2010? _____

6. What types of credentials or experience were required of your post-weatherization quality control inspectors in your state weatherization office in Program Year 2010? (Check all that apply)
   - Technical certification _____
   - Extensive experience performing pre-weatherization audits _____
   - Extensive experience performing weatherization work _____
   - Extensive experience supervising weatherization work _____
   - Construction experience _____
   - Other (please specify) _____ _____

7. Please indicate their level of experience of the post-weatherization quality control inspectors in your state weatherization office for each of the following areas in Program Year 2010.

	Very High	**High**	**Medium**	**Low**	**Very Low**
Performing pre-weatherization audits					
Performing weatherization work					
Supervising weatherization work					
Working in construction					
Performing post-weatherization inspections					
Other (specify)					

8. On average, how frequently did state weatherization program office staff visit each local agency to conduct post-weatherization quality control inspections in Program Year 2010? (Check best answer)

   _____ Weekly
   _____ Monthly
   _____ Quarterly
   _____ Annually
   _____ Other (please specify) _____

9. On how many dwelling units did your state perform post-weatherization quality control inspections in Program Year 2010? _____

   9a. Of those inspected, approximately how many were found to have a problem significant enough to require a return visit by local agency weatherization crews? _____

   9b. Of those requiring a return visit, how many had work done that probably resulted in more energy savings? _____

   9c. What were the three most common problems found in the dwelling units inspected by your state in Program Year 2010?
   _____
   _____
   _____

10. In those cases where a Program Year 2010 post-weatherization quality control inspection revealed a problem with the job performed, what single action was most commonly taken in response to that finding? (Check best answer)
    - Made agency send crew back to correct problem _____
    - Made agency send crew supervisor to correct problem _____
    - Sent someone from state office to correct problem _____
    - No action taken _____
    - Other (please specify) _____ _____

11. What *other* actions were taken in Program Year 2010 in response to the discovery of a problem with the weatherization job performed? (Check all that apply)
    - Made agency send original crew back to correct problem _____
    - Made agency send different crew to correct problem _____
    - Made agency send crew supervisor to correct problem _____
    - Sent someone from state office to correct problem _____
    - No action taken _____
    - Other (please specify) _____ _____

12. How often did the inspection reveal a misuse of the priority list?
    a. Never
    b. 1-5% of the time
    c. 6-10% of the time
    d. 11-20% of the time
    e. More than 20% of the time
    f. N/A

13. How often did the inspection reveal a misuse of the computer audit?
    a. Never
    b. 1-5% of the time
    c. 6-10% of the time
    d. 11-20% of the time
    e. More than 20% of the time
    f. N/A

14. Which of the following monitoring tasks did your state perform in Program Year 2010 to check on the administration of local weatherization efforts? (Check all that apply)

- Verification of number of dwelling units weatherized _____
- Verification of clients' income eligibility _____
- Verification of average expenditure per weatherized unit _____
- Verification of material expenditures _____
- Verification that installed measures had an SIR of 1.0 or greater _____
- Examination of vehicle costs _____
- Examination of other equipment costs _____
- Examination of training and technical assistance (T&TA) costs _____
- Examination of administrative costs _____
- Examination of material inventory _____
- Interviews with agency staff _____
- Interviews with agency contractor staff _____
- Interviews with agency clients _____
- Other (please specify) _____ _____

15. Please indicate which types of monitoring tasks listed below were initiated since ARRA to PY 2009. (Check all that apply)

- Verification of number of dwelling units weatherized _____
- Verification of clients' income eligibility _____
- Verification of average expenditure per weatherized unit _____
- Verification of material expenditures _____
- Verification that installed measures had an SIR of 1.0 or greater _____
- Examination of vehicle costs _____
- Examination of other equipment costs _____
- Examination of training and technical assistance (T&TA) costs _____
- Examination of administrative costs _____
- Examination of material inventory _____
- Interviews with agency staff _____
- Interviews with agency contractor staff _____
- Interviews with agency clients _____
- Other (please specify) _____ _____

16. Please indicate the cost, the amount of training needed, the amount of time needed and the effectiveness of the following types of monitoring tasks relative to each other for PY 2010. Please use the following scale: 1 – very low; 2 -- low; 3 – moderate; 4 –high; 5 – very high.

Type of Monitoring Tasks	**Cost**	**Training Needed**	**Time Needed**	**Effectiveness**
Verification of number of dwelling units weatherized				
Verification of clients' income eligibility				
Verification of average expenditure per weatherized unit				
Verification of material expenditures				
Verification that installed measures had an SIR of 1.0 or greater				
Examination of vehicle costs				
Examination of other equipment costs				
Examination of training and technical assistance (T&TA) costs				
Examination of administrative costs				
Examination of material inventory				
Interviews with agency staff				
Interviews with agency contractor staff				
Interviews with agency clients				
Other (specify)				

17. On average, how many hours were spent by state weatherization office staff on-site at each local agency monitoring agency administrative activities in Program Year 2010? _____

18. What types of credentials or experience were required of those who monitored the administration of local weatherization efforts in your state in Program Year 2010? *Check all that apply*.

- Technical certification _____
- Extensive experience performing pre-weatherization audits _____
- Extensive experience performing weatherization work _____
- Extensive experience supervising weatherization work _____
- Construction experience _____
- Extensive management experience _____
- Extensive finance experience _____
- Extensive experience administering local weatherization programs _____
- Other (please specify) _____ _____

19. Please indicate their level of experience of the local agency monitors in your state weatherization office for each of the following areas in Program Year 2010.

	Very High	**High**	**Moderate**	**Low**	**Very Low**
Management					
Finance					
Administration of local weatherization programs					
Other (specify)					

20. On average, how frequently did state weatherization program office staff visit each local agency to monitor administrative activities in Program Year 2010? (Check best answer)

_____ Weekly
_____ Monthly
_____ Quarterly
_____ Annually
_____ Other (please specify) _____

21. For how many of the local weatherization agencies monitored in your state in Program Year 2010 was an administrative problem found that required corrective actions above and beyond acceptable findings and recommendations? _____

22. What were the three most common problems requiring corrective actions above and beyond acceptable findings and recommendations found in the local weatherization agencies monitored in your state in Program Year 2010?

_____
_____
_____

23. In those cases where state monitoring of the administration of local weatherization efforts in Program Year 2010 revealed an administrative problem requiring corrective actions above and beyond acceptable findings and recommendations, what actions were taken in response? (Check all that apply)

- Sent written report to local agency _____
- Required corrective action _____
- Made presentation to local agency _____
- Sent someone from state office to help correct problem _____
- Sent state contractor to help correct problem _____
- No action taken _____
- Other (please specify) _____ _____

24 Did the observation of problems with the quality of weatherization work lead to changes in weatherization training for local agency staff?

_____ Yes
_____ No

24a. If Yes, what changes were made? _____

25. Does your state observe weatherization training sessions to help identify potential problem areas for monitoring in the field (e.g., with respect to installation of measures that trainees seem to have trouble understanding)?
_____ Yes
_____ No

25a. If Yes, briefly describe how your in-field monitoring activities were affected by your training session observations. _____
_____

OMB Control Number: XXXX-XXXX

APPENDIX D -- S2: ALL AGENCIES PROGRAM INFORMATION SURVEY

This data is being collected to conduct a process evaluation of the Weatherization Assistance Program at the local level. The data you supply will be used to characterize the program in Program Year 2010, unless otherwise noted.

Public reporting burden for this collection of information is estimated to average eight hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Records Management Division, IM-11, Paperwork Reduction Project (XXXX-XXXX), U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project (XXXX-XXXX), Washington, DC 20503.

All of the information obtained from this survey will be protected and will remain confidential. The data will be analyzed in such a way that the information provided cannot be associated back to your state, your agencies, or the housing units and clients that your state served. Again, please note that the questions refer to PY 2010 unless otherwise noted.

Part 1. General Information

1. Please identify your state. _____

2. Please identify your local agency. _____

3. Which of the following best characterizes your agency? (Please check the one answer that best applies):

_____ Local Non-Profit Organization
_____ Local Government Agency
_____ County Government Agency
_____ Indian Tribe
_____ Other entity not eligible for CSBG funding
_____ Other (please specify) _____

4. For how many years had the current director of your local Weatherization Program served in that capacity prior to PY 2010? _____

5. What agency, office, or department was responsible for reviewing the performance of your local Weatherization Program in PY 2010? _____

6. How many layers of management or supervision were there between your weatherization crews and the director of your local Weatherization Program in PY 2010? _____ [If your weatherization crews reported directly to the Program director, the answer should be 0.]

7. Please indicate other energy-related, housing, and other programs that cooperated with your agency's weatherization program, by source of funding in PY 2010. Please check all that apply.

Type of Program	Federal Funding	State Funding	Utility Funding	Other
Energy bill paying assistance				
Housing re-habilitation				
Home emergency repairs				
Hardship funds (other than for energy bill paying)				
Fuel delivery in crisis				
Fair housing				
Health and safety				
Energy education (other than client education delivered by weatherization program)				
Home buying education				
Rehabilitation loan				
Mortgage loan				
Emergency food				
Emergency safety				
Other (please specify)				
Other (please specify)				
Other (please specify)				
Other (please specify)				
Other (please specify)				
Other (please specify)				

Part 2. Leveraging

1. Please describe your agency's leveraging relationships and funding pre-ARRA, for **PY 2008**. The first column provides the amount of leveraged funding received in PY 2008 as reported by your agency. Please make any necessary edits to this column, including revising leveraging amounts, and adding previously left out leveraged sources. Also, please indicate when your agency began to receive funding from this source and also how long your agency worked to establish the leveraging relationship before it was put in place.

Source of PY 2008 Leveraged Weatherization Funding Administered by Agency		**Amount of Leveraged Funding PY 2008**	**Year That Agency Began to Receive Leveraged Funding From This Source**	**If known, number of years that agency worked to achieve this leveraging relationship**
LIHEAP				
Petroleum Violation Escrow (PVE)				
Other Federal Programs				
State Public Benefit Funds				
Other State Programs (Please enter names ↓)				
Other Program 1.				
Other Program 2.				
Other Program 3.				
All Other Programs				
Utilities (Please enter names ↓)				
Utility 1.				
Utility 2.				
Utility 3.				
All Other Utilities				
Program Income				
In-Kind (Please describe ↓)				
In-Kind 1.				
In-Kind 2.				
In-Kind 3.				
All other In-kind				
Non-Profits (Please enter names ↓)				
Non-Profit 1.				
Non-Profit 2.				
Non-Profit 3.				
All Other Non-Profits				
Other (Please enter names ↓)				
Other 1.				
Other 2.				
Other 3.				
Third Party: (e.g., Foundation, Lender)				
All Others				

2. Please describe your leveraging relationships and funding during WAP ARRA PY 2010 for each source listed in Question 1 and please add any new sources. Please provide the amount of leveraged funding received in PY 2010 by source. Please forecast leveraging relationship for the post-ARRA period, that is during PY 2012. If there are no leveraging relationships to report, please skip to Question 3.

Source of PY 2008 Leveraged Weatherization Funding Administered by Agency		**Amount of Leveraged Funding PY 2010**	**If leveraged funding from this source decreased from PY 2008, was the change attributable to increased ARRA funding? (Yes, No)**	**Do you expect leveraged funding from this source to increase (I), decrease (D) or stay the same (S) from the PY 2010 level post-ARRA, in PY 2012**
LIHEAP				
Petroleum Violation Escrow (PVE)				
Other Federal Programs				
State Public Benefit Funds				
Other State Programs (Please enter names ↓)				
Other Program 1.				
Other Program 2.				
Other Program 3.				
All Other Programs				
Utilities (Please enter names ↓)				
Utility 1.				
Utility 2.				
Utility 3.				
All Other Utilities				
Program Income				
In-Kind (Please describe ↓)				
In-Kind 1.				
In-Kind 2.				
In-Kind 3.				
All other In-kind				
Non-Profits (Please enter names ↓)				
Non-Profit 1.				
Non-Profit 2.				
Non-Profit 3.				
All Other Non-Profits				
Other (Please enter names ↓)				
Other 1.				
Other 2.				
Other 3.				
Third Party: (e.g., Foundation, Lender)				
All Others				

3. How important were leveraged funds for your agency's Weatherization Program in PY 2010 compared to program years without additional ARRA funding? (Check best answer)

_____Very important
_____ Important
_____ Not very important
_____ Not important at all

4. Did your agency set aside funding to advocate for leveraged resources in PY 2010?

_____ Yes
_____ No

5. How successful would you rate your agency's efforts to acquire leveraged funds in PY 2010? (Check best answer)

_____ Very successful
_____ Successful
_____ Not very successful
_____ Not successful at all
_____ State does not seek leveraged funds

6. What factors limited the success of your agency's efforts to acquire leveraged funding in PY 2010?
_____

7. Did your agency experience delays or other difficulties in spending any of these types of non-DOE funds in PY 2010?

Source of Non-DOE Funding	**Yes, No, or N/A**	**Please Provide a Short Description of and the Reasons for the Delays or Other Difficulties**
LIHEAP		
Petroleum Violation Escrow (PVE)		
Other Federal Programs		
State Public Benefit Funds		
Other State Programs		
Utilities		
Program Income		
In-Kind		
Non-profit Organizations		
Other (please specify)		
Other (please specify)		
Other (please specify)		
Other (please specify)		

8. Did your agency encounter any of the following problems in spending non-DOE funds in general in PY 2010? (Check all that apply)

_____ Our agency could not easily increase the number of homes weatherized during the year in order to better spend non-DOE funds

_____ Our agency required the expenditure of DOE weatherization funds before non-DOE funds were expended

_____ We had insufficient staff to manage the receipt and expenditure of non-DOE funds

_____ We had inadequate accounting systems to manage the receipt and expenditure of non-DOE funds

_____ Guidance received from DOE and/or our state made it difficult to expend non-DOE funds in a timely manner

_____ Other _____

9. Have you modified your agency's weatherization program practices or regulations in the three years prior to PY 2010 to facilitate spending and reporting on leveraged resources?

_____ Yes

_____ No

10. How has the influx of ARRA funding impacted previously existing leveraging relationships?

a. Extremely positive impact
b. Positive impact
c. No Impact
d. Negative impact
e. Extremely negative impact

11. Please describe the change in leveraging relationships between your agency's low-income weatherization program and these partners during the ARRA period.

Partner	Extremely positive	Positive	No change	Negative	Extremely Negative
LIHEAP					
Other Federal Programs					
State Public Benefit Funds					
Other State Programs					
Utilities					
Non-profits					
Third Party: (e.g., Foundation, Lender)					
OTHER ____					

12. Can leveraging relationships damaged or lost during ARRA be re-built post-ARRA?
a. Yes, absolutely
b. Yes, probably
c. Uncertain
d. No, probably not
e. No, definitely not

13. What aspects about your ageny's low-income weatherization program are most misunderstood by actual and potential leveraging partners? _____

14. How has your program worked to overcome these misunderstandings? _____

15. What information would your agency's weatherization program like to have that could be used to overcome these misunderstandings? _____

16. What other information would your agency's weatherization program like to have that could be used to 'sell' leveraging relationships? _____

17. What was the quality of the support and assistance on leveraging the Weatherization Assistance Program with other funding sources and related programs that your agency received from the state and its contractors in Program Year 2010? (Check best answer)

_____ very high quality
_____ high quality
_____ moderate quality
_____ low quality
_____ very low quality
_____ not applicable

5a. If appropriate, why did you rate the quality very low or low? _____

18. Overall, what is your expectation for total agency leveraged for low-income weatherization funding post ARRA in PY 2012 compared to pre-ARRA PY 2008
a. Greatly increased
b. Increased
c. Same level
d. Decreased
e. Greatly decreased

19. On balance, how beneficial do you think will ARRA funding prove to be over the longer-term on your agency's ability to leverage DOE WAP-program funding for low-income weatherization?
a. Extremely beneficial
b. Beneficial
c. No long-term impact
d. Unbeneficial
e. Extremely unbeneficial

20. For each of the non-DOE sources of weatherization funds which your agency administered in Program Year 2010, did your agency follow DOE rules when spending the money? If you did *not* require DOE rules to be followed for non-DOE jobs, what were the major differences in the rules governing those expenditures in comparison to DOE rules? If you did not administer funding from a particular source in Program Year 2010 for weatherization, please enter N/A. Survey answers from PY 2008 are included for comparison.

Source of non-DOE PY 2008 and PY 2010 Weatherization Funding Administered by Agency	**(A) Did your agency follow DOE rules when spending funds from this source? (Yes/No/NA)**		**(B) If the answer in Column (A) was no, what were the major differences in the rules governing the expenditure of funds from this source in comparison to the rules governing the expenditure of DOE funds?**	
	PY2008	**PY2010**	**PY2008**	**PY2010**
LIHEAP				
Petroleum Violation Escrow (PVE)				
Other Federal Programs				
State Public Benefit Funds				
Other State Programs				
Utilities				
Program Income				
In-Kind				
Non-Profit Organizations				
Third Party: (e.g., Foundation, Lender)				
Other				

21. Please indicate the amount of weatherization funding from each source that your agency administered in Program Year 2010 that was spent on the different functions or applications shown below. The amount that you list in the right-most cell at the very bottom of the table should equal the total amount of weatherization funding from all sources that your agency administered in Program Year 2010.

Source of PY 2010 Weatherization Funding Administered by Agency	**Training and Technical Assistance (T&TA)**		**Program Management**		**Other (funds for weatherization, health and safety, and other measures)**	**Total**
DOE						
LIHEAP						
Petroleum Violation Escrow (PVE)						
Other Federal Programs						
State Public Benefit Funds						
Other State Programs						
Utilities						
Program Income						
In-Kind						
Non-Profit Organizations						
Third Party: (e.g., Foundation, Lender)						
Other						
Total						

22. Of the Program Year 2010 funds retained by your Agency's Weatherization Program for Program Management, how much was used for each function listed below?

Type of Management Function	**Total**
Administration*	
Agency monitoring	
Other (specify)	
TOTAL	

* Includes planning, finance and accounting, clerical support, outreach, and evaluation.

23. Did your agency classify its expenditures for client intake, audits, and post-weatherization inspections as program management costs or as allowable costs used in the calculation of average cost per unit in PY 2010? Please indicate your answer for each type of expenditure by checking the appropriate cell in the table below.

Type of Expenditure	**Classified as Program Management Costs?**	**Classified as Allowable Costs for Purpose of Calculating Average Cost per Unit?**
Expenditures for Client Intake		
Expenditures for Audits		
Expenditures for Post-Weatherization Quality Control Inspections		

24. Of the TOTAL amount spent by your agency in Program Year 2010 using funds from *all* sources (shown at bottom of right-most column in table for Question 9), please give your best estimate of how much was spent on Audits and Inspections. $_____

25. Please divide your agency's Program Year 2010 expenditures on DOE units into in-house expenditures and contractor expenditures, as shown in the following table.

Type of Expenditure	**PY 2010 In-house Expenditures on DOE Units (in $)**	**PY 2010 Contractor Expenditures on DOE Units (in $)**	**PY 2010 Total Expenditures on DOE Units (in $)[1]**
Expenditures for Health and Safety, Repairs, and Other Non Cost-Effective Measures			
All Expenditures Defined as Allowable Costs for Purpose of Calculating Average Cost per Unit			
TOTAL FUNDS			

[1] The amount that you list for Total Expenditures for Health and Safety, Repairs, and Other Non Cost-Effective Measures in the right-most column of this table should equal the TOTAL FUNDS listed for that same category of expenditures under DOE units at the bottom of the table for Question 9. The amount that you list for Total Expenditures for All Expenditures Defined as Allowable Costs for Purpose of Calculating Average Cost per Unit in the right-most column of this table should equal the TOTAL FUNDS listed for that same category of expenditures under DOE units at the bottom of the table for Question 9.

26. Of your agency's total Program Year 2010 expenditures on DOE units (shown at bottom of right-most column in table for Question 12), please give your best estimate of how much was for labor, how much for materials, and how much for other expenses.

Type of Expenditure	PY 2010 Expenditures on DOE units (in $)
Labor	
Materials	
Other Expenses (e.g., costs for vehicles, transportation, maintenance, and storage)	
TOTAL FUNDS	

27. Please provide the following information about ALL low-income dwelling units weatherized by your agency in Program Year 2010.

Type of Unit Weatherized	Number of Units Weatherized in PY 2010			
	DOE Units[1]	Non-DOE Units[2]		TOTAL Units
		Comprehensive Weatherization[3]	Non-comprehensive Weatherization[4]	
Single Family Attached and Detached				
Small Multi-family (2-4 units)				
Multifamily (5 or More Units per Building)				
Mobile Home				
Shelter				
TOTAL UNITS				

[1] These are dwelling units that your agency weatherized and reported to the State as "DOE Units"
[2] These are dwelling units that your agency weatherized but did not report as "DOE Units"
[3] Comprehensive weatherization units are those for which an audit or priority list was used that addressed a large proportion of potential energy-saving measures.
[4] Non-comprehensive weatherization units are those for which a limited set of measures was considered (e.g., baseload electric measures only; low cost/no cost measures only), reflecting the needs and priorities of the funding entity.

28. Of all the DOE units weatherized by your agency in Program Year 2010, how many used each of the following as their main heating fuel (i.e., the fuel providing most of the heat for the dwelling unit) in the winter prior to weatherization?

- Natural gas _____
- Fuel oil _____
- Electricity _____
- Propane/LPG _____
- Kerosene or coal oil _____
- Wood _____
- Other (please specify) _____

29. Of all the DOE units weatherized by your agency in Program Year 2010, how many housed members of the following high-priority client populations (leave blank if do not know)?

- Children (according to your state's definition of that term) _____
- Elderly (age 60 and older) _____
- Disabled _____
- Native American _____

30. Did your state have official definitions of "high energy expenditure" or "high energy burden" in PY 2010?

Yes ____
No ____

31. Of all the DOE units weatherized by your agency in Program Year 2010, how many met your state's definition of having "high energy expenditures" _____ and "high energy burden"_____? (leave blank if do not know or if state did not have that definition)

PART 3. WAP ARRA Program Information

1. For many years, the national weatherization network and the state-level national weatherization networks had been relatively stable. During the ARRA period, did the composition of your agency-level weatherization network change?
a. Yes
b. No (Skip to Question 5)

2. How would you characterize the magnitude of this change?
a. Extreme
b. Great
c. Moderate
d. Small

3. Using the table below, please list the names and contributions of the major new players.

Name	**Description of Weatherization Related Contributions (e.g., provides training, sells energy efficient products)**

4. On balance, how beneficial have these new players been to your agency's weatherization program?
a. Extremely beneficial
b. Beneficial
c. Neither beneficial nor unbeneficial
d. Unbeneficial
e. Extremely unbeneficial

Please Explain _____

5. During the ARRA period, did organizational responsibilities for your agency's weatherization program (e.g., reporting lines, organizational home) change?
a. Yes
b. No (Skip to Question 9)

6. How did the organizational responsibilities change? Please Explain _____

7. In your opinion, was this change a result of increased visibility of your agency's weatherization program created by the substantial funding increase?
a. Yes
b. No

8. On balance, how beneficial has this change been to your agency's weatherization program?
a. Extremely beneficial
b. Beneficial
c. Neither beneficial nor unbeneficial
d. Unbeneficial
e. Extremely unbeneficial

Please explain _____

9. During the ARRA period, how has state-level oversight of your agency's weatherization assistance program changed?
a. Greatly increased
b. Increased
c. Stayed the same
d. Decreased
e. Greatly decreased

10. During the ARRA period, has your state passed any new laws and/or implemented any new regulations that have directly impacted your agency's weatherization assistance program?
a. Yes
b. No (Skip to Question 14)

11. Please describe the new laws and/or regulations. _____

12. On balance, how beneficial have these new laws and/or regulations been to your agency's weatherization program?
a. Extremely beneficial
b. Beneficial
c. Neither beneficial nor unbeneficial
d. Unbeneficial
e. Extremely unbeneficial

Please explain _____

13. Would these laws and/or regulations have been passed with or without the increased attention on the program attributable to ARRA?
a. Wholely due to ARRA
b. Primarily due to ARRA
c. Somewhat due to ARRA
d. Would have been passed anyway without ARRA

14. During the ARRA period, how has the visibility of your agency's weatherization program changed with respect to elected officials?
a. Greatly increased
b. Increased
c. Stayed the same
d. Decreased
e. Greatly decreased

15. On balance during the ARRA period, how has the public's support for your agency's weatherization assistance program changed?
a. Greatly increased
b. Increased
c. Stayed the same
d. Decreased
e. Greatly decreased

Please explain _____

16. How would you rate the public's understanding of your agency's low-income weatherization assistance program?
a. Excellent
b. Good
c. Fair
d. Poor

17. Please explain those aspects of the program that are most frequently misunderstood by the public.
_____

18. During the ARRA period, how has media attention on your agency's weatherization program changed?
a. Greatly increased
b. Increased
c. Stayed the same
d. Decreased
e. Greatly decreased

19. Please rate the quality of the media coverage your agency's weatherization program has received during the ARRA period?
a. very high quality
b. high quality
c. moderate quality
d. low quality
e. very low quality
f. N/A no media coverage

20. Please describe the overall media coverage of your agency's weatherization program during the ARRA period:
a. very positive
b. positive
c. neither positive or negative
d. negative
e. very negative

21. What topics did the media mainly focus on? (check all that apply)
a. Jobs created
b. Energy saved
c. Helping low income households
d. Waste, fraud and abuse
e. Lack of energy savings
f. Organizational mis-steps
g. Other _____

22. Will weatherization issues identified rightly or wrongly by the media during ARRA have lasting impacts on weatherization funding for your agency in the future?
a. could substantial reduce funding
b. could reduce funding
c. no impact
d. could increase funding
e. could substantially increase funding

23. On balance, how beneficial has been the attention paid to your agency's weatherization program during the ARRA period?
a. Extremely beneficial
b. Beneficial
c. Neither beneficial nor unbeneficial
d. Unbeneficial
e. Extremely unbeneficial

Please explain _____

PART 4. WAP PROGRAM IMPLEMENTATION DURING THE ARRA PERIOD

1. How have relationships changed between your state weatherization office and your local weatherization agency during ARRA?
a. become much more congenial
b. become more congenial
c. no changes
d. become more strained
e. become much more strained

2. What was the quality of the administrative support and assistance that your agency received from the state and its contractors in Program Year 2010? (Check best answer)

_____ very high quality
_____ high quality
_____ moderate quality
_____ low quality
_____ very low quality
_____ not applicable

2a. If appropriate, why did you rate the quality very low or low? _____

3. What was the quality of the training that your agency received from the state and its contractors in Program Year 2010? (Check best answer)

_____ very high quality
_____ high quality
_____ moderate quality
_____ low quality
_____ very low quality
_____ not applicable

3a. If appropriate, why did you rate the quality very low or low? _____

4. What was the quality of the support and assistance on client education that your agency received from the state and its contractors in Program Year 2010? (Check best answer)

_____ very high quality
_____ high quality
_____ moderate quality
_____ low quality
_____ very low quality
_____ not applicable

4a. If appropriate, why did you rate the quality very low or low? _____

5. What was the quality of the support and assistance on leveraging the Weatherization Assistance Program with other funding sources and related programs that your agency received from the state and its contractors in Program Year 2010? (Check best answer)

_____ very high quality
_____ high quality
_____ moderate quality
_____ low quality
_____ very low quality
_____ not applicable

5a. If appropriate, why did you rate the quality very low or low? _____

6. What was the quality of the *technical* support that your agency received from the state and its contractors in Program Year 2010? (Check best answer)

_____ very high quality
_____ high quality
_____ moderate quality
_____ low quality
_____ very low quality
_____ not applicable

6a. If appropriate, why did you rate the quality very low or low? _____

7. How flexible did you find the DOE program rules that governed the weatherization program in Program Year 2010? In other words, did the program rules allow your agency to tailor your program to your needs (very flexible) or proscribe your program to only one way of operation (very inflexible (Check best answer)

_____ Very Flexible
_____ Flexible
_____ Inflexible
_____ Very Inflexible

7a. Using PY 2010 as the reference point, how should the program rules change?

_____ Become much more flexible
_____ Become more flexible
_____ Stay about the same
_____ Become more inflexible
_____ Become much more inflexible

7b. In what areas should the program rules become more flexible? _____

7c. In what areas should the program rules become less flexible? _____

8. Please describe any important political issues faced by your agency's weatherization program in Program Year 2010.

_____
_____
_____

9. Which statement best describes how your agency dealt with program expansion during the ARRA period?
a. promoted existing weatherization staff to management positions and hired new entry level workers
b. hired new weatherization managers and hired new entry level workers
c. promoted existing weatherization staff to management positions and hired contractors to ramp up production
d. simply hired contractors to ramp up production

10. Did expanding your agency's level of production result in any economies of scale benefits?
a. No
b. some benefits
c. moderate benefits
d. substantial benefits

11. How did your agency change its in-take procedures during the ARRA-period from the procedures used pre-ARRA (i.e., PY2008)? (Check Best Answer)
a. No change
b. Eligibility checks more stringent
c. Eligibility checks less stringent
d. Other _____

12. Were there any material, equipment or other supply chain bottlenecks during the ARRA period that negatively impacted weatherization production by your agency?
a. No
b. Yes
If yes, what was in short supply? _____

13. To what extent have large DOE programs, WAP, State Energy Program, Energy Efficiency Community Block Grant Program, competed for labor during the ARRA period?
a. Not at all
b. a small extent
c. a moderate extent
d. a large extent
e. a very large extent

14. During the ARRA period, how has state-level oversight of your state's weatherization assistance program changed?
a. Greatly increased
b. Increased
c. Stayed the same
d. Decreased
e. Greatly decreased

15. How did your agency manage increasing workloads and performance expectations?
Please Explain _____

16. Has ARRA funding allowed your agency to purchase and implement new information technologies to improve program administration?
a. Yes
b. No
If yes, please describe these new information technologies. _____

17. Has ARRA funding allowed your agency to purchase new field technologies (e.g., Infrared Thermal Imagers) to improve weatherization audits and measure installation?
a. Yes
b. No
If yes, please describe these purchases.

18. How timely has DOE's guidance been during the ARRA period?
a. very timely
b. timely
c. not very timely
d. not timely at all

19. How clear has DOE's guidance been during the ARRA period?
a. very clear
b. clear
c. not very clear
d. not clear at all

20. During PY 2010, how much of a burden were your agency's administrative costs associated with increased oversight during the ARRA period (e.g., from DOE IG, GAO)?
a. no burden
b. slight burden
c. moderate burden
d. substantial burden
e. extreme burden

21. Did your agency change its audit approach during the ARRA-period from the approach used pre-ARRA (i.e., PY2008)?
a. Yes, went from priority list to computerized audit
b. Yes, went from computerized audit to priority list
c. Yes, changed from one computerized audit tool to another
d. No

22. To what extent have measure costs used in SIR calculations diverted from actual measure costs experienced during ARRA in PY 2010? (choose the best description)
a. on balance actual measure costs were much higher than SIR calculations
b. on balance actual measure costs were higher than SIR calculations
c. SIR calculations and actual measure costs were about the same
d. on balance SIR calculations and actual measure costs were about the same but the actual measure costs fluctuated a great deal up and down
e. on balance actual measure costs were lower than SIR calculations
f. on balance actual measure costs were much lower than SIR calculations

23. Did your agency change it quality assurance procedures during the ARRA-period (e.g., PY 2010) from the procedures used pre-ARRA (i.e., PY2008)?
a. Yes, procedures are much more stringent
b. Yes, procedures are more stringent
c. No

24. Did your agency change its approach to using in-house crews versus contractors during the ARRA-period (e.g., PY 2010) from the procedures used pre-ARRA (i.e., PY2008)?
a. Contractors are performing a much higher percentage of weatherization jobs
b. Contractors are performing a higher percentage of weatherization jobs
c. In-House crews are performing a higher percentage of weatherization jobs
d. In-house crews are performing a much higher percentage of weatherization jobs
e. No

24a. If there was a change, what prompted the change? (choose the best description)
a. Change was solely made to meet production targets
b. Change was solely made to deal with Davis-Bacon
c. Change was made to meet production targets and deal with Davis-Bacon
d. Other (Please explain) _____

24b. How did your training requirements change with the change in approach?
a. All workers were required to be trained in weatherization work
b. Only in-house crews were required to be trained
c. Only contractors were required to be trained
d. No training was required.

25. Did your agency implement any innovative approaches to weatherization during the ARRA-period?
a. No
b. Yes
If yes, please describe the innovative approaches _____

26. Did your agency implement any other major programmatic changes during the ARRA-period?
a. No
b. Yes
If yes, please describe these programmatic changes _____

27. Does your agency have a deferral policy?
a. Yes
b. No

28. Please estimate the number of units where weatherization was deferred during PY 2010?
a. 0%
b. 1-5%
c. 6-10%
d. 10-20%
e. 21-30%
f. more than 30%

28a. What was the leading cause for deferral during PY 2010? _____

28b. Please estimate what percentage of units where weatherization was deferred during PY 2010 will eventually be weatherized?
a. 0%
b. 1-25%
c. 26-50%
d. 51-75%
e. 76-90%
f. 91-100%

28c. Please describe your agency's deferral rates in PY2010 compared to PY2008:
a. very great increase
b. great increase
c. increase
d. no change
e. decrease
f. great decrease
g. very great decrease

29. How much of a priority does your agency place on health and safety when weatherizing homes?
a. Very high priority
b. High priority
c. Medium priority
d. Low priority
e. Very low priority
f. No priority

30. What would be the ideal amount of money per home your agency would like to spend for addressing health and safety issues? _____

31. Of all the homes weatherized by your agency in Program Year 2010, how many did you refer to non-energy programs for additional services (e.g., nutrition; family counseling)? _____

32. What approaches did your local agency use to recruit new qualified, reliable and trustworthy weatherization crew members and how effective were these approaches: _____

33. What approaches did your local agency use to train the expanded weatherization workforce?
a. Utilized existing state program-basedtraining resources, i.e. State monitors or other staff providing training to the network
b. Sent weatherization workers to one of 26 newly funded weatherization training centers
c.Sent weatherization workers to one of 12 legacy weatherization training centers (i.e. COAD, NRCERT, INCAA, BPC, PG&E Stockton, NYSWDA, FSL, AEA, etc. YY)
d. Utilized private, consultant training providers (i.e. Saturn, BMI, EMC)
e. OTHER Please explain:_____
f. No additional training was provided

34. In your opinion, how effective were these approaches?
a. Highly effective
b. Very Effective
c. Somewhat effective
d. No effective

35. Has your agency implemented new certification requirements for weatherization workers during the ARRA period?
a. No (go to Q28)
b. Yes

36. What new certifications are required? (Check all that apply)
a. BPI Building Analyst
b. BPI Envelope
c. BPI Residential Building Envelope Accessible Areas Air Leakage Control Installer
d. Residential Building Envelope Whole House Air Leakage Control Crew Chief
e. BPI Manufactured Housing
f. BPI Heating
g. BPI Air Conditioning and Heat Pump
h. BPI Multifamily
i. HERS
j. LEED
k. Lead Safe Weatherization
l. Lead Certified Renovator
m. NAHB Green Building
n. Other _____

37. Did staff turnover change during the ARRA period as compared to the pre-ARRA period?
a. Turnover greatly increased
b. Turnover increased
c. No, turnover did not change
d. Turnover decreased
e. Turnover greatly decreased

38. Which statement best describes changes in the level of employment in your agency's jurisdiction resulting from Davis-Bacon?
a. large number of jobs created
b. small number of jobs created
c. no change in the number of jobs
d. small number of jobs lost
e. large number of jobs lost

39. Which statement best describes the impact of Davis-Bacon on wages paid to weatherization workers by your agency?
a. large increase in wages
b. small increase in wages
c. no increase in wages
d. small decrease in wages
e. large decrease in wages

40. Did Davis-Bacon paperwork requirements lead some experienced weatherization contractors who worked for your agency to leave the low-income weatherization field?
a. No
b. Yes, a few
c. Yes, many

41. How much of a problem was faced by your agency in coordinating wages stipulated by Davis-Bacon for weatherization workers whose operations spanned multiple counties?
a. no problem
b. small problem
c. moderate problem
d. large problem
e. very large problem
f. N/A because your agency works exclusively in one county

42. Have changes in weatherization costs associated with Davis-Bacon altered choices of measures installed in homes?
a. No
b. Yes
If yes, please explain _____

43. In your agency, on average, how much did Davis-Bacon rules increase the cost of weatherizing low-income multifamily buildings four stories and higher?
a. no increase
b. 1-10%
c. 11-20%
d. 21-30%
e. 31+%
f. N/A

44. Overall, how did Davis-Bacon impact the costs of weatherization in your agency?
a. greatly increased costs
b. increased costs
c. no change in costs
d. decreased costs
e. greatly decreased costs

45. Does your state allow the weatherization of large low-income multi-family buildings?
a. yes
b. no (go to Q 40)
If not, why not? _____

46. Does your agency weatherize large low-income multi-family buildings?
a. No
b. Yes

47. What are the barriers to weatherizing large low-income multi-family buildings? (check all that apply)
a. lack of trained auditors
b. lack of trained crew
c. too expensive
d. building owners are uncooperative
e. energy savings are not high enough
f. unclear guidance from DOE on owner contributions
g. other _____

48. Does your state allow the weatherization of public housing, that is, housing owned by a public housing authority?
a. Yes
b. No (go to Q. 43)
If not, why not? _____

49. Does your agency weatherize public housing?
a. No
b. Yes

50. What are the barriers to weatherizing public housing units?
_____

51. Does your state allow the weatherization of HUD assisted housing?
a. Yes
b. No (go to Q46)
If not, why not? _____

52. Does your agency weatherize HUD assisted housing?
a. No
b. Yes

53. What are the barriers to weatherizing HUD assisted housing? _____

54. How many units of each type were weatherized in your state in PY 2010?

Type of Housing	Large Multi-family (Not Public Housing or HUD Assisted	Public Housing Multi-family	HUD Assisted Multi-family

55. Are there any DOE rules that could be changed to make it easier to weatherize large low-income multi-family buildings?
a. No
b. Yes
If yes, please explain _____

56. Does your agency's weatherization program have an agreement with your State Historic Preservation Office (SHPO)?
a. Yes
b. No

57. What percentage of units weatherized by your agency in PY 2010 fell under the SHPO agreement?
a. 0
b. 1-5
c. 6-10
d. 11-15
e. 15+

58. In general, have the historic preservation guidelines changed the types of measures installed in these homes?
a. No
b. Yes
If yes, please explain _____

59. Has low-income weatherization had an impact in preventing home foreclosures during the ARRA period in your agency's jurisdiction?
a. no
b. little impact
c. moderate impact
d. great impact
e. very great impact

59a. Has low-income weatherization had an impact on preventing homelessness during the ARRA period in your agency's jurisdiction?
a. no
b. little impact
c. moderate impact
d. great impact
e. very great impact

60. How many homes were on your wait list for weatherization in PY 2010? _____

61. On average, how long was a home on the wait list before it was weatherized in PY 2010?
_____

62. In Program Year 2010, did your agency set targets and actively solicit participation by dwelling units of the types shown below? (Check all that apply)

Type of dwelling unit	**Set targets for number of dwelling units of this type to weatherize**	**Actively sought participation by households residing in this type of dwelling unit**
Single Family Attached and Detached		
Small Multi-family (2-4 units)		
Multifamily (5 or More Units per Building)		
Mobile Home		
Shelter		

63. Which of the following approaches did your agency use in Program Year 2010 to market your weatherization services to low-income households? (Check all that apply)

- Targeted mailings to potential clients _____
- Targeted mailings to landlords of potential clients _____
- Visits to potential clients _____
- Visits to landlords of potential clients _____
- Advertising with other social service agencies _____
- Advertising in local newspapers or magazines _____
- Radio advertising _____
- Television advertising _____
- Posting information on website _____
- Other (please specify) _____ _____

64. Who was responsible for leading the marketing/outreach efforts described above? (Check all that apply)

- Agency management _____
- In-house outreach coordinator _____
- Contractor outreach coordinator _____
- In-house communications staff _____
- Contractor communications staff _____
- Other in-house staff (please specify) _____ _____
- Other contractor staff (please specify) _____ _____

65. In general, how satisfied were you with the length of time between the client's request to have their home weatherized and when it was actually weatherized in PY 2010? (Check best answer)

_____ Very satisfied
_____ Satisfied
_____ Not satisfied or dissatisfied
_____ Dissatisfied
_____ Very dissatisfied

66. In general, how easy was it to schedule your visits to client homes to perform audits, weatherization, and inspections in PY 2010? (Check best answer)

_____Very easy
_____ Easy
_____ Not easy or difficult
_____ Difficult
_____ Very difficult

67. What percentage of households whose homes were weatherized by your agency in Program Year 2010 registered a complaint regarding the quality or nature of the weatherization job performed on their dwelling unit? _____

68. Of those households that filed complaints, what percentage of these required some additional work? _____

APPENDIX E. S3: SUBSET OF AGENCIES DETAILED PROGRAM INFORMATION SURVEY

This data is being collected to conduct a detailed process evaluation of the Weatherization Assistance Program at the local level. The data you supply will be used to characterize local agency weatherization activities in Program Year 2010.

Public reporting burden for this collection of information is estimated to average sixteen hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Records Management Division, IM-11, Paperwork Reduction Project (XXXX-XXXX), U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project (XXXX-XXXX), Washington, DC 20503.

All of the information obtained from this survey will be protected and will remain confidential. The data will be analyzed in such a way that the information provided cannot be associated back to your state, your agencies, or the housing units and clients that your state served. Again, please note that the questions refer to PY 2010 unless otherwise noted.

PROGRAM CHARACTERIZATION

1. Please identify your state. _____

2. Please identify your local agency. _____

3. Please indicate the number of staff that supported your agency's weatherization program and their work effort in Program Year 2010. In considering the number of staff, please include everyone who worked full- or part-time or who worked with the weatherization program as well as other agency programs.

Type of Administrative Function	Number of Agency Staff (# persons)	Agency Staff Work Effort (FTE)
Management/administration		
Auditing/inspection		
Home weatherization		
Other (specify)		

4. For the agency staff working on your agency's weatherization in each of the following functional areas in Program Year 2010, please indicate their level of experience with the weatherization program:

	Very High	**High**	**Average**	**Low**	**Very Low**
Management/administration					
Auditing/inspection					
Home weatherization					
Other (specify)					

5. For the agency staff working on your agency's weatherization program in each of the following functional area, please indicate the amount of turnover in staff over a **three year period ending with PY 2010**. Turnover is defined as the number of new staff in a functional area in the past three years divided by the total number of staff working in that functional area. If a particular position has had more than one new person during the past three years (e.g., Person 1 leaves, Person 2 is hired to take Person 1's position, then Person 2 leaves and a third person is hired), just count that as one new staff person. (Please check appropriate boxes)

	No Turnover	**1 to 10%**	**11 to 25%**	**26 to 50%**	**51 to 75%**	**76 to 100%**
Management/ administration						
Auditing/inspection						
Home weatherization						
Other (specify)						

6. For which of the following functional areas were there certification or licensing requirements in Program Year 2010 for the in-house or contractor staff serving your state's weatherization program? (Check all that apply)

	Certification or Licensing Requirement for In-house Staff	**Certification or Licensing Requirement for Contractor Staff**
Management/ administration		
Auditing/inspection		
Home weatherization		
Other (specify)		

AUDIT

1. What was the primary method that your agency used in Program Year 2010 to select weatherization measures for clients' dwelling units (excluding health, safety, and repair measures and general heat waste measures)? (Check best answer)
   - Priority list used for all dwelling units _____
   - Calculation procedure (e.g., spreadsheet, computerized audit) used for all dwelling units _____
   - Priority list applied to dwelling units meeting specified guidelines and calculation procedure used for remaining units _____
   - Other (specify) _____ _____

2. Including PY 2010, for how many years had your agency used the weatherization measure selection method indicated above? _____

3. What types of credentials or experience were required of your staff or contractors who were engaged in measure selection in Program Year 2010? *Check all that apply.*
   - Technical certification _____
   - Extensive weatherization work experience _____
   - Extensive weatherization supervision experience _____
   - Construction experience _____
   - Other (specify) _____ _____

4. Please indicate the level of experience for the agency staff engaged in measure selection in Program Year 2010 in each of the following functional areas:

	Very High	**High**	**Average**	**Low**	**Very Low**
Performing weatherization work					
Supervising weatherization work					
Working in construction					
Performing pre-weatherization audits					

5. On average, approximately how many hours did it take to select weatherization measures for a typical dwelling unit served by your agency in Program Year 2010, by the major components listed below?
   - Preparation/scheduling _____
   - Travel _____
   - On-site auditing _____
   - Post-audit analysis and write-up _____
   - Other _____
   - TOTAL of all components _____

6. If your agency used a priority list for at least some dwelling units in Program Year 2010, how difficult was it for your staff to use that priority list? (Check best answer)
   _____Very Difficult
   _____ Difficult
   _____ Easy
   _____ Very Easy

7. If your agency used a priority list in Program Year 2010, how effective was that list? (Check best answer)
   _____ Very Ineffective
   _____ Ineffective
   _____ Effective
   _____ Very Effective

8. If your agency used a calculation procedure for at least some dwelling units in Program Year 2010, what was the name of the procedure or procedures employed? (Check all that apply)
   - AK Warm _____
   - EA-3 _____
   - EASY _____
   - EA-QUIP _____
   - HomeCheck _____
   - Meadows _____
   - REES _____
   - REM/Rate _____
   - SMOC-ERS _____
   - TIPS _____
   - TREAT _____
   - Weatherization Assistant (NEAT/MHEA) _____
   - WXEOR _____
   - Other (specify) _____ _____

9. If your agency used a calculation procedure in Program Year 2010, use the following scale to describe how difficult it was for your staff to use the applicable procedure(s). Circle best answer). 1= Very Difficult; 2=Difficult; 3= Easy; 4=Very Easy; 5 =N/A

• AK Warm	1	2	3	4	5
• EA-3	1	2	3	4	5
• EASY	1	2	3	4	5
• EA-QUIP	1	2	3	4	5
• HomeCheck	1	2	3	4	5
• Meadows	1	2	3	4	5
• REES	1	2	3	4	5
• REM/Rate	1	2	3	4	5
• SMOC-ERS	1	2	3	4	5
• TIPS	1	2	3	4	5
• TREAT	1	2	3	4	5
• Weatherization Assistant (NEAT/MHEA)	1	2	3	4	5
• WXEOR	1	2	3	4	5
• Other (specify) _____	1	2	3	4	5

10. If your agency used a calculation procedure in Program Year 2010, use the following scale to describe how effective you found the applicable procedure(s).1= Very Ineffective; 2=Ineffective; 3= Effective; 4=Very Effective; 5=N/A

a. AK Warm	1	2	3	4	5
b. EA-3	1	2	3	4	5
c. EASY	1	2	3	4	5
d. EA-QUIP	1	2	3	4	5
e. HomeCheck	1	2	3	4	5
f. Meadows	1	2	3	4	5
g. REES	1	2	3	4	5
h. REM/Rate	1	2	3	4	5
i. SMOC-ERS	1	2	3	4	5
j. TIPS	1	2	3	4	5
k. TREAT	1	2	3	4	5
l. Weatherization Assistant (NEAT/MHEA)	1	2	3	4	5
m. WXEOR	1	2	3	4	5
n. Other (specify) _____	1	2	3	4	5

11. If your agency used a calculation procedure for at least some dwelling units in Program Year 2010, did your state allow under DOE rules the installation of general heat waste measures (low-cost/no-cost weatherization activities) in those units without the need for an energy justification?

_____Yes

_____ No (go to Question 13)

12. Please indicate which of the following general heat waste measures your agency was allowed to install in Program Year 2010. *Check all that apply.*
    - Weatherstripping _____
    - Caulking _____
    - Insulation for plugging air leaks _____
    - Low-flow shower heads _____
    - Low-flow faucet aerators _____
    - Air filters _____
    - Glass patching _____
    - Lighting _____
    - Hot water tank insulation (water heater wrap) _____
    - Water pipe insulation _____
    - Other (specify) _____

13. What was the *primary* justification used by your agency in Program Year 2010 for performing work specifically targeted at reducing air infiltration (i.e., air sealing work)? *Check best answer.*
    - Work should be performed where the air leakage rate as measured by a blower door test is greater than a minimum number (e.g., minimum ventilation guideline) calculated for the dwelling unit in question _____
    - Work should be performed to address occupant complaints _____
    - All *significant* air leakage sites should be sealed _____
    - Air sealing work should be performed on all dwelling units _____
    - Other (specify) _____

14. What *other* justifications were used by your agency in Program Year 2010 for performing work specifically targeted at reducing air infiltration (i.e., air sealing work)? *Check all that apply.*
    - Work should be performed where the air leakage rate as measured by a blower door test is greater than a minimum number (e.g., minimum ventilation guideline) calculated for the dwelling unit in question _____
    - Work should be performed to address occupant complaints _____
    - All *significant* air leakage sites should be sealed _____
    - Air sealing work should be performed on all dwelling units _____
    - Other (specify) _____

15. What was the *primary* method used by your agency in Program Year 2010 to identify air leakage sites to seal? *Check only one.*
    - Auditor identified air leakage sites visually and communicated relevant information to crew _____
    - Auditor identified air leakage sites using a blower door and/or pressure diagnostics and communicated relevant information to crew _____
    - Crew identified air leakage sites visually _____
    - Crew identified air leakage sites using a blower door and/or pressure diagnostics _____
    - Other (specify) _____

16. What *other* methods were used by your agency in Program Year 2010 to identify air leakage sites to seal? *Check all that apply*.
    - Auditor identified air leakage sites visually and communicated relevant information to crew _____
    - Auditor identified air leakage sites using a blower door and/or pressure diagnostics and communicated relevant information to crew _____
    - Crew identified air leakage sites visually _____
    - Crew identified air leakage sites using a blower door and/or pressure diagnostics _____
    - Other (specify) _____

17. In Program Year 2010, at what point did your agency stop performing air sealing work on a given dwelling unit? (Check all that apply)
    - When all identified air leakage sites were sealed _____
    - When all *significant* air leakage sites were sealed _____
    - When the air leakage rate as measured by a blower door test dropped below a minimum number calculated for the dwelling unit in question _____
    - When a blower door test indicated that the most recent infiltration reduction measure installed in the dwelling unit was not cost effective _____
    - Other (specify) _____ _____

18. Did your agency do duct sealing work in Program Year 2010?
    _____ Yes
    _____ No (go to Question 22)

19. How did your agency determine when duct sealing work was needed for a particular dwelling unit in PY 2010? (Check all that apply)
    - All houses with ducts received duct sealing measures _____
    - All houses with return air ducts get sealed _____
    - Ducts were sealed in those cases where leakage sites were visible _____
    - Ducts were sealed when a blower door test indicated the presence of leaks _____
    - Ducts were sealed when duct diagnostics (blower door subtraction, duct blower, or pressure pan measurements) indicated that the leakage rate was greater than a minimum number calculated for the dwelling unit in question _____

20. What methods were used by your agency in Program Year 2010 to identify duct leakage sites to seal? (Check all that apply)
    - Auditor identified duct leakage sites visually and communicated relevant information to crew _____
    - Auditor identified duct leakage sites using a blower door and communicated relevant information to crew _____
    - Auditor identified duct leakage sites using duct diagnostics and communicated relevant information to crew _____
    - Crew identified duct leakage sites visually _____
    - Crew identified duct leakage sites using a blower door _____
    - Crew identified duct leakage sites using duct diagnostics _____
    - Other (specify) _____ _____

21. In Program Year 2010, at what point did your agency stop performing duct sealing work on a given dwelling unit? (Check all that apply)
    - When all identified duct leakage sites were sealed _____
    - When a blower door test indicated no more flow from the ducts _____
    - When the duct leakage rate as measured by duct diagnostics dropped below a minimum number calculated for the dwelling unit in question _____
    - Other (specify) _____ _____

22. How did you determine when a particular refrigerator should be replaced in PY 2010? (Check all that apply)
    - Not allowed to replace refrigerators _____
    - Energy use of existing refrigerator was metered _____
    - Energy use of existing refrigerator was assumed base on rated/nameplate value_____
    - Non-energy criteria were used (e.g., age, color, physical appearance) _____
    - Refrigerator was replaced if it was no longer running or could not maintain desired temperature _____
    - Other (specify) _____

22a.How did you determine when a particular air conditioner should be replaced in PY 2010? (Check all that apply)
    - Not allowed to replace air conditioner _____
    - Energy use of existing air conditioner was metered _____
    - Energy use of existing air conditioner was assumed base on rated/nameplate value _____
    - Non-energy criteria were used (e.g., age, physical appearance) _____
    - Air conditioner was replaced if it was no longer running or could not maintain desired temperature _____
    - Other (specify) _____
    - Not applicable _____

23. Which of the following diagnostic procedures did your agency perform in Program Year 2010? (Check all that apply)

Pressure diagnostics:

- Blower door (house air leakage rate) _____
- Zonal pressure measurements _____
- Room-to-room pressure measurements (distribution balancing) _____
- Duct pressure pan measurements _____
- Duct blower measurements (duct air leakage rate) _____

Space-heating system:

- Flue gas analysis (steady-state efficiency measurements) _____
- Heat rise measurements _____
- CO measurements in flues _____
- Draft/spillage (normal operation) _____

Air-conditioning system:

- Refrigerant charge (e.g., superheat, subcooling) _____

HVAC components and cross-cutting diagnostics:

- Air handler flow rate _____
- Thermostat anticipator current _____
- Worst case draft/spillage (CAZ) _____

Hot-water (water-heating) system:

- Flue gas analysis (steady-state efficiency measurements) _____
- CO measurements in flues _____
- Draft/spillage (normal operation) _____
- Water flow rates (showerheads and faucets) _____

Other CO measurements:

- CO measurements in equipment rooms _____
- Cooking stove _____
- CO measurements in living areas _____

Other diagnostics and inspections:

- Refrigerator energy use _____
- Exhaust fan air flow rate measurement _____
- Infrared scanning (camera) _____
- Radon testing _____
- Lead testing _____
- Mold and mildew testing _____
- Moisture context testing _____
- Other (please specify) _____ _____

24. Which of the diagnostic procedures listed below were initiated by your agency in PY 2010 and the two years prior to PY 2010? If your agency did not use a particular procedure, leave that item blank.

Pressure diagnostics:

- Blower door (house air leakage rate) _____
- Zonal pressure measurements _____
- Room-to-room pressure measurements (distribution balancing) _____
- Duct pressure pan measurements _____
- Duct blower measurements (duct air leakage rate) _____

Space-heating system:

- Flue gas analysis (steady-state efficiency measurements) _____
- Heat rise measurements _____
- CO measurements in flues _____
- Draft/spillage (normal operation) _____

Air-conditioning system:

- Refrigerant charge (e.g., superheat, subcooling) _____

HVAC components and cross-cutting diagnostics:

- Air handler flow rate _____
- Thermostat anticipator current _____
- Worst case draft/spillage (CAZ) _____

Hot-water (water-heating) system:

- Flue gas analysis (steady-state efficiency measurements) _____
- CO measurements in flues _____
- Draft/spillage (normal operation) _____
- Water flow rates (showerheads and faucets) _____

Other CO measurements:

- CO measurements in equipment rooms _____
- Cooking stove _____
- CO measurements in living areas _____

Other diagnostics and inspections:

- Refrigerator energy use _____
- Exhaust fan air flow rate measurement _____
- Infrared scanning (camera) _____
- Radon testing _____
- Lead testing _____
- Mold and mildew testing _____
- Moisture context testing _____
- Other (please specify) _____ _____

25. What types of credentials or experience were required of your staff who performed diagnostic procedures in Program Year 2010? *Check all that apply*.
    - Technical certification _____
    - Extensive weatherization work experience _____
    - Extensive weatherization supervision experience _____
    - Construction experience _____
    - Other (specify) _____ _____

26. Approximately how many hours did your agency spend on performing diagnostic procedures for a typical dwelling unit served by your agency in Program Year 2010? _____

27. Please indicate the cost, amount of training needed, amount of time needed and effectiveness of the following types of diagnostic procedures relative to each other for PY 2010. Please use the following scale: 1 – very low; 2 -- low; 3 – medium; 4 – high; 5 – very high.

	Cost	**Training Needed**	**Time Needed**	**Effectiveness**
Pressure diagnostics:				
Blower door (house air leakage rate)				
Zonal pressure measurements				
Room-to-room pressure measurements (distribution balancing)				
Duct pressure pan measurements				
Duct blower measurements (duct air leakage rate)				
Space-heating system:				
Flue gas analysis (steady-state efficiency measurements)				
Heat rise measurements				
CO measurements in flues				
Draft/spillage (normal operation)				
Air-conditioning system:				
Refrigerant charge (e.g., superheat, subcooling)				
HVAC components and cross-cutting diagnostics:				
Air handler flow rate				
Thermostat anticipator current				
Worst case draft/spillage (CAZ)				
Hot-water (water-heating) system:				
Flue gas analysis (steady-state efficiency measurements)				
CO measurements in flues				
Draft/spillage (normal operation)				
Water flow rates (showerheads and faucets)				
Other CO measurements:				
CO measurements in equipment rooms				
Cooking stove				
CO measurements in living areas				
Other diagnostics and inspections:				
Refrigerator energy use				
Exhaust fan air flow rate measurement				
Infrared scanning (camera)				
Radon testing				
Lead testing				
Mold and mildew testing				
Moisture context testing				
Other (please specify				

CLIENT EDUCATION

1. Which of the following client education approaches did your agency use in Program Year 2010? (Check all that apply)
    - Provide literature at time of client intake _____
    - Provide video, CD or DVD at time of client intake _____
    - Provide in-person instruction at time of client intake _____
    - Provide hardware kit at time of client intake _____
    - Provide literature at time of audit _____
    - Provide video, CD or DVD at time of audit _____
    - Provide in-person instruction at time of audit _____
    - Provide hardware kit at time of audit _____
    - Provide literature at time of weatherization _____
    - Provide video, CD or DVD at time of weatherization _____
    - Provide in-person instruction at time of weatherization _____
    - Provide hardware kit at time of weatherization _____
    - Provide literature at separate client education visit _____
    - Provide video, CD or DVD at separate client education visit _____
    - Provide in-person instruction at separate client education visit _____
    - Provide hardware kit at separate client education visit _____
    - Provide literature at time of inspection _____
    - Provide video, CD or DVD at time of inspection _____
    - Provide in-person instruction at time of inspection _____
    - Provide hardware kit at time of inspection _____
    - Group training class _____
    - Other (please specify) _____ _____

2. Which of the following broad topics did your agency cover with clients in Program Year 2010? (Check all that apply)
    - Thermostat management _____
    - HVAC system operation/maintenance _____
    - Distribution system adjustment and zoning _____
    - Cooling load reduction _____
    - Windows _____
    - Insulation _____
    - Ventilation _____
    - Mold _____
    - Refrigerator _____
    - Hot water use _____
    - Water heating system operation/maintenance _____
    - Lighting _____
    - Laundry _____
    - Kitchen appliance operation _____
    - Other baseload electric use _____
    - Energy Star _____
    - Safety monitors (e.g., CO monitors, smoke alarm) _____
    - Energy bills _____
    - Other (please specify) _____ _____

3. Which of the following people provided client education for your agency in Program Year 2010? (Check all that apply)
    a. In-house manager _____
    b. In-house education specialist _____
    c. Contractor education specialist _____
    d. Intake staff person _____
    e. Auditor _____
    f. In-house weatherization crew chief _____
    g. Contractor weatherization crew chief _____
    h. In-house weatherization crew member _____
    i. Contractor weatherization crew member _____
    j. Inspector _____
    k. Other (please specify) _____ _____

4. If in-person instruction was provided by your agency in Program Year 2010, who was your preferred target? (Check best answer)

    _____ Applicant
    _____ Other adult member of household
    _____ Child living in household
    _____ Adult not living in household
    _____ Other (please specify) _____

5. If in-person instruction was provided by your agency in Program Year 2010, was it typically provided to a single person or multiple persons? *Check best answer*.

    _____ single person
    _____ multiple persons

6. What types of credentials or experience were required of those who provided client education for your agency in Program Year 2010? *Check all that apply.*
    - College degree _____
    - Technical certification _____
    - Extensive experience in performing weatherization work _____
    - Extensive experience in supervising weatherization work _____
    - Educational background _____
    - Other (please specify) _____ _____

7. Which of the client education approaches listed below were initiated by your agency during the ARRA period? (Check all that apply)
    - Provide literature at time of client intake _____
    - Provide video, CD or DVD at time of client intake _____
    - Provide in-person instruction at time of client intake _____
    - Provide hardware kit at time of client intake _____
    - Provide literature at time of audit _____
    - Provide video, CD or DVD at time of audit _____
    - Provide in-person instruction at time of audit _____
    - Provide hardware kit at time of audit _____
    - Provide literature at time of weatherization _____
    - Provide video, CD or DVD at time of weatherization _____
    - Provide in-person instruction at time of weatherization _____
    - Provide hardware kit at time of weatherization _____
    - Provide literature at separate client education visit _____
    - Provide video, CD or DVD at separate client education visit _____
    - Provide in-person instruction at separate client education visit _____
    - Provide hardware kit at separate client education visit _____
    - Provide literature at time of inspection _____
    - Provide video, CD or DVD at time of inspection _____
    - Provide in-person instruction at time of inspection _____
    - Provide hardware kit at time of inspection _____
    - Group training class _____
    - Other (please specify) _____ _____

8. Please indicate the cost, amount of training needed, amount of time needed and effectiveness of the following types of client education approaches relative to each other for PY 2010. Please use the following scale: 1 – very low; 2 –low; 3 – medium; 4 – high; 5 – very high.

Cost	Training Needed	Time Needed	Effectiveness
Provide video, CD or DVD at time of client intake			
Provide in-person instruction at time of client intake			
Provide hardware kit at time of client intake			
Provide literature at time of audit			
Provide video, CD or DVD at time of audit			
Provide in-person instruction at time of audit			
Provide hardware kit at time of audit			
Provide literature at time of weatherization			
Provide video, CD or DVD at time of weatherization			
Provide in-person instruction at time of weatherization			
Provide hardware kit at time of weatherization			
Provide literature at separate client education visit			
Provide video, CD or DVD at separate client education visit			
Provide in-person instruction at separate client education visit			
Provide hardware kit at separate client education visit			
Provide literature at time of inspection			
Provide video, CD or DVD at time of inspection			
Provide in-person instruction at time of inspection			
Provide hardware kit at time of inspection			
Group training class			
Other (please specify)			

9. On average, approximately how many minutes were spent in Program Year 2010 on client education in a typical dwelling? _____

TRAINING

1. On which of the following weatherization topics did agency staff working on your agency's weatherization efforts receive training in Program Year 2010? *Check all that apply.*

(1) Diagnostic procedures _____
(2) Insulation _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(3) Space heating, ventilation, air conditioning _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(4) Infiltration measures _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(5) Doors and windows _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(6) Hot water heating _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(7) Baseloads (e.g., lighting, refrigerators) _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____

1a. On which of the following administrative-related topics did agency staff working on your agency's weatherization efforts receive training in Program Year 2010? *Check all that apply.*

(1) Management _____
(2) Client education _____
(3) Auditing/estimating _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(4) Monitoring/quality control _____
(5) Financial topics _____
(6) Outreach and communications _____
(7) Other (please specify) _____

1b. On which of the following health and safety topics did agency staff working on your agency's weatherization efforts receive training in Program Year 2010? *Check all that apply.*

_____ Fire safety
_____ Indoor air quality
_____ Measures to increase security of housing unit
_____ Measures to reduce common household hazards
_____ Mold and mildew
_____ Lead
_____ Asbestos
_____ Vermiculite
_____ General crew safety
_____ Other health and safety
_____ Other (please specify)

2. On which of the following diagnostic procedures did agency staff working on your agency's weatherization efforts receive training in Program Year 2010? *Check all that apply.*

Pressure diagnostics:

- Blower door (house air leakage rate) _____
- Zonal pressure measurements _____
- Room-to-room pressure measurements (distribution balancing) _____
- Duct pressure pan measurements _____
- Duct blower measurements (duct air leakage rate) _____

Space-heating system:

- Flue gas analysis (steady-state efficiency measurements) _____
- Heat rise measurements _____
- CO measurements in flues _____
- Draft/spillage (normal operation) _____

Air-conditioning system:

- Refrigerant charge (e.g., superheat, subcooling) _____

HVAC components and cross-cutting diagnostics:

- Air handler flow rate _____
- Thermostat anticipator current _____
- Worst case draft/spillage (CAZ) _____

Hot-water (water-heating) system:

- Flue gas analysis (steady-state efficiency measurements) _____
- CO measurements in flues _____
- Draft/spillage (normal operation) _____
- Water flow rates (showerheads and faucets) _____

Other CO measurements:

- CO measurements in equipment rooms _____
- Cooking stove _____
- CO measurements in living areas _____

Other diagnostics and inspections:

- Refrigerator energy use _____
- Exhaust fan air flow rate measurement _____
- Infrared scanning (camera) _____
- Radon testing _____
- Lead testing _____
- Mold and mildew testing _____
- Moisture context testing _____
- Other (please specify) _____ _____

3. How many of your agency's staff were trained at the following events in Program Year 2010?

_____ National Weatherization Program Conference
_____ Affordable Comfort Conference
_____ Other national conference
_____ Regional weatherization conference
_____ Your state's weatherization conference
_____ Some other relevant conference in your state
_____Weatherization conference given by another state
_____ Some other relevant conference given by another state
_____ Any state or regional training center class
_____ Manufacturer's training school class
_____ Utility training class
_____ Training classes provided by your agency or those agencies you work for
_____ One-time state-sponsored class
_____ Any other class not sponsored by your state (e.g., another state, trade organization)
_____ Visit to an agency you do not work for training
_____ Instruction provided by your state to your individual agency or those agencies you work for
_____ In-person expert visit just to your agency (e.g., peer exchange, consultant)
_____ Web cast
_____ Other (please specify)

4. Which of the following weatherization topics listed below were agency staff first trained on in PY 2010 and two years prior to PY 2010? (Check all that apply)

(1) Diagnostic procedures _____
(2) Insulation _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(3) Space heating, ventilation, air conditioning _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(4) Infiltration measures _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(5) Doors and windows _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(6) Hot water heating _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(7) Baseloads (e.g., lighting, refrigerators) _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____

4a. Which of the following administrative-related topics listed below were agency staff first trained on in PY 2010 and in the two years prior to PY 2010? If your agency did not receive training on a particular subject, leave that item blank.

(1) Management _____
(2) Client education _____
(3) Auditing/estimating _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(4) Monitoring/quality control _____
(5) Financial topics _____
(6) Outreach and communications _____
(7) Other (please specify) _____

4b. Which of the following health and safety topics listed below were agency staff first trained on in PY 2010 and in the two years prior to PY 2010? (Check all that apply)

_____ Fire safety
_____ Indoor air quality
_____ Measures to increase security of housing unit
_____ Measures to reduce common household hazards
_____ Mold and mildew
_____ Lead
_____ Asbestos
_____ Vermiculite
_____ General crew safety
_____ Other health and safety
_____ Other (please specify)

5. On which of the following weatherization topics did your agency provide training to your own in-house staff in Program Year 2010? (Check all that apply)

(1) Diagnostic procedures _____
(2) Insulation _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(3) Space heating, ventilation, air conditioning _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(4) Infiltration measures _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(5) Doors and windows _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(6) Hot water heating _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(7) Baseloads (e.g., lighting, refrigerators) _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____

5a. On which of the following administrative-related topics did your agency provide training to your own in-house staff in Program Year 2010? (Check all that apply)

(1) Management _____
(2) Client education _____
(3) Auditing/estimating _____
-- single family dwellings _____
-- multifamily dwellings _____
-- mobile homes _____
(4) Monitoring/quality control _____
(5) Financial topics _____
(6) Outreach and communications _____
(7) Other (please specify) _____

5b. On which of the following health and safety topics did your agency provide training to your own in-house staff in Program Year 2010? (Check all that apply)

_____ Fire safety
_____ Indoor air quality
_____ Measures to increase security of housing unit
_____ Measures to reduce common household hazards
_____ Mold and mildew
_____ Lead
_____ Asbestos
_____ Vermiculite
_____ General crew safety
_____ Other health and safety
_____ Other (please specify)

6. On which of the following diagnostic procedures did your agency provide training to your staff in Program Year 2010? (Check all that apply)

Pressure diagnostics:

- Blower door (house air leakage rate) _____
- Zonal pressure measurements _____
- Room-to-room pressure measurements (distribution balancing) _____
- Duct pressure pan measurements _____
- Duct blower measurements (duct air leakage rate) _____

Space-heating system:

- Flue gas analysis (steady-state efficiency measurements) _____
- Heat rise measurements _____
- CO measurements in flues _____
- Draft/spillage (normal operation) _____

Air-conditioning system:

- Refrigerant charge (e.g., superheat, subcooling) _____

HVAC components and cross-cutting diagnostics:

- Air handler flow rate _____
- Thermostat anticipator current _____
- Worst case draft/spillage (CAZ) _____

Hot-water (water-heating) system:

- Flue gas analysis (steady-state efficiency measurements) _____
- CO measurements in flues _____
- Draft/spillage (normal operation) _____
- Water flow rates (showerheads and faucets) _____

Other CO measurements:

- CO measurements in equipment rooms _____
- Cooking stove _____
- CO measurements in living areas _____

Other diagnostics and inspections:

- Refrigerator energy use _____
- Exhaust fan air flow rate measurement _____
- Infrared scanning (camera) _____
- Radon testing _____
- Lead testing _____
- Mold and mildew testing _____
- Moisture context testing _____
- Other (please specify) _____ _____

7. For each broad subject listed in the left-most column of the following table, put a check mark in the appropriate cell(s) to indicate which training method(s) you believe were most effective for imparting key skills and information in that area to your agency's in-house or contractor weatherization staff in PY 2010:

	Conferences	**Primarily Field training**	**Primarily Classroom training**	**Agency visits**	**Web casts**	**Other (specify)**
Subject						
Management						
Weatherization skills and methods						
Auditing/ Estimating						
Monitoring/ quality control						
Financial topics						
Outreach and communications						
Health and safety						
Diagnostic procedures						
Procedures for selecting weatherization measures						
Client education						
Other (specify)						

8. For each broad subject listed in the left-most column of the following table, please indicate the quality of training received in Program Year 2010 at the training venues listed in the column headings. Please leave cells blank were your agency did not receive training during this period of time. Please use the following scale: 1-very low; 2 - low; 3-medium; 4- high; 5-very high

	National Weatherization Program Conference	**Affordable Comfort Conference**	**Regional Weatherization Conference**	**State Weatherization Conference**	**State/ Regional Training Center**	**Training Provided by Your Own Agency**
Subject						
Management						
Weatherization skills and methods						
Auditing/ Estimating						
Monitoring/ quality control						
Financial topics						
Outreach and communications						
Health and safety						
Diagnostic procedures						
Procedures for selecting weatherization measures						
Client education						
Other (specify)						

9. For those staff working in your agency who needed to have knowledge about the following list of weatherization topics in PY 2010, how well trained were they in each area in PY 2010? Please use the following scale: 1– not at all well trained; 2 – not well trained; 3 – moderately well trained; 4 –well trained; 5 – very well trained; 6 – not applicable (Circle best answer)

(1) Diagnostic procedures	1	2	3	4	5	6
(2) Insulation						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(3) Space heating, ventilation, air conditioning						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(4) Infiltration measures						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(5) Doors and windows						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(6) Hot water heating						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(7) Baseloads (e.g., lighting, refrigerators)						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6

9a. For those staff working in your agency who needed to have knowledge about the following list of administrative-related topics, how well trained were they in each area in PY 2010? Please use the following scale: 1– not at all well trained; 2 – not well trained; 3 – moderately well trained; 4 –well trained; 5 – very well trained; 6 – not applicable *Circle best answer.*

(1) Management	1	2	3	4	5	6
(2) Client education	1	2	3	4	5	6
(3) Auditing/estimating						
-- single family dwellings	1	2	3	4	5	6
-- multifamily dwellings	1	2	3	4	5	6
-- mobile homes	1	2	3	4	5	6
(4) Monitoring/quality control	1	2	3	4	5	6
(5) Financial topics	1	2	3	4	5	6
(6) Outreach and communications	1	2	3	4	5	6
(7) Other (please specify)	1	2	3	4	5	6

9b. For those staff working in your agency who needed to have knowledge about the following list of health and safety topics, how well trained were they in each area in PY 2010? Please use the following scale: 1– not at all well trained; 2 – not well trained; 3 – moderately well trained; 4 –well trained; 5 – very well trained; 6 – not applicable *Circle best answer.*

(1) Fire safety	1	2	3	4	5	6
(2) Indoor air quality	1	2	3	4	5	6
(3) Measures to increase security of housing unit	1	2	3	4	5	6
(4) Measures to reduce common household hazards	1	2	3	4	5	6
(5) Mold and mildew	1	2	3	4	5	6
(6) Lead	1	2	3	4	5	6
(7) Asbestos	1	2	3	4	5	6
(8) Vermiculite	1	2	3	4	5	6
(9) General crew safety	1	2	3	4	5	6
(10) Other health and safety	1	2	3	4	5	6
(11) Other (please specify	1	2	3	4	5	6

9c. For categories receiving answers of (1)-not at all well trained, or (2)-not well trained to the above questions, what were the barriers for receiving this training:
a. Funding
b. Time
c. Not a priority
d. Not available
e. Other_____

10. For those staff working in your agency who needed to have knowledge about the following list of diagnostic topics, how well trained were they in each area in PY 2010? Please use the following scale: 1– not at all well trained; 2 – not well trained; 3 – moderately well trained; 4 –well trained; 5 – very well trained; 6 – not applicable *Circle best answer.*

Pressure diagnostics:						
• Blower door (house air leakage rate)	1	2	3	4	5	6
• Zonal pressure measurements	1	2	3	4	5	6
• Room-to-room pressure measurements	1	2	3	4	5	6
• Duct pressure pan measurements	1	2	3	4	5	6
• Duct blower measurements (duct air leakage rate)	1	2	3	4	5	6
Space-heating system:						
• Flue gas analysis (steady-state efficiency measurements)	1	2	3	4	5	6
• Heat rise measurements	1	2	3	4	5	6
• CO measurements in flues	1	2	3	4	5	6
• Draft/spillage (normal operation)	1	2	3	4	5	6
Air-conditioning system:						
• Refrigerant charge (e.g., superheat, subcooling)	1	2	3	4	5	6
HVAC components and cross-cutting diagnostics:						
• Air handler flow rate	1	2	3	4	5	6
• Thermostat anticipator current	1	2	3	4	5	6
• Worst case draft/spillage (CAZ)	1	2	3	4	5	6
Hot-water (water-heating) system:						
• Flue gas analysis (steady-state efficiency measurements)	1	2	3	4	5	6
• CO measurements in flues	1	2	3	4	5	6
• Draft/spillage (normal operation)	1	2	3	4	5	6
• Water flow rates (showerheads and faucets)	1	2	3	4	5	6
Other CO measurements:						
• CO measurements in equipment rooms	1	2	3	4	5	6
• Cooking stove	1	2	3	4	5	6
• CO measurements in living areas	1	2	3	4	5	6
Other diagnostics and inspections:						
• Refrigerator energy use	1	2	3	4	5	6
• Exhaust fan air flow rate measurement	1	2	3	4	5	6
• Infrared scanning (camera)	1	2	3	4	5	6
• Radon testing	1	2	3	4	5	6
• Lead testing	1	2	3	4	5	6
• Mold and mildew testing	1	2	3	4	5	6
• Moisture context testing	1	2	3	4	5	6
• Other (please specify) _____	1	2	3	4	5	6

10a. For categories receiving answers of (1)-not at all well trained, or (2)-not well trained to the above question, what were the barriers for receiving this training:
a. Funding
b. Time
c. Not a priority
d. Not available
e. Other_____

11. Overall, how well trained were your agency's weatherization crews in PY 2010? (Check best answer)

_____ Very well trained
_____ Well trained
_____ Neither well nor poorly trained
_____ Poorly trained
_____ Very poorly trained

12. What were the barriers that prevented your crews from receiving all the training they need? (Check all that apply)

_____ Lack of training funds
_____ Cannot take crews out of the field long enough for training
_____ Training not available at the right times
_____ Training not available at the right places
_____ Available training is poor in quality

INSPECTION

1. Which of the following types of post-weatherization quality control inspection did your agency perform on your weatherized dwelling units in Program Year 2010? (Check all that apply)
   - Visual inspection of installed measures _____
   - Verification of insulation depths/quantities _____
   - Verification of operation of measures installed _____
   - Assessment of quality of measures installed _____
   - Identification of needed measures that were not installed _____
   - Blower door test _____
   - Heating system efficiency test (flue gas analysis) _____
   - Draft/spillage tests of heating systems _____
   - Carbon monoxide (CO) monitoring _____
   - Infrared scanning _____
   - Identification of unresolved health and safety issues _____
   - Discussion with occupants _____
   - Other (specify) _____ _____

2. Please indicate which types of post-weatherization quality control inspection listed below were initiated since ARRA PY 2009. *Check all that apply.*
    - Visual inspection of installed measures _____
    - Verification of insulation depths/quantities _____
    - Verification of operation of measures installed _____
    - Assessment of quality of measures installed _____
    - Identification of needed measures that were not installed _____
    - Blower door test _____
    - Heating system efficiency test (flue gas analysis) _____
    - Draft/spillage tests of heating systems _____
    - Carbon monoxide (CO) monitoring _____
    - Infrared scanning _____
    - Identification of unresolved health and safety issues _____
    - Discussion with occupants _____
    - Other (specify) _____ _____

3. Which of the following post-weatherization quality and control inspection topics listed below were agency staff trained on in PY 2010? Check all that apply.
    - Visual inspection of installed measures _____
    - Verification of insulation depths/quantities _____
    - Verification of operation of measures installed _____
    - Assessment of quality of measures installed _____
    - Identification of needed measures that were not installed _____
    - Blower door test _____
    - Other diagnostic tests _____
    - Identification of unresolved health and safety issues _____
    - Discussion with occupants _____
    - Other (specify) _____ _____

4. Please indicate the cost, amount of training needed, amount of time needed and effectiveness of the following types of post-weatherization quality control inspection procedures relative to each other for PY 2010. Please use the following scale: 1 – very low; 2 –low; 3 – medium; 4 – high; 5 – very high

	Cost	Training Needed	Time Needed	Effectiveness
Visual inspection of installed measures				
Verification of insulation depths/quantities				
Verification of operation of measures installed				
Assessment of quality of measures installed				
Identification of needed measures that were not installed				
Blower door test				
Other diagnostic tests				
Identification of unresolved health and safety issues				
Discussion with occupants				
Other (please specify)				

5. Approximately how many hours did it take to perform a typical post-weatherization quality control inspection in Program Year 2010, by the major components listed below?
   - Scheduling _____
   - Travel _____
   - On-site work _____
   - Post-inspection analysis and write-up _____
   - Other _____
   - TOTAL of all components _____

6. Which of the following parties were involved in performing your agency's post-weatherization quality control inspections in Program Year 2010? *Check all that apply.*
   - In-house manager _____
   - In-house inspection specialist _____
   - Contractor inspection specialist _____
   - In-house weatherization crew chief _____
   - Contractor weatherization crew chief _____
   - In-house weatherization crew member _____
   - Contractor weatherization crew member _____
   - Other (please specify) _____

6a. Which party was primarily responsible for post-weatherization quality control inspections? Check best answer.

- In-house manager _____
- In-house inspection specialist _____
- Contractor inspection specialist _____
- In-house weatherization crew chief _____
- Contractor weatherization crew chief _____
- In-house weatherization crew member _____
- Contractor weatherization crew member _____
- Other (please specify) _____ _____

7. About how many agency weatherization office staff went into the field to monitor local weatherization agencies in your state in Program Year 2010? *{Note: do not include people who do quality assurance at the local agency level for the local agencies.}*

- Agency staff _____
- Agency contractors _____
- Other (please specify) _____ _____

8. What types of credentials or experience did your agency's post-weatherization quality control inspectors have in Program Year 2010? *Check all that apply.*

- Technical certification _____
- Extensive experience performing pre-weatherization audits _____
- Extensive experience performing weatherization work _____
- Extensive experience supervising weatherization work _____
- Construction experience _____
- Other (please specify) _____ _____

9. Please indicate the level of experience for the agency staff engaged post-weatherization quality control inspections in Program Year 2010 in each of the following functional areas:

	Very High	**High**	**Average**	**Low**	**Very Low**
Performing weatherization work					
Supervising weatherization work					
Working in construction					
Performing pre-weatherization audits					

10. For those dwelling units for which post-weatherization quality control inspections were performed by your agency in Program Year 2010, typically how many days after weatherization completion did the initial inspection take place? _____

11. In those cases where a Program Year 2010 post-weatherization quality control inspection revealed a problem with the job performed, what action was most commonly taken in response to that finding? (Check one)

- Sent original crew or contractor back to correct problem _____
- Sent different crew or contractor to correct problem _____
- Sent crew supervisor to correct problem _____
- Sent someone from state office to correct problem _____
- No action taken _____
- Other (please specify) _____ _____

12. What *other* actions were taken in Program Year 2010 in response to the discovery of a problem with the weatherization job performed? (Check all that apply)

- Sent original crew or contractor back to correct problem _____
- Sent different crew or contractor to correct problem _____
- Sent crew supervisor to correct problem _____
- Sent someone from state office to correct problem _____
- No action taken _____
- Other (please specify) _____ _____

13. In Program Year 2010, how many of the dwelling units weatherized by your agency required some additional work as a result of the findings of your post-weatherization quality control inspections? _____

13a. Of those requiring some additional work, how many had work done that probably resulted in more energy savings? _____

14. What were the three most common problems found in the dwelling units inspected by your agency in Program Year 2010?

1) _____
2) _____
3) _____

15. In Program Year 2010, did your agency use findings from your post-weatherization quality control inspections to provide feedback to your in-house or contractor crews on workmanship or related issues? _____

16. To what extent does post-weatherization quality control inspection affect the quality of future weatherization work?

(1) No extent
(2) Little extent
(3) Moderate extent
(4) Substantial extent
(5) Very substantial extent

17. Did the observation of problems with the quality of weatherization work lead to changes in weatherization training for your staff?
(1) Yes
(2) No

17a. If Yes, what changes were made? _____

18. Did your agency observe weatherization training sessions to help identify potential problem areas for inspecting in the field (e.g., with respect to installation of measures that trainees seem to have trouble understanding)?
(1) Yes
(2) No

18a. If Yes, briefly describe how your in-field inspection activities were affected by your training session observations.

_____

_____

_____

OMB Control Number: XXXX-XXXX

APPENDIX F. DF2: HOUSING UNIT INFORMATION SURVEY

This survey collects detailed information about homes weatherized (or waitlisted) by your agency that have been selected for analysis by the national evaluation. The data you supply will be used with billing history data to better understand energy savings attributable to the Weatherization Assistance Program.

Please use this form to provide information about any single family detached and attached houses, mobile homes, or individual units within multifamily buildings. The Building Information Survey should be used to document information on small or large multifamily buildings in which the whole building and all units in the building were weatherized or are waitlisted. Refer to the definitions of each building type provided at the end of the survey because these definitions are slightly different than those commonly used within the Weatherization Assistance Program.

Public reporting burden for this collection of information is estimated to average forty hours per weatherization agency, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Records Management Division, IM-11, Paperwork Reduction Project (XXXX-XXXX), U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project (XXXX-XXXX), Washington, DC 20503.

All of the information obtained from this survey will be protected and will remain confidential. The data will be analyzed in such a way that the information provided cannot be associated back to your state, your agencies, or the housing units and clients that your state served.

Form completed by: _____ Date: _____

Unit identification number (to be completed by the evaluation team): _____

IDENTIFICATION

1. Subgrantee (agency) name: _____

2. State: _____

3. Agency job number: _____

4. Occupant name: _____

5. Site address: _____ 6. City: _____
7. If this home is currently waitlisted, check here ☐ and complete only the Housing Unit and Household sections below.

WEATHERIZATION INFORMATION

Weatherization dates (not audit or inspection dates):

8a. Started: _____ _____ _____

8b. Completed: _____ _____ _____

(month) (day) (year)

9. Was this a "reweatherized" unit? ***(Check only one)***

- ☐ Yes
- ☐ No
- ☐ Don't know

10. Does the housing unit meet your state's definition for being a high residential energy user? ***(Check only one)***

- ☐ Yes
- ☐ No
- ☐ No state definition in place
- ☐ Don't know

11. Does the housing unit meet your state's definition for being a household with a high energy burden? ***(Check only one)***

- ☐ Yes
- ☐ No
- ☐ No state definition in place
- ☐ Don't know

12. Did this client file a complaint about the weatherization services you provided? ***(Check only one)*** ☐ Yes

- ☐ No
- ☐ Don't know

HOUSING UNIT

13. Building type – see definitions at end of form: ***(Check only one)***

- ☐ Single-family detached house
- ☐ Single-family attached house (e.g., side-by-side duplex, townhouse, row house)
- ☐ Single-family – unknown whether attached or detached
- ☐ Mobile home
- ☐ Small multifamily building (2-4 units per building and not a SF attached house)
- ☐ Large multifamily building (5 or more units per building and not a SF attached house)
- ☐ Shelter
- ☐ Don't know

14. If single-family detached or attached, number of stories above grade: ***(Check only one)***

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4 or more
- ☐ Don't know
- ☐ Not applicable

15. If single-family attached, number of units attached (adjacent) to this unit: ***(Check only one)***

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4 or more
- ☐ Don't know
- ☐ Not applicable

16. If mobile home, number of rooms that have been added on: ***(Check only one)***

- ☐ None
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4 or more
- ☐ Don't know
- ☐ Not applicable

17. If small or large multifamily building, number of units in the building: ***(Check only one)***

- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5-9
- ☐ 10-19
- ☐ 20-29
- ☐ 30-49
- ☐ 50-99
- ☐ 100 or more
- ☐ Don't know
- ☐ Not applicable

18. Ownership ***(Check only one)***

- ☐ Owner occupied
- ☐ Rental
- ☐ Other (specify: _____)
- ☐ Don't know

19. Year house/building originally built: ***(Check only one)***

- ☐ 2000 or later
- ☐ 1990 to 1999
- ☐ 1980 to 1989
- ☐ 1970 to 1979
- ☐ 1960 to 1969
- ☐ 1950 to 1959
- ☐ 1940 to 1949
- ☐ 1930 to 1939
- ☐ 1920 to 1929
- ☐ 1910 to 1919
- ☐ 1900 to 1909
- ☐ Before 1900
- ☐ Don't know

Conditioned floor area at the time of weatherization: ***(include the basement only if it is intentionally conditioned)***

20a. Heated floor area: _____ ft² ☐ Don't know

20b. Air conditioned floor area: _____ft² ☐ Don't know

21. Primary fuel used to heat the unit during the winter before weatherization: ***(Check only one)***

- ☐ Natural gas
- ☐ Propane/LPG
- ☐ Kerosene (#1 fuel oil)
- ☐ Fuel oil (#2 fuel oil)
- ☐ Electricity
- ☐ Wood
- ☐ Coal
- ☐ Other (specify) _____
- ☐ Don't know

22. Type of *primary* space-heating system before weatherization: ***(Check only one)***

- ☐ Central (ducted) warm-air furnace (forced-air or gravity, any fuel including electricity)
- ☐ Heat pump
- ☐ Built-in electric units (e.g., electric baseboards, ceiling heat)
- ☐ Steam or hot water system (e.g., floor or baseboard radiators, convectors)
- ☐ Floor, wall, or pipeless (ductless) furnace (e.g., floor or wall furnace)
- ☐ Room/space heater (nonportable)
- ☐ Portable space heater
- ☐ Cooking stove
- ☐ None
- ☐ Don't know

23. If small or large multifamily building, was the primary space-heating system shared with other housing units? ***(Check only one)***

- ☐ Yes
- ☐ No
- ☐ Don't know
- ☐ Not applicable

24. *Supplemental* fuel used to heat the unit during the winter before weatherization: ***(Check all that apply)***

- ☐ Natural gas
- ☐ Propane/LPG
- ☐ Kerosene (#1 fuel oil)
- ☐ Fuel oil (#2 fuel oil)
- ☐ Electricity
- ☐ Wood
- ☐ Other (specify: _____)
- ☐ None
- ☐ Don't know

25. Type of *operable* air conditioning system present before weatherization: ***(Check all that apply)***

- ☐ Central air conditioner/heat pump
- ☐ Window/wall units
- ☐ Evaporative cooling system ("swamp coolers")
- ☐ None
- ☐ Don't know

26. Number of window/wall air conditioning units: ***(Check only one)***

- ☐ None
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4 or more
- ☐ Don't know

Electric utility information:

27a. Name: _____ ☐ Don't know

27b. Account number: _____ ☐ Don't know

Natural gas utility information:

28a. ☐ Natural gas not installed in house

28b. Name: _____ ☐ Don't know

28c. Account number: _____ ☐ Don't know

HOUSEHOLD

29. Household annual income (as used to determine Program eligibility): $_____ per year

30. Total number of occupants: ***(Check only one)***

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7
- ☐ 8
- ☐ 9 or more
- ☐ Don't know

31. Check if the housing unit was occupied by at least one person who was: ***(Check all that apply)***

- ☐ Elderly (60 or older)
- ☐ Disabled
- ☐ Native American
- ☐ A child (as defined by your state)

32. Number of children (as defined by your state): ***(Check only one)***

- ☐ None
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 or more
- ☐ Don't know

33. Number of elderly (60 or older): ***(Check only one)***

- ☐ None
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 or more
- ☐ Don't know

34. Number of disabled: ***(Check only one)***

- ☐ None
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 or more
- ☐ Don't know

35. Year moved into housing unit: ***(Check only one)***

- ☐ 2007
- ☐ 2008
- ☐ 2005
- ☐ 2000 to 2004
- ☐ 1995 to 1999
- ☐ 1990 to 1994
- ☐ 1985 to 1989
- ☐ 1980 to 1984
- ☐ 1975 to 1979
- ☐ 1970 to 1974
- ☐ 1965 to 1969
- ☐ 1960 to 1964
- ☐ 1955 to 1959
- ☐ 1950 to 1954
- ☐ Before 1950
- ☐ Don't know

36. Is the household headed by a single parent? ***(Check only one)***

- ☐ Yes
- ☐ No
- ☐ Don't know

37. Race and ethnicity of the head of household: ***(Check all that apply)***

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or other Pacific Islander
- ☐ White
- ☐ Hispanic or Latino
- ☐ Don't know

AUDIT

38. Primary method used to select weatherization measures for this house (excluding health, safety, and repair measures and general heat waste measures): ***(Check only one)***

- ☐ Priority list
- ☐ Calculation procedure (e.g., spreadsheet, computerized audit)
- ☐ Other (specify: _____)

39. If a calculation procedure was used, the name of the procedure(s): ***(Check all that apply)***

- ☐ AK Warm
- ☐ EA-3
- ☐ EASY
- ☐ EA-QUIP
- ☐ HomeCheck
- ☐ Meadows
- ☐ REES
- ☐ REM/Rate
- ☐ SMOC-ERS
- ☐ TIPS
- ☐ TREAT
- ☐ Weatherization Assistant (NEAT/MHEA)
- ☐ WXEOR
- ☐ Other (specify: _____)
- ☐ Not applicable

DIAGNOSTICS AND INSPECTIONS

Indicate which of the following diagnostic measurements and inspections were performed by your agency on **THIS** housing unit and when they were performed: ***(Check all that apply)***

Diagnostic measurement or inspection	**Diagnostic/inspection performed during:**		
	Audit/house assessment	**Measure installation**	**Post-inspection**
Pressure diagnostics:			
40a. Blower door measurement (house air leakage rate)	☐	☐	☐
40b. Zonal pressure	☐	☐	☐
40c. Room-to-room pressures (distribution system balancing)	☐	☐	☐
40d. Duct pressure pan measurements	☐	☐	☐
40e. Duct blower measurement (duct air leakage rate)	☐	☐	☐
40f. Blower door subtraction meas. (duct air leakage rate)	☐	☐	☐
Space-heating system:			
41a. Flue gas analysis (steady-state efficiency measurement)	☐	☐	☐
41b. Heat rise	☐	☐	☐
41c. CO level in flue	☐	☐	☐
41d. CO level of equipment room	☐	☐	☐
41e. Draft/spillage (normal operation)	☐	☐	☐
41f. Worst case draft/spillage (CAZ)	☐	☐	☐
41g. Safety inspection	☐	☐	☐
Air-conditioning system:			
42a. Refrigerant charge (e.g., superheat or subcooling)	☐	☐	☐
42b. Safety inspection	☐	☐	☐
HVAC components:			
43a. Air handler flow rate	☐	☐	☐
43b. Thermostat anticipator current	☐	☐	☐

Diagnostic measurement or inspection	Diagnostic/inspection performed during:		
	Audit/house assessment	Measure installation	Post-inspection
Hot-water (water-heating) system:			
44a. Flue gas analysis (steady-state efficiency measurement)	☐	☐	☐
44b. CO level in flue	☐	☐	☐
44c. CO level of equipment room	☐	☐	☐
44d. Draft/spillage (normal operation)	☐	☐	☐
44e. Worst case draft/spillage (CAZ)	☐	☐	☐
44f. Hot water temperature	☐	☐	☐
44g. Shower head flow rate	☐	☐	☐
44h. Faucet flow rate	☐	☐	☐
44i. Safety inspection	☐	☐	☐
Other CO measurements:			
45a. Cook stove	☐	☐	☐
45b. Kitchen	☐	☐	☐
45c. Main living area	☐	☐	☐
Other diagnostics and inspections:			
46a. Refrigerator energy use	☐	☐	☐
46b. Exhaust fan air flow rate	☐	☐	☐
46c. Infrared scanning (camera)	☐	☐	☐
46d. Radon testing	☐	☐	☐
46e. Other (specify: _____)	☐	☐	☐
46f. Other (specify: _____)	☐	☐	☐
46g. Other (specify: _____)	☐	☐	☐

Record the diagnostic measurements taken on **THIS** housing unit: ***(Fill in all that were taken)***

Diagnostic measurement	Pre-weatherization	Post weatherization
House air leakage (blower door measurement):		
47a. Air leakage rate	cfm	cfm
47b. House WRT outside pressure difference	Pa	Pa
Duct leakage (pressure pan measurements):		
48a. Sum of pressure pan readings	Pa	Pa
48b. Number of registers included in sum		
48c. House WRT outside pressure difference	Pa	Pa
Duct leakage (duct blower measurements):		
49a. Total duct leakage rate	cfm	cfm
49b. Duct leakage to the outside	cfm	cfm
49c. Duct WRT outside pressure difference	Pa	Pa
Steady-state efficiency (flue gas analysis):		
50a. Primary space-heating system	%	%
50b. Secondary space-heating system	%	%
50c. Hot water heater	%	%

MEASURES INSTALLED

Identify the measures that were installed on **THIS** housing unit: ***(Check all that apply)***

Measure	Installed by	
	In-house crew	**Contractor**
Air sealing work:		
51a. General house caulking and weatherstripping (e.g., doors, windows)	☐	☐
51b. House air sealing emphasizing bypasses (leaks identified by auditor and/or crew without using a blower door)	☐	☐
51c. House air sealing emphasizing bypasses (leaks identified by auditor and/or crew with aid of a blower door)	☐	☐
51d. Air distribution system (duct) sealing and repair	☐	☐
51e. Other non-window air sealing work (specify: _____)	☐	☐
Insulation:		
52a. Attic insulation (installed where there was no existing insulation)	☐	☐
52b. Attic insulation (added to existing insulation)	☐	☐
52c. Wall insulation (normal density—two-hole gravity blow technique)	☐	☐
52d. Wall insulation (high density—one-hole tube-fill technique)	☐	☐
52e. Floor insulation	☐	☐
52f. Rim or band joist insulation	☐	☐
52g. Foundation wall insulation	☐	☐
52h. Duct insulation	☐	☐
52i. White roof coat	☐	☐
52j. Skirting	☐	☐
52k. Other insulation (specify: _____)	☐	☐
Windows:		
53a. New window (justified because cost-effective)	☐	☐
53b. New window (justified for reason other than cost-effectiveness)	☐	☐
53c. Window glazings	☐	☐
53d. New window screen	☐	☐
53e. Window lock replacement	☐	☐

Measure	Installed by	
	In-house crew	Contractor
Windows (continued):		
53f. Window screen repair	☐	☐
53g. Other window repair (e.g., sashes, frames)	☐	☐
53h. Storm window	☐	☐
53i. Window shading (e.g., awning, film, sun screen)	☐	☐
53j. Other window treatments (specify: _____)	☐	☐
Doors:		
54a. New door (justified because cost-effective)	☐	☐
54b. New door (justified for reason other than cost-effectiveness)	☐	☐
54c. Door lock (new or replacement)	☐	☐
54d. Door or door framing repair	☐	☐
54e. Storm door	☐	☐
54f. Other door treatments (specify: _____)	☐	☐
Space-heating systems:		
55a. New space-heating system (justified because cost-effective)	☐	☐
55b. New space-heating system (justified for reason other than cost-effectiveness)	☐	☐
55c. Space-heating system repair (e.g., controls, safety items, flues)	☐	☐
55d. Space-heating system tune-up	☐	☐
55e. Vent damper	☐	☐
55f. Intermittent ignition device	☐	☐
55g. Other space-heating system modification (specify: _____)	☐	☐
Air-conditioning systems:		
56a. New air conditioner (justified because cost-effective)	☐	☐
56b. New air conditioner (justified for reason other than cost-effectiveness)	☐	☐
56c. Air conditioner repair	☐	☐

Measure	Installed by	
	In-house crew	Contractor
Air-conditioning systems (continued):		
56d. Air conditioner recharge/tune-up	☐	☐
56e. Ceiling or whole-house fans	☐	☐
56f. Other air-conditioning system modification (specify: _____)	☐	☐
Ventilation:		
57a. Exhaust fan in bathroom	☐	☐
57b. Exhaust fan in kitchen	☐	☐
57c. Whole-house ventilation system	☐	☐
57d. Other ventilation system improvements (specify: _____)	☐	☐
HVAC accessories:		
58a. New programmable (setback) thermostat	☐	☐
58b. New standard thermostat	☐	☐
58c. Duct vents, grills, or registers	☐	☐
58d. Standard air filter	☐	☐
58e. High efficiency particulate arresting (HEPA) air filter	☐	☐
58f. Other HVAC accessories (specify: _____)	☐	☐
Water-heating system:		
59a. New water heater (justified because cost-effective)	☐	☐
59b. New water heater (justified for reason other than cost-effectiveness)	☐	☐
59c. Water-heating system repair	☐	☐
59d. Water-heater tank insulation wrap	☐	☐
59e. Pipe insulation	☐	☐
59f. Low-flow showerhead	☐	☐
59g. Faucet aerators	☐	☐
59h. Water heater temperature reduction	☐	☐

Measure	Installed by	
Water-heating system (continued):	**In-house crew**	**Contractor**
59i. Other water heating system measure (specify: _____)	☐	☐
Other baseloads:		
60a. Indoor lighting	☐	☐
60b. Outdoor lighting	☐	☐
60c. Refrigerator (justified because cost-effective)	☐	☐
60d. Refrigerator (justified for reason other than cost-effectiveness)	☐	☐
60e. Other baseload measure (specify: _____)	☐	☐
Client education:		
61a. Literature (e.g., brochures, booklets, manuals)	☐	☐
61b. Videos, DVDs, or compact disks (CDs)	☐	☐
61c. Hardware kit and/or kit of weatherization materials	☐	☐
61d. <5 minute total in-home education/discussion time	☐	☐
61e. 5-14 minute total in-home education/discussion time	☐	☐
61f. 15-29 minute total in-home education/discussion time	☐	☐
61g. 30-60 minute total in-home education/discussion time	☐	☐
61h. >1 hour total in-home education/discussion time	☐	☐
61i. Classroom training	☐	☐
61j. Other client education approach (specify: _____)	☐	☐
Other health, safety, and repair:		
62a. Smoke alarm	☐	☐
62b. CO monitor	☐	☐
62c. Attic ventilation	☐	☐
62d. Roof repair	☐	☐
62e. Ceiling repair	☐	☐
62f. Wall repair	☐	☐

Measure Other health, safety, and repair (continued):	Installed by	
	In-house crew	Contractor
62g. Floor repair	☐	☐
62h. Foundation repair	☐	☐
62i. Ground vapor barrier	☐	☐
62j. Gutter or downspout (installed or repaired)	☐	☐
62k. Grading of lot	☐	☐
62l. Plumbing repair	☐	☐
62m. Sewer repair	☐	☐
62n. Electrical repair	☐	☐
62o. Stair repair	☐	☐
62p. Install/repair non-skid material on stairs	☐	☐
62q. Install/repair safety gate at stairs	☐	☐
62r. Install/repair grab bar in bathroom	☐	☐
62s. Install/repair non-skid material in bathtub	☐	☐
62t. Install/repair metal chimney liner	☐	☐
62u. Lead abatement	☐	☐
62v. Asbestos abatement	☐	☐
62w. Removal or safe storage of household poisons	☐	☐
62x. Other H&S and repair items (specify: _____)	☐	☐

63. If a new space-heating system was installed, indicate the primary fuel used to heat the unit during the winter after weatherization: ***(Check only one)***

- ☐ Natural gas
- ☐ Propane/LPG
- ☐ Kerosene (#1 fuel oil)
- ☐ Fuel oil (#2 fuel oil)
- ☐ Electricity
- ☐ Wood
- ☐ Coal
- ☐ Other (specify: _____)
- ☐ Don't know
- ☐ Not applicable

64. If a new space-heating system was installed, indicate the type of *primary* space-heating system after weatherization: ***(Check only one)***

- ☐ Central (ducted) warm-air furnace (forced-air or gravity, any fuel including electricity)
- ☐ Heat pump
- ☐ Built-in electric units (e.g., electric baseboards, ceiling heat)
- ☐ Steam or hot water system (e.g., floor or baseboard radiators, convectors)
- ☐ Floor, wall, or pipeless (ductless) furnace (e.g., floor or wall furnace)
- ☐ Room/space heater (nonportable)
- ☐ Portable space heater
- ☐ Cooking stove
- ☐ None
- ☐ Don't know
- ☐ Not applicable

65. If a new space-heating system was installed and justified for reasons other than cost-effectiveness, identify the reason it was replaced: ***(Check all that apply)***

- ☐ Cost of repair/retrofit exceeded 50% of replacement cost
- ☐ Existing heating system was not running
- ☐ Existing heating system was old (e.g., at end of life, too old to be repaired/adjusted)
- ☐ To switch fuel
- ☐ To convert from a steam system to a hot water system
- ☐ Heat exchanger was cracked
- ☐ Boiler was leaking
- ☐ Safety switches/controls were not operational and could not be repaired
- ☐ To replace unvented space heater(s)
- ☐ Existing heating system was not safe to run for other reason (specify: _____)
- ☐ Other (specifiy: _____)

66. Please identify any cost-effective energy-efficiency measures (not repair or health and safety measures) recommended by your energy audit procedures that you were unable to install in this housing unit because of insufficient funds: ***(Check all that apply)***

- ☐ Air sealing
- ☐ Duct sealing
- ☐ Attic insulation
- ☐ Wall insulation
- ☐ Floor/foundation insulation
- ☐ Duct insulation
- ☐ New window(s)
- ☐ Storm windows(s)
- ☐ Door(s)
- ☐ Storm door(s)
- ☐ New space-heating system
- ☐ Space-heating system tune-up
- ☐ New air conditioner(s)
- ☐ Air conditioner tune-up(s)
- ☐ HVAC thermostat
- ☐ New water heater
- ☐ Water heater insulation wrap
- ☐ Water flow devices (e.g., showerheads, faucet aerators)
- ☐ Lighting
- ☐ Refrigerator
- ☐ Other: _____
- ☐ None

67. If energy efficiency measures were checked in the previous question, provide a rough estimate of the cost for installing all the measures checked: $_____

68. Please identify any repair or health and safety measures recommended by your audit procedures that you were unable to install in this housing unit because of insufficient funds: ***(Check all that apply)***

- ☐ New window(s)
- ☐ Window glazing(s)
- ☐ Window screen(s)
- ☐ Window lock(s)
- ☐ Window repair
- ☐ New door(s)
- ☐ Door lock(s)
- ☐ Door repair
- ☐ New space-heating system
- ☐ Space-heating system repair
- ☐ New air conditioner(s)
- ☐ Air conditioner repair
- ☐ Ceiling or whole-house fan(s)
- ☐ Exhaust fan(s) or ventilation system
- ☐ New water heater
- ☐ Water-heating system repair
- ☐ Refrigerator
- ☐ Smoke alarm
- ☐ CO monitor
- ☐ Attic ventilation
- ☐ Roof, wall, floor, or foundation repair
- ☐ Plumbing/sewer repair
- ☐ Electrical repair
- ☐ Other: _____
- ☐ None

69. If repair or health and safety measures were checked in the previous question, provide a rough estimate of the cost for installing all the measures checked: $_____

COSTS

Provide the costs associated with installing the measures in **THIS** housing unit from all funding sources. Do **NOT** include any program management costs such as those associated with intake and eligibility determination, audits and house assessments, final inspections, contractor or crew management, and program administration. Also, do **NOT** include installation-related overhead costs such as those associated with vehicles, equipment, and training.

	In-House Crew	**Contractor**	**Total**
70a. Material costs			
70b. Labor costs[1]			
70c. Profit/overhead[2]			
70d. Total[3]			

[1]Crew-based labor costs should be based on the crew's fully loaded hourly rate (rather than the crew's take-home pay rate) which may include costs associated with medical and other insurance, workers compensation, vacations, and other benefits. These labor costs should include the crew's time for traveling to and from the job site.

[2]If contractor profit and overhead are included in the contractor's material and labor costs, then leave these cells blank.

[3]If the contractor costs are not split out by material and labor, then just enter the total costs.

Divide the total costs spent on this housing unit (cell in lower right corner of above table) into the following expenditure categories:

Expenditure category	Costs[1]
71a. Cost-effective energy-related measures (SIR > 1.0)	
71b. Incidental repairs	
71c. Health and safety, repairs, and other non-cost-effective measures	
71d. Total	
[1]71e. Labor and material	

Divide the total costs spent on this housing unit (cell in lower right corner of the two above tables) into the following funding sources:

Funding source	Total funds
72a. DOE funds	
72b. Non-DOE funds	
72c. Total	

Building Type Definitions:

Single-family detached house—House that provides living space for one family or household, is contained within walls that go from the basement (or the ground floor, if there is no basement) to the roof, and has no walls that are shared (or built in contact) with another household. A manufactured house assembled on site is a single-family detached housing unit, not a mobile home.

Single-family attached house—House that provides living space for one family or household, is contained within walls that go from the basement (or the ground floor, if there is no basement) to the roof, has at least one wall that is shared (or built in contact) with an adjacent household, and has an independent outside entrance. An attached house is not divided into more than one housing unit and does not have a household living above or below another one within the walls extending from the basement to the roof to separate any adjacent units. Examples include a house that is a side-by-side duplex, part of a townhouse building, and a row house.

Mobile home—Home that is built on a movable chassis, is moved to the site, and may be placed on a permanent or temporary foundation. If rooms are added to the structure, it is considered a mobile home if the added floor area is less than the mobile home's original floor area; otherwise, it is a single-family detached house. A manufactured house assembled on site is a single-family detached house, not a mobile home.

Small multifamily—Building with two to four housing units (i.e., building that is divided into living quarters for two, three, or four families or households) in which one household lives above or beside another and does not meet the single-family attached house definition. Includes houses originally intended for occupancy by one family (or for some other use) that have since been converted to separate dwellings for two to four families. Typical arrangements in these types of living quarters are separate apartments downstairs and upstairs or one apartment on each of three or four floors.

Large multifamily—Building with five or more housing units (i.e., building that contains living quarters for five or more families or households) that does not meet the single-family attached house definition.

Shelter—Structure whose principal purpose is to house individuals on a temporary basis who may or may not be related to one another and who are not living in nursing homes, prisons, or similar institutional care facilities.

OMB Control Number: XXXX-XXXX

APPENDIX G. DF3: BUILDING INFORMATION SURVEY

This survey collects detailed information about multifamily buildings weatherized (or waitlisted) by your agency that have been selected for analysis by the national evaluation. The data you supply will be used with billing history data to better understand energy savings attributable to the Weatherization Assistance Program.

Please use this form to provide information about small or large multifamily buildings in which the whole building and all units in the building were weatherized or are waitlisted. The Housing Unit Information Survey should be used to document information on any single family detached and attached houses, mobile homes, or individual units within multifamily buildings. Refer to the definitions of each building type provided at the end of the survey because these definitions are slightly different than those commonly used within the Weatherization Assistance Program.

Public reporting burden for this collection of information is estimated to average eight hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Records Management Division, IM-11, Paperwork Reduction Project (XXXX-XXXX), U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project (XXXX-XXXX), Washington, DC 20503.

All of the information obtained from this survey will be protected and will remain confidential. The data will be analyzed in such a way that the information provided cannot be associated back to your state, your agencies, or the housing units and clients that your state served.

Form completed by: _____ Date: _____

Building identification number (provided by the evaluation team): _____

IDENTIFICATION

1. Subgrantee (agency) name: _____

2. State: _____

3. Agency job number: _____

4. Building name: _____

5. Site address:_____ 6. City: _____

7. If this building is currently waitlisted, check here ☐ and complete only the Building Information and Households sections below.

WEATHERIZATION INFORMATION

Weatherization dates (not audit or inspection dates):

8a. Started: _____ _____ _____

8b. Completed _____ _____ _____

(month) (day) (year)

9. Was this a "reweatherized" building? ***(Check only one)***

☐ Yes
☐ No
☐ Don't know

10. Does the building meet your state's definition for being a high residential energy user? ***(Check only one)***

☐ Yes
☐ No
☐ No state definition in place
☐ Not applicable
☐ Don't know

11. Did the building owner or any occupants of housing units within the building file a complaint about the weatherization services you provided? ***(Check only one)***

☐ Yes
☐ No
☐ Don't know

BUILDING INFORMATION

12. Building type – see definitions at end of form: ***(Check only one)***

☐ Small multifamily building (2-4 units per building and not a SF attached house)
☐ Large multifamily building (5 or more units per building and not a SF attached house)
☐ Don't know

13. Number of housing units in the building: _____

14. Number of housing units in the building that met the Program's eligibility requirements: ___

15. Number of stories above grade: ***(Check only one)***

☐ 1
☐ 2
☐ 3
☐ 4
☐ 5-9
☐ 10-19
☐ 20 or more
☐ Don't know

16. Year building originally built: ***(Check only one)***

- ☐ 2000 or later
- ☐ 1990 to 1999
- ☐ 1980 to 1989
- ☐ 1970 to 1979
- ☐ 1960 to 1969
- ☐ 1950 to 1959
- ☐ 1940 to 1949
- ☐ 1930 to 1939
- ☐ 1920 to 1929
- ☐ 1910 to 1919
- ☐ 1900 to 1909
- ☐ Before 1900
- ☐ Don't know

Conditioned floor area at the time of weatherization:

17a. Heated floor area: _____ ft² ☐ Don't know

17b. Air conditioned floor area: _____ft² ☐ Don't know

18. Primary fuel used to heat the building during the winter before weatherization: ***(Check only one)***

- ☐ Natural gas
- ☐ Propane/LPG
- ☐ Kerosene (#1 fuel oil)
- ☐ Fuel oil #2
- ☐ Fuel oil #4
- ☐ Fuel oil #5L
- ☐ Fuel oil #5H
- ☐ Fuel oil #6
- ☐ Electricity
- ☐ Wood
- ☐ Coal
- ☐ Steam (purchased from a central distribution system)
- ☐ Hot water (purchased from a central distribution system)
- ☐ Other (specify: _____)
- ☐ Don't know

19. Type of *primary* space-heating system before weatherization: ***(Check only one)***

- ☐ Central (ducted) warm-air furnace (forced-air or gravity, any fuel including electricity)
- ☐ Heat pump
- ☐ Built-in electric units (e.g., electric baseboards, ceiling heat)
- ☐ Steam or hot water system (e.g., floor or baseboard radiators, convectors)
- ☐ Floor, wall, or pipeless (ductless) furnace (e.g., floor or wall furnace)
- ☐ Room/space heater (nonportable)
- ☐ Portable space heater
- ☐ Cooking stove
- ☐ None
- ☐ Don't know

20. Was the primary space-heating system a central system? ***(Check only one)***

- ☐ Yes, a central system that supplied heat to all or most of the units in the building
- ☐ No, each unit had its own heating system
- ☐ Don't know

21. *Supplemental* fuel used to heat the unit during the winter before weatherization: ***(Check all that apply)***

- ☐ Natural gas
- ☐ Propane/LPG
- ☐ Kerosene (#1 fuel oil)
- ☐ Fuel oil (#2 fuel oil)
- ☐ Electricity
- ☐ Wood
- ☐ Other (specify: _____)
- ☐ None
- ☐ Don't know

22. Type of *operable* air conditioning system present before weatherization: ***(Check all that apply)***

- ☐ Central air conditioner/heat pump
- ☐ Window/wall units
- ☐ Evaporative cooling system ("swamp coolers")
- ☐ None
- ☐ Don't know

23. Number of window/wall air conditioning units: ***(Check only one)***

- ☐ None
- ☐ 1-4
- ☐ 5-9
- ☐ 10-19
- ☐ 20-49
- ☐ 50 or more
- ☐ Don't know

AUDIT

24. Primary method used to select weatherization measures for this building (excluding health, safety, and repair measures and general heat waste measures): ***(Check only one)***

- ☐ Priority list
- ☐ Calculation procedure (e.g., spreadsheet, computerized audit)
- ☐ Other (specify: _____)

25. If a calculation procedure was used, the name of the procedure(s): ***(Check all that apply)***

- ☐ AK Warm
- ☐ EA-3
- ☐ EASY
- ☐ EA-QUIP
- ☐ HomeCheck
- ☐ Meadows
- ☐ REES
- ☐ REM/Rate
- ☐ SMOC-ERS
- ☐ TIPS
- ☐ TREAT
- ☐ Weatherization Assistant (NEAT/MHEA)
- ☐ WXEOR
- ☐ Other (specify: _____)
- ☐ Not applicable

DIAGNOSTICS AND INSPECTIONS

Indicate which of the following diagnostic measurements and inspections were performed by your agency on **THIS** building and when they were performed: ***(Check all that apply)***

Diagnostic measurement or inspection	Diagnostic/inspection performed during:		
	Audit/house assessment	**Measure installation**	**Post-inspection**
Pressure diagnostics:			
26a. Blower door measurement (building air leakage rate)	☐	☐	☐
26b. Zonal pressure	☐	☐	☐
26c. Room-to-room pressures (distribution system balancing)	☐	☐	☐
26d. Duct pressure pan measurements	☐	☐	☐
26e. Duct blower measurement (duct air leakage rate)	☐	☐	☐
26f. Blower door subtraction meas. (duct air leakage rate)	☐	☐	☐
Space-heating system:			
27a. Flue gas analysis (steady-state efficiency measurement)	☐	☐	☐
Space-heating system (continued):			
27b. Heat rise	☐	☐	☐
27c. CO level in flue	☐	☐	☐
27d. CO level of equipment room	☐	☐	☐
27e. Draft/spillage (normal operation)	☐	☐	☐
27f. Worst case draft/spillage (CAZ)	☐	☐	☐
27g. Safety inspection	☐	☐	☐
Air-conditioning system:			
28a. Refrigerant charge (e.g., superheat or subcooling)	☐	☐	☐
28b. Safety inspection	☐	☐	☐
HVAC components:			
29a. Air handler flow rate	☐	☐	☐
29b. Thermostat anticipator current	☐	☐	☐

Diagnostic measurement or inspection	Diagnostic/inspection performed during:		
	Audit/house assessment	Measure installation	Post-inspection
Hot-water (water-heating) system:			
30a. Flue gas analysis (steady-state efficiency measurement)	☐	☐	☐
30b. CO level in flue	☐	☐	☐
30c. CO level of equipment room	☐	☐	☐
30d. Draft/spillage (normal operation)	☐	☐	☐
30e. Worst case draft/spillage (CAZ)	☐	☐	☐
30f. Hot water temperature	☐	☐	☐
30g. Shower head flow rate	☐	☐	☐
30h. Faucet flow rate	☐	☐	☐
30i. Safety inspection	☐	☐	☐
Other CO measurements:			
31a. Cook stove	☐	☐	☐
Other CO measurements continued:			
31b. Kitchen	☐	☐	☐
31c. Main living area	☐	☐	☐
Other diagnostics and inspections:			
32a. Refrigerator energy use	☐	☐	☐
32b. Exhaust fan air flow rate	☐	☐	☐
32c. Infrared scanning (camera)	☐	☐	☐
32d. Radon testing	☐	☐	☐
32e. Other (specify: _____)	☐	☐	☐
32f. Other (specify: _____)	☐	☐	☐
32g. Other (specify: _____)	☐	☐	☐

Record the diagnostic measurements taken on **THIS** housing unit: ***(Fill in all that were taken)***

Diagnostic measurement	Pre-weatherization	Post weatherization
Building air leakage (blower door measurement):		
33a. Air leakage rate	cfm	cfm
33b. House WRT outside pressure difference	Pa	Pa
Duct leakage (pressure pan measurements):		
34a. Sum of pressure pan readings	Pa	Pa
34b. Number of registers included in sum		
34c. House WRT outside pressure difference	Pa	Pa
Duct leakage (duct blower measurements):		
35a. Total duct leakage rate	cfm	cfm
35b. Duct leakage to the outside	cfm	cfm
35c. Duct WRT outside pressure difference	Pa	Pa
Steady-state efficiency (flue gas analysis):		
36a. Primary space-heating system	%	%
36b. Secondary space-heating system	%	%
36c. Hot water heater	%	%

MEASURES INSTALLED

Identify the measures that were installed on **THIS** building: ***(Check all that apply)***

Measure	Installed by	
	In-house crew	**Contractor**
Air sealing work:		
37a. General house caulking and weatherstripping (e.g., doors, windows)	☐	☐
37b. House air sealing emphasizing bypasses (leaks identified by auditor and/or crew without using a blower door)	☐	☐
37c. House air sealing emphasizing bypasses (leaks identified by auditor and/or crew with aid of a blower door)	☐	☐
37d. Air distribution system (duct) sealing and repair	☐	☐
37e. Other non-window air sealing work (specify: _____)	☐	☐
Insulation:		
38a. Attic insulation (installed where there was no existing insulation)	☐	☐
38b. Attic insulation (added to existing insulation)	☐	☐
38c. Wall insulation (normal density—two-hole gravity blow technique)	☐	☐
38d. Wall insulation (high density—one-hole tube-fill technique)	☐	☐
38e. Floor insulation	☐	☐
38f. Rim or band joist insulation	☐	☐
38g. Foundation wall insulation	☐	☐
38h. Duct insulation	☐	☐
38i. White roof coat	☐	☐
38j. Skirting	☐	☐
38k. Other insulation (specify: _____)	☐	☐

Measure	Installed by	
	In-house crew	Contractor
Windows:		
39a. New window (justified because cost-effective)	☐	☐
39b. New window (justified for reason other than cost-effectiveness)	☐	☐
39c. Window glazings	☐	☐
39d. New window screen	☐	☐
39e. Window lock replacement	☐	☐
39f. Window screen repair	☐	☐
39g. Other window repair (e.g., sashes, frames)	☐	☐
39h. Storm window	☐	☐
39i. Window shading (e.g., awning, film, sun screen)	☐	☐
39j. Other window treatments (specify: _____)	☐	☐
Doors:		
40a. New door (justified because cost-effective)	☐	☐
40b. New door (justified for reason other than cost-effectiveness)	☐	☐
40c. Door lock (new or replacement)	☐	☐
40d. Door or door framing repair	☐	☐
40e. Storm door	☐	☐
40f. Other door treatments (specify: _____)	☐	☐
Space-heating systems:		
41a. New space-heating system (justified because cost-effective)	☐	☐
41b. New space-heating system (justified for reason other than cost-effectiveness)	☐	☐
41c. Space-heating system repair (e.g., controls, safety items, flues)	☐	☐
41d. Space-heating system tune-up	☐	☐
41e. Vent damper	☐	☐
41f. Intermittent ignition device	☐	☐
41g. Other space-heating system modification (specify: _____)	☐	☐

Measure	Installed by	
	In-house crew	Contractor
Air-conditioning systems:		
42a. New air conditioner (justified because cost-effective)	☐	☐
42b. New air conditioner (justified for reason other than cost-effectiveness)	☐	☐
Air-conditioning systems (continued):		
42c. Air conditioner repair	☐	☐
42d. Air conditioner recharge/tune-up	☐	☐
42e. Ceiling or whole-house fans	☐	☐
42f. Other air-conditioning system modification (specify: _____)	☐	☐
Ventilation:		
43a. Exhaust fan in bathroom	☐	☐
43b. Exhaust fan in kitchen	☐	☐
43c. Whole-house ventilation system	☐	☐
43d. Other ventilation system improvements (specify: _____)	☐	☐
HVAC accessories:		
44a. New programmable (setback) thermostat	☐	☐
44b. New standard thermostat	☐	☐
44c. Duct vents, grills, or registers	☐	☐
44d. Standard air filter	☐	☐
44e. High efficiency particulate arresting (HEPA) air filter	☐	☐
44f. Other HVAC accessories (specify: _____)	☐	☐
Water-heating system:		
45a. New water heater (justified because cost-effective)	☐	☐
45b. New water heater (justified for reason other than cost-effectiveness)	☐	☐

Measure	Installed by	
	In-house crew	Contractor
Water-heating system (continued):		
45c. Water-heating system repair	☐	☐
45d. Water-heater tank insulation wrap	☐	☐
45e. Pipe insulation	☐	☐
45f. Low-flow showerhead	☐	☐
45g. Faucet aerators	☐	☐
45h. Water heater temperature reduction	☐	☐
45i. Other water heating system measure (specify: _____)	☐	☐
Other baseloads:		
46a. Indoor lighting	☐	☐
46b. Outdoor lighting	☐	☐
46c. Refrigerator (justified because cost-effective)	☐	☐
46d. Refrigerator (justified for reason other than cost-effectiveness)	☐	☐
46e. Other baseload measure (specify: _____)	☐	☐
Client education:		
47a. Literature (e.g., brochures, booklets, and manuals)	☐	☐
47b. Videos, DVDs, or compact disks (CDs)	☐	☐
47c. Hardware kits and/or kits of weatherization materials	☐	☐
47d. <5 minute total in-home education/discussion time per unit	☐	☐
47e. 5-14 minute total in-home education/discussion time per unit	☐	☐
47f. 15-29 minute total in-home education/discussion time per unit	☐	☐
47g. 30-60 minute total in-home education/discussion time per unit	☐	☐
47h. >1 hour total in-home education/discussion time per unit	☐	☐

Measure	Installed by	
	In-house crew	Contractor
Client Education (continued):		
47i. Classroom training	☐	☐
47j. Other client education approach (specify: _____)	☐	☐
Other health, safety, and repair:		
48a. Smoke alarm	☐	☐
48b. CO monitor	☐	☐
48c. Attic ventilation	☐	☐
48d. Roof repair	☐	☐
48e. Ceiling repair	☐	☐
48f. Wall repair	☐	☐
48g. Floor repair	☐	☐
48h. Foundation repair	☐	☐
48i. Ground vapor barrier	☐	☐
48j. Gutter or downspout (installed or repaired)	☐	☐
48k. Grading of lot	☐	☐
48l. Plumbing repair	☐	☐
48m. Sewer repair	☐	☐
48n. Electrical repair	☐	☐
48o. Stair repair	☐	☐
48p. Install/repair non-skid material on stairs	☐	☐
48q. Install/repair safety gate at stairs	☐	☐
48r. Install/repair grab bar in bathroom	☐	☐
48s. Install/repair non-skid material in bathtub	☐	☐
48t. Install/repair metal chimney liner	☐	☐
48u. Lead abatement	☐	☐

Other health, safety, and repair (continued):		
48v. Asbestos abatement	☐	☐
48w. Removal or safe storage of household poisons	☐	☐
48x. Other H&S and repair items (specify: _____)	☐	☐

49. If a new space-heating system was installed, indicate the primary fuel used to heat the building during the winter after weatherization: ***(Check only one)***

- ☐ Natural gas
- ☐ Propane/LPG
- ☐ Kerosene (#1 fuel oil)
- ☐ Fuel oil #2
- ☐ Fuel oil #4
- ☐ Fuel oil #5L
- ☐ Fuel oil #5H
- ☐ Fuel oil #6
- ☐ Electricity
- ☐ Wood
- ☐ Coal
- ☐ Steam (purchased from a central distribution system)
- ☐ Hot water (purchased from a central distribution system)
- ☐ Other (specify: _____)
- ☐ Don't know
- ☐ Not applicable

50. If a new space-heating system was installed, indicate the type of *primary* space-heating system after weatherization: ***(Check only one)***

- ☐ Central (ducted) warm-air furnace (forced-air or gravity, any fuel including electricity)
- ☐ Heat pump
- ☐ Built-in electric units (e.g., electric baseboards, ceiling heat)
- ☐ Steam or hot water system (e.g., floor or baseboard radiators, convectors)
- ☐ Floor, wall, or pipeless (ductless) furnace (e.g., floor or wall furnace)
- ☐ Room/space heater (nonportable)
- ☐ Portable space heater
- ☐ Cooking stove
- ☐ None
- ☐ Don't know
- ☐ Not applicable

51. If a new space-heating system was installed and justified for reasons other than cost-effectiveness, identify the reason it was replaced: ***(Check all that apply)***

- ☐ Cost of repair/retrofit exceeded 50% of replacement cost
- ☐ Existing heating system was not running
- ☐ Existing heating system was old (e.g., at end of life, too old to be repaired/adjusted)
- ☐ To switch fuel

- ☐ To convert from a steam system to a hot water system
- ☐ Heat exchanger was cracked
- ☐ Boiler was leaking
- ☐ Safety switches/controls were not operational and could not be repaired
- ☐ To replace unvented space heater(s)
- ☐ Existing heating system was not safe to run for other reason (specify: _____)
- ☐ Other (specify: _____)

52. Please identify any cost-effective energy-efficiency measures (not repair or health and safety measures) recommended by your audit procedures that you were unable to install in this housing unit because of insufficient funds: ***(Check all that apply)***

- ☐ Air sealing
- ☐ Duct sealing
- ☐ Attic insulation
- ☐ Wall insulation
- ☐ Floor/foundation insulation
- ☐ Duct insulation
- ☐ New window(s)
- ☐ Storm windows(s)
- ☐ Door(s)
- ☐ Storm door(s)
- ☐ New space-heating system
- ☐ Space-heating system tune-up
- ☐ New air conditioner(s)
- ☐ Air conditioner tune-up(s)
- ☐ HVAC thermostat
- ☐ New water heater
- ☐ Water heater insulation wrap
- ☐ Water flow devices (e.g., showerheads, faucet aerators)
- ☐ Lighting
- ☐ Refrigerator
- ☐ Other: _____
- ☐ None

53. If energy efficiency measures were checked in the previous question, provide a rough estimate of the cost for installing all the measures checked: $_____

54. Please identify any repair or health and safety measures recommended by your audit procedures that you were unable to install in this building because of insufficient funds: ***(Check all that apply)***

- ☐ New window(s)
- ☐ Window glazing(s)
- ☐ Window screen(s)
- ☐ Window lock(s)
- ☐ Window repair
- ☐ New door(s)
- ☐ Door lock(s)
- ☐ Door repair
- ☐ New space-heating system
- ☐ Space-heating system repair
- ☐ New air conditioner(s)
- ☐ Air conditioner repair
- ☐ Ceiling or whole-house fan(s)
- ☐ Exhaust fan(s) or ventilation system
- ☐ New water heater(s)
- ☐ Water-heating system repair
- ☐ Refrigerator(s)
- ☐ Smoke alarm(s)
- ☐ CO monitor(s)
- ☐ Attic ventilation
- ☐ Roof, wall, floor, or foundation repair
- ☐ Plumbing/sewer repair
- ☐ Electrical repair
- ☐ Other: _____
- ☐ None

55. If repair or health and safety measures were checked in the previous question, provide a rough estimate of the cost for installing all the measures checked: $_____

COSTS

Provide the costs associated with installing the measures in **THIS** building from all funding sources. Do **NOT** include any program management costs such as those associated with intake and eligibility determination, audits and house assessments, final inspections, contractor or crew management, and program administration. Also, do **NOT** include installation-related overhead costs such as those associated with vehicles, equipment, and training.

	In-House Crew	**Contractor**	**Total**
56a. Material costs			
56b. Labor costs[1]			
56c. Profit/overhead[2]			
56d. Total[3]			

[1]Crew-based labor costs should be based on the crew's fully loaded hourly rate (rather than the crew's take-home pay rate) which may include costs associated with medical and other insurance, workers compensation, vacations, and other benefits. These labor costs should include the crew's time for traveling to and from the job site.

[2]If contractor profit and overhead are included in the contractor's material and labor costs, then leave these cells blank.

[3]If the contractor costs are not split out by material and labor, then just enter the total costs.

Divide the total costs spent on this building (cell in lower right corner of above table) into the following expenditure categories:

Expenditure category	Costs[1]
57a. Cost-effective energy-related measures (SIR > 1.0)	
57b. Incidental repairs	
57c. Health and safety, repairs, and other non-cost-effective measures	
57d. Total	
[1]57e. Labor and material	

Divide the total costs spent on this building (cell in lower right corner of the two above tables) into the following funding sources:

Funding source	Total funds
58a. DOE funds	
58b. Non-DOE funds	
58c. Total	

Building Type Definitions:

Single-family detached house—House that provides living space for one family or household, is contained within walls that go from the basement (or the ground floor, if there is no basement) to the roof, and has no walls that are shared (or built in contact) with another household. A manufactured house assembled on site is a single-family detached housing unit, not a mobile home.

Single-family attached house—House that provides living space for one family or household, is contained within walls that go from the basement (or the ground floor, if there is no basement) to the roof, has at least one wall that is shared (or built in contact) with an adjacent household, and has an independent outside entrance. An attached house is not divided into more than one housing unit and does not have a household living above or below another one within the walls extending from the basement to the roof to separate any adjacent units. Examples include a house that is a side-by-side duplex, part of a townhouse building, and a row house.

Mobile home—Home that is built on a movable chassis, is moved to the site, and may be placed on a permanent or temporary foundation. If rooms are added to the structure, it is considered a mobile home if the added floor area is less than the mobile home's original floor area; otherwise, it is a single-family detached house. A manufactured house assembled on site is a single-family detached house, not a mobile home.

Small multifamily—Building with two to four housing units (i.e., building that is divided into living quarters for two, three, or four families or households) in which one household lives above or beside another and does not meet the single-family attached house definition. Includes houses originally intended for occupancy by one family (or for some other use) that have since been converted to separate dwellings for two to four families. Typical arrangements in these types of living quarters are separate apartments downstairs and upstairs or one apartment on each of three or four floors.

Large multifamily—Building with five or more housing units (i.e., building that contains living quarters for five or more families or households) that does not meet the single-family attached house definition.

Shelter—Structure whose principal purpose is to house individuals on a temporary basis who may or may not be related to one another and who are not living in nursing homes, prisons, or similar institutional care facilities.

OMB Control Number: XXXX-XXXX

APPENDIX H. DF4: ELECTRIC & NATURAL GAS BILLING INFORMATION FROM AGENCIES DATA FORM

This data form collects detailed information about single family and multifamily homes weatherized (or waitlisted) by your agency in Program Years 2007, 2008 and 2009. The data you supply will be used to characterize the program and collect utility billing histories pre- and post-weatherization to better understand energy savings attributable to the Weatherization Assistance Program.

Public reporting burden for this collection of information is estimated to average thirty-two hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Records Management Division, IM-11, Paperwork Reduction Project (XXXX-XXXX), U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project (XXXX-XXXX), Washington, DC 20503.

All of the information obtained from this survey and from utilities will be protected and will remain confidential. The data will be analyzed in such a way that the information provided cannot be associated back to your state, your agencies, or the housing units and clients that your state served.

Requested Initial Information: Part A of Sections 2 and 3

We would like to collect electricity and natural gas billing data on a number of housing units served by your agency. To help us randomly select a sample of weatherized units, please use Part A in Sections 2 and 3 of this form to provide the job numbers and building type for all the housing units that you weatherized in Program Years XXXX and homes on your waiting list for Program Year XXXX. If you store the necessary housing unit data (job number, building type, utility name, utility account number, and weatherization date) in an electronic format, then all units will be selected.

Additional Information: Part B of Section 2 and Part B and C of Section 3

Once we have selected a sample from your list of clients, we will ask you to complete Part B in Section 2 and Parts B and C in Section 3 to provide additional information for each of the selected units, including utility account numbers, fuel release forms and weatherization dates. This information will support the collection of utility billing data for sampled units. Agencies can choose to provide the information requested in Parts B and C now for **all** units, or submit the information requested in Parts B and C **for sampled units only** after those units have been identified in a subsequent data request. Please note that Part B requires copies of all utility billing data release forms to be attached.

Utility Information: Section 4

Please provide contact information for each utility listed in Sections 2 and 3.

HAVING TROUBLE COPYING REST OF DF4….

OMB Control Number: XXXX-XXXX

APPENDIX I: DF5A - NATIONAL WEATHERIZATION ASSISTANCE PROGRAM EVALUATION HOUSEHOLD ELECTRICITY USAGE FORM

This data is being collected to assist in the evaluation of energy savings attributable to the U.S. Department of Energy's Weatherization Assistance Program.

Public reporting burden for this collection of information is estimated to average twenty-four hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Records Management Division, IM-11, Paperwork Reduction Project (XXXX-XXXX), U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project (XXXX-XXXX), Washington, DC 20503.

All of the information obtained from this data form will be protected and will remain confidential. The data will be analyzed in such a way that the information provided cannot be associated back to your utility or the housing units and buildings that your utility served.

STEP 1 – Review List of Customer Accounts

This form is accompanied by a list of households that have voluntarily participated in the Weatherization Assistance Program (WAP). These program participants have indicated that your company furnishes electric services to their household and have signed an ***Authorization Form*** that allows you to release data to ORNL for purposes of program evaluation. The list of customer accounts includes the following information:

Field	**Purpose**	**Notes**
Utility Company ID	Internal reference number	Developed by Evaluation Team
WAP Project ID	Internal reference number	Developed by Evaluation Team
Customer Account Number	Identifies record to be extracted	Collected by local agency from client at the time of service delivery
Customer Last Name	Last name of program participant	Individual who signed the utility data Authorization Form
Customer First Name	First name of program participant	
Service Address (Line 1)	Service address	Address at which the weatherization services were delivered
Service Address (Line 2)	Supplemental address information	
City	City	
State	State	
ZIP	ZIP	

Please review this list of customers and confirm that the listed account numbers are consistent with your records.

STEP 2 – Prepare a Data File with Customer Usage and Charge Information

Please furnish an electronic data file with monthly electric usage and charge information for the period from XXXX through XXXX. The extract should furnish one record for each month for each customer. The required information includes:

Field	**Purpose**	**Notes**
Utility Company ID	Internal reference number	Developed by Evaluation Team
WAP Project ID	Internal reference number	Developed by Evaluation Team
Customer Account Number	Identifies record to be extracted	Collected by local agency from client at the time of service delivery
Customer Last Name	Last name of program participant	Individual who signed the utility data Authorization Form
Customer First Name	First name of program participant	
Service Address (Line 1)	Service address	Address at which the weatherization services were delivered
Service Address (Line 2)	Supplemental address information	
City	City	
State	State	
ZIP	ZIP	
Meter Read Date	Date of the read	MM/DD/YYYY or MM/DD/YY
Days in Billing Period	Allows computation of start date	XXX
Meter Reading Code	Allows assessment of data quality	A = Actual E = Estimated P = Phone / postcard customer read C = Corrected F = Final
Usage Amount (kWh)	Furnishes consumption amount	Reported in kWh
Usage Charge ($$$.cc)	Furnishes charge amount	Report usage charge only (exclude service charge and charges for other services)

We are interested in the monthly electricity consumption for each housing unit, even if a change of occupancy has occurred. We will review the monthly customer name field to identify a change of occupancy

STEP 3 – Return Data File via CD or FTP

Your case manager will furnish instructions for delivery of the data file. The data can be delivered on a password protected CD or via a secure FTP site.

HOUSEHOLD ELECTRIC USAGE FORM EXAMPLE

Utility Data Request ID	Project Housing Unit ID	Account Number	Last Name	First Name	Service Address	Service Address Line 2	City	State	ZIP Code	Meter Read Date (mm/dd/yy)	Days in Billing Cycle	Meter-Read Code A/E/P/C/F	Usage (kWh)	Charge ($$$.cc)

NATIONAL WEATHERIZATION ASSISTANCE PROGRAM EVALUATION
HOUSEHOLD ELECTRICITY USAGE FORM
FREQUENTLY ASKED QUESTIONS

What is the purpose of the National WAP Evaluation?

We are evaluating the performance of the U.S. Department of Energy's Weatherization Assistance Program, which is a program that installs energy efficiency measures in the homes of low-income clients. A primary component of the evaluation is to determine the electricity savings achieved by the Program in housing units heated primarily by electricity or natural gas.

What is the purpose of this form?

These data are being collected to estimate change in electricity use in homes weatherized by the Weatherization Assistance Program. The data you supply will be used in statistical procedures to estimate electricity savings.

How do I know this is a valid U.S. Government survey?

All U.S. Government surveys are required to be reviewed by the U.S. Office of Management and Budget (OMB). An OMB approved survey will have a valid OMB number and expiration date on the data collection form. You will find the OMB approval number and expiration date at the top right-hand corner of this form. In addition, if you wish to contact someone at the Oak Ridge National Laboratory to verify that this is a valid survey, call Bruce Tonn at 865-574-4041 or you can email him at bet@ornl.gov.

What data are to be reported and in what format?

The monthly billing data should be provided to us in electronic format. At a minimum for each month, the billing information should identify the account number, the customer name, the service address, the date the meter was read, the meter reading or the consumption, any code associated with the reading (e.g., estimated value), and the kWh charge. See the attached form for an example of how we would like the data formatted. We are interested in the monthly energy consumptions of each housing unit, even if a change of occupancy has occurred.

How do I know that this information request does not violate my customer's privacy?

We have obtained fuel release forms for all the account numbers shown above. Please contact us if you need to see copies of these signed forms.

In addition, the information that you provide will be protected and will remain confidential. When analysis results are reported, energy use and savings will not be associated with the housing units, account numbers, or the names of the clients in any way.

Who is conducting the survey?

The sponsor of this survey, the Energy Efficiency and Renewable Energy Branch of the U.S. Department of Energy, has contracted with Oak Ridge National Laboratory (ORNL) to conduct this evaluation. ORNL has subcontracted with APPRISE Incorporated and their partner the Energy Center of Wisconsin (ECW) to collect the information for this evaluation. You will return your completed forms on CD to ECW or will upload your data file to the secure website identified by ECW.

How long will it take to complete this form?

Public reporting burden for this collection of information is estimated to average 24 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

How may I report these data? What format can I use?
We are furnishing a data file with account number, name, and service address. By merging these data will your records, you will be able to develop an electronic data file with the required information. You should send this data file by mail to ECW on a password protected CD or upload this data file to the secure FTP site furnished by ECW. Under special circumstances, you can furnish data in other formats. Please consult with your case manager at ECW to discuss other options.

OMB Control Number: XXXX-XXXX

APPENDIX J. DF5B: NATIONAL WEATHERIZATION ASSISTANCE PROGRAM EVALUATION HOUSEHOLD NATURAL GAS USAGE FORM

This data is being collected to assist in the evaluation of energy savings attributable to the U.S. Department of Energy's Weatherization Assistance Program.

Public reporting burden for this collection of information is estimated to average twenty-four hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Records Management Division, IM-11, Paperwork Reduction Project (XXXX-XXXX), U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project (XXXX-XXXX), Washington, DC 20503.

All of the information obtained from this data form will be protected and will remain confidential. The data will be analyzed in such a way that the information provided cannot be associated back to your utility or the housing units and buildings that your utility served.

STEP 1 – Review List of Customer Accounts

This form is accompanied by a list of households that have voluntarily participated in the Weatherization Assistance Program (WAP). These program participants have indicated that your company furnishes natural gas services to their household and have signed an ***Authorization Form*** that allows you to release data to ORNL for purposes of program evaluation. The list of customer accounts includes the following information:

Field	**Purpose**	**Notes**
Utility Company ID	Internal reference number	Developed by Evaluation Team
WAP Project ID	Internal reference number	Developed by Evaluation Team
Customer Account Number	Identifies record to be extracted	Collected by local agency from client at the time of service delivery
Customer Last Name	Last name of program participant	Individual who signed the utility data Authorization Form
Customer First Name	First name of program participant	
Service Address (Line 1)	Service address	Address at which the weatherization services were delivered
Service Address (Line 2)	Supplemental address information	
City	City	
State	State	
ZIP	ZIP	

Please review this list of customers and confirm that the listed account numbers are consistent with your records.

STEP 2 – Prepare a Data File with Customer Usage and Charge Information

Please furnish an electronic data file with monthly natural gas usage and charge information for the period from XXXX through XXXX. The extract should furnish one record for each month for each customer. The required information includes:

Field	Purpose	Notes
Utility Company ID	Internal reference number	Developed by Evaluation Team
WAP Project ID	Internal reference number	Developed by Evaluation Team
Customer Account Number	Identifies record to be extracted	Collected by local agency from client at the time of service delivery
Customer Last Name	Last name of program participant	Individual who signed the utility data Authorization Form
Customer First Name	First name of program participant	
Service Address (Line 1)	Service address	Address at which the weatherization services were delivered
Service Address (Line 2)	Supplemental address information	
City	City	
State	State	
ZIP	ZIP	
Meter Read Date	Date of the read	MM/DD/YYYY or MM/DD/YY
Days in Billing Period	Allows computation of start date	XXX
Meter Reading Code	Allows assessment of data quality	A = Actual E = Estimated P = Phone / postcard customer read C = Corrected F = Final
Usage Amount	Furnishes consumption amount	Report units in next column
Units	Furnishes units	C = CCF M = MCF T = Therms D = dTherms O = Other
Usage Charge ($$$.cc)	Furnishes charge amount	Report usage charge only (exclude service charge and charges for other services)

We are interested in the monthly natural gas consumption of each housing unit, even if a change of occupancy has occurred. We will review the monthly customer name data to identify a change of occupancy

STEP 3 – Return Data File via CD or FTP

Your case manager will furnish instructions for delivery of the data file. The data can be delivered on a password protected CD or via a secure FTP site.

NATURAL GAS USAGE DATA FORM EXAMPLE

Utility Data Request ID	Project Housing Unit ID	Account Number	Last Name	First Name	Service Address	Service Address Line 2	City	State	ZIP Code	Meter Read Date (mm/dd/yy)	Days in Billing Cycle	Meter-Read Code A/P/E/C/F	Usage (report units in next column)	Units C/M/T/D/O	Charge ($$$.cc)

NATIONAL WEATHERIZATION ASSISTANCE PROGRAM EVALUATION
HOUSEHOLD NATURAL GAS USAGE FORM
FREQUENTLY ASKED QUESTIONS

What is the purpose of the National WAP Evaluation?

We are evaluating the performance of the U.S. Department of Energy's Weatherization Assistance Program, which is a program that installs energy efficiency measures in the homes of low-income clients. A primary component of the evaluation is to determine the natural gas savings achieved by the Program in housing units heated primarily by natural gas.

What is the purpose of this form?

These data are being collected to estimate change in natural gas use in homes weatherized by the Weatherization Assistance Program. The data you supply will be used in statistical procedures to estimate natural gas savings.

How do I know this is a valid U.S. Government survey?

All U.S. Government surveys are required to be reviewed by the U.S. Office of Management and Budget (OMB). An OMB approved survey will have a valid OMB number and expiration date on the data collection form. You will find the OMB approval number and expiration date at the top right-hand corner of this form. In addition, if you wish to contact someone at the Oak Ridge National Laboratory to verify that this is a valid survey, call Bruce Tonn at 865-574-4041 or you can email him at bet@ornl.gov.

What data are to be reported and in what format?

The monthly billing data should be provided to us in electronic format. At a minimum for each month, the billing information should identify the account number, the customer name, the service address, the date the meter was read, the meter reading or the consumption, the consumption units, any code associated with the reading (e.g., estimated value), and the usage charge. See the attached form for an example of how we would like the data formatted. We are interested in the monthly energy consumptions of each housing unit, even if a change of occupancy has occurred.

How do I know that this information request does not violate my customer's privacy?

We have obtained fuel release forms for all the account numbers shown above. Please contact us if you need to see copies of these signed forms.

In addition, the information that you provide will be protected and will remain confidential. When analysis results are reported, energy use and savings will not be associated with the housing units, account numbers, or the names of the clients in any way.

Who is conducting the survey?

The sponsor of this survey, the Energy Efficiency and Renewable Energy Branch of the U.S. Department of Energy, has contracted with Oak Ridge National Laboratory (ORNL) to conduct this evaluation. ORNL has subcontracted with APPRISE Incorporated and their partner the Energy Center of Wisconsin (ECW) to collect the information for this evaluation. You will return your completed forms on CD to ECW or will upload your data file to the secure website identified by ECW.

How long will it take to complete this form?

Public reporting burden for this collection of information is estimated to average 24 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

How may I report these data? What format can I use?

We are furnishing a data file with account number, name, and service address. By merging these data will your records, you will be able to develop an electronic data file with the required information. You should send this data file by mail to ECW on a password protected CD or upload this data file to the secure FTP site furnished by ECW. Under special circumstances, you can furnish data in other formats. Please consult with your case manager at ECW to discuss other options.

APPENDIX K. S4: OCCUPANT SURVEY

This data is being collected to conduct a survey of occupants about their experiences with the Weatherization Assistance Program and benefits they believe they have received from the program. The data you supply will be used to describe occupant satisfaction with the program as well as changes in energy education and non-energy benefits provided by the program.

Public reporting burden for this collection of information is estimated to average two hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Records Management Division, IM-11, Paperwork Reduction Project (**XXXX-XXXX**), U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project (**XXXX-XXXX**), Washington, DC 20503.

Lastly, all of the information obtained from this survey will be protected and will remain confidential. The data will be analyzed in such a way that the information provided cannot be associated back to you or your household. Your answers will not be shared with or reported back to anyone within the agency that served you or your state.

PRE-WEATHERIZATION SURVEY
{INTERVIEWER: STATE PRIOR TO PRE-WEATHERIZATION SURVEY ONLY}I will need to ask these questions of the adult in the household most involved with the weatherization of the home or the head of the household. Am I speaking to the right person?

POST-WEATHERIZATION SURVEY
{INTERVIEWER: VERIFY RESPONDENT IS THE SAME RESPONDENT FROM THE PRE-WEATHERIZATION SURVEY}Before we begin, I need to verify that this is the same person who completed this survey before your home received weatherization services. Am I speaking to the same person?

PLEASE RECORD RESPONDENT'S NAME, GENDER and AGE

	Name	Gender	Age
Main Respondent:			

1. How long have you lived in your current home?
   {If less than one year} Enter: _____ months
   Enter: _____ years

1a. {IF RESPONDENT HAS LIVED IN THE HOME < ONE YEAR} Has ANY OTHER ADULT living in the household lived in the home for more than one year?

(1) Yes
(2) No

{IF YES} Name _____
{IF NO: STOP SURVEY}

PART I. Energy Consumption, Non-Energy Impacts, Health and Demographics

2. Are you currently…?

(1) Married
(2) Divorced
(3) Widowed
(4) Separated
(5) Never married
(6) A member of an unmarried couple
(7) Refused

3. What is the highest degree or level of school you have completed?

(1) No Schooling Completed
(2) Kindergarten to grade 12 (No Diploma)
(3) High school diploma or GED
(4) Some college, no degree
(5) Associate's degree (for example: AA, AS)
(6) Bachelor's degree (for example: BA, BS)
(7) Master's degree (for example: MA, MS, MBA)
(8) Professional degree (for example: MD, JD)
(9) Doctorate degree (for example: PhD, EdD)
(10) Refused

4. Do you consider yourself to be of Hispanic or Latino origin, such as Mexican, Puerto Rican, Cuban, or other Spanish background?

(1) Yes
(2) No
(3) Don't know/Not Sure
(4) Refused

5. Which describes your race? You can select one or more categories.

(1) White
(2) Black or African-American
(3) American Indian or Alaska Native
(4) Asian
(5) Native Hawaiian or Other Pacific Islander
(6) Other (if volunteered)
(7) Hispanic or Latino (if volunteered)
(8) Refused

5a. {IF MORE THAN ONE} Which ONE of these groups best represents your race? You can select one or more categories.

(1) White
(2) Black or African-American
(3) American Indian or Alaska Native
(4) Asian
(5) Native Hawaiian or Other Pacific Islander
(6) Other (if volunteered)
(7) Hispanic or Latino (if volunteered)
(8) Refused

6. Were you born a citizen of the United States or did you become a citizen of the United States through naturalization?

(1) Born
(2) Naturalized
(3) Neither
(4) Refused

In this next section, I will be asking you about your home and your use of energy.

7. Do you rent or own your current residence?

(1) Rent
(2) Own
(3) Neither (Please describe the housing agreement).

_____

8. Which of the following best describes the location of your home? Do you live in a city, a town, the suburbs, or in a rural area?

(1) City
(2) Town
(3) Suburbs
(4) Rural
(5) Don't Know/Not Sure
(6) Refused

9. In the past 12 months has anyone in your household owned or had the regular use of any cars, trucks, vans, sports-utility-vehicles or similar vehicles? DO NOT INCLUDE MOTORCYCLES OR MOPEDS.

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

INTERVIEWER: "REGULAR USE" MEANS THE VEHCILE IS KEPT AT HOME <u>AND</u> IS AVAILABLE FOR <u>SOME</u> PERSONAL USE.

10. Thinking of the area where you live, in the past 12 months, have members of your household had regular access to public transportation? {PROBE: buses, trolley buses, trains, trams, rapid transit (metro/subway/underground), water taxi/ferries, free transportation offered by community services agencies, Medicaid covered transportation…)

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

11. Which of the following do you believe best describes your current home? Is it a… (INTERVIEWER: DEFINE EACH HOUSING TYPE IF NEEDED)

(1) Single-family detached house
(2) a Single-family attached house,
(3) an Apartment building with 2-4 units,
(4) an Apartment building with 5 or more units, or
(5) a Mobile home?

12. How many bedrooms do you have in your home? [*Include bedrooms in finished attics or finished basements*.] _____

13. Now think about other rooms in your home besides bedrooms and bathrooms. Not including unfinished areas, hallways, and closets, how many other rooms are there in your home?
_____

16. Is your home heated during the winter?

(1) Yes (SKIP to Q17)
(2) No
(3) Don't Know/Not Sure
(4) Refused

16a. {IF NO}You have just told me that you don't heat your home during the winter. Just to clarify, is it that you have heating equipment but don't use it, or does your home just not have any heating equipment?

(1) Have equipment, but don't use it (SKIP to Q8)
(2) Don't have any heating equipment
(3) Don't Know/Not Sure
(4) Refused

17. Last winter, did you heat all # (sum from Q12 ad Q13) rooms?

(1) Yes (SKIP to Q18)
(2) No
(3) Don't Know/Not Sure
(4) Refused

17a. How many of those rooms were not heated last winter?
Enter the number _____

18. Is any air conditioning equipment used in your home?

(5) Yes (SKIP to Q19)
(6) No
(7) Don't Know/Not Sure
(8) Refused

18a. (IF NO) Just to clarify, do you have air conditioning equipment but don't use it, or does your home just not have any air conditioning equipment?

(1) Have equipment, but don't use it (SKIP to Q 20)
(2) Don't have any air conditioning equipment
(3) Don't Know/Not Sure
(4) Refused

19. Last summer, did you air condition all # (sum Q12 and Q13) rooms?

(1) Yes (SKIP to Q20)
(2) No
(3) Don't Know/Not Sure
(4) Refused

19a.How many of those rooms were not cooled last summer?

Enter the number _____

20. Is any part of your home over a crawl space with exposed dirt as the floor?

(1) Yes
(2) No
(3) Don't Know/Not sure
(4) Refused

21. Is any part of your home over a basement?

(1) Yes
(2) No (SKIP TO 22)
(3) Don't Know/Not Sure
(4) Refused

21a. Do you use your basement for living space? That is, do you use it for work, play or sleep?

(1) Yes
(2) No (SKIP to Q22)
(3) Don't Know/Not Sure
(4) Refused

21b. Is the basement warm enough to be used as a living space in the winter?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

21c. Is the basement cool enough to be used as a living space in the summer?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

22. An attic is an area directly below the roof, accessible by stairs, with space for you to stand upright and easily move about. Does your home have an attic?

(1) Yes
(2) No (SKIP to Q23)
(3) Don't Know/Not Sure
(4) Refused

22a. Do you use the attic for living space? That is, do you use it for work, play or sleep?

(1) Yes
(2) No (SKIP to Q23)
(3) Don't Know/Not Sure
(4) Refused

22b. Is the attic warm enough to be used as a living space in the winter?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused
(5)

22c. Is the attic cool enough to be used as a living space in the summer?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

23. Does your home have a garage that is attached to or part of your home?

(1) Yes
(2) No (SKIP to 24)
(3) Don't Know/Not Sure
(4) Refused

23a. Do you warm up your vehicle in your garage?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

23b. Have you or anyone else living in your home observed the smell of vehicle exhaust inside your home?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

I have some questions about heating your home.

24. {IF NO TO HEAT FROM PREVIOUS SECTION SKIP TO COOLING}Let's start with the main source of heating in your home. Please tell me which type of heating equipment provides *most* of the heat for your home. Remember to include portable heaters, fireplaces, heating stoves and cooking stoves.

(1) Heat pump
(2) Central furnace with ducts to individual rooms
(3) Steam/Hot water system with radiators or pipes in each room
(4) Built-in electric units in each room installed in walls, ceilings, baseboards, or floors
(5) Built-in floor/wall pipeless furnace
(6) Built-in room heater burning gas, oil, or kerosene
(7) Heating stove burning wood, coal, or coke
(8) Portable heaters
(9) Fireplace
(10) Cooking stove used to heat your home as well as to cook
(11) Some other equipment (Specify _____)

25. Does the main heating equipment for your home also heat any other apartments, condos, households, businesses, or farm buildings?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

26. What is the *main* fuel used for heating your home? That is, which fuel is the one that provides the most heat for your home?

(1) Electricity
(2) Natural gas from underground pipes
(3) Propane (bottled gas)
(4) Fuel oil
(5) Kerosene
(6) Wood
(7) Biomass
(8) Solar or Wind
(9) Geothermal
(10) District steam
(11) Some other fuel (Specify _____)

27. You told me that [EQUIPM] is the main source of heat in your home. In the past 12 months, did you use any other types of heating equipment? Remember to include portable heaters, fireplaces, heating stoves and cooking stoves. CHECK ALL THAT APPLY

(1) No other equipment
(2) Heat pump
(3) Central furnace with ducts to individual rooms
(4) Steam/Hot water system with radiators or pipes in each room
(5) Built-in electric units in each room installed in walls, ceilings, baseboards, or floors
(6) Built-in floor/wall pipeless furnace
(7) Built-in room heater burning gas, oil, or kerosene
(8) Heating stove burning wood, coal, coke, or biomass (such as pellets or corn)
(9) Portable heaters
(10) Fireplace
(11) Cooking stove used to heat your home as well as to cook
(12) Some other equipment (Specify _____)

28. What fuel does the [FILL: EQUIPAUX] use?

(1) Electricity
(2) Natural gas from underground pipes
(3) Propane (bottled gas)
(4) Fuel oil
(5) Kerosene
(6) Wood
(7) Biomass (wood pellets or corn)
(8) Solar or Wind
(9) Geothermal
(10) District steam
(11) Some other fuel (Specify _____)

29. {IF YES WIND OR SOLAR FOR EITHER MAIN OR OTHER FUELS USED}
Do you have any on-site system that generates electricity such as a solar system or a small wind turbine?

(1) Yes
(2) No (SKIP to Q30)
(3) Don't Know/Not Sure
(4) Refused

29a. What type of on-site system do you have?

(1) Solar or Photovoltaic system
(2) Small wind turbine
(3) Combined Heat and Power system
(4) Other . Please specify_____

29b. Is your on-site system connected to the grid?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

30. {IF YES HEATING STOVE}Which statement best describes your heating stove?

(1) Manufactured before 1992
(2) Energy Star
(3) Neither
(4) Don't Know/Not Sure
(5) Refused

31. {IF YES FIREPLACE} Does this fireplace have a flue to the outside or is it entirely self-contained?

(1) Flue to the outside
(2) Flueless (self-contained)
(3) Don't Know/Not Sure
(4) Refused

32. {IF YES HEATING STOVE OR FIREPLACE}In the past 12 months how often did you have to burn garbage, cardboard, plastics, foam, colored ink, magazines, boxes, or wrappers to keep warm?

(1) Never
(2) Once
(3) Sometimes
(4) Often
(5) Most of the winter
(6) Don't Know/Not Sure
(7) Refused

33. {IF YES HEATING STOVE OR FIREPLACE}In the past 12 months how often did you have to burn coated, painted, or pressure-treated wood, driftwood, plywood, particle board, or any wood with glue in it to keep warm?

(1) Never
(2) Once
(3) Sometimes
(4) Often
(5) Most of the winter
(6) Don't Know/Not Sure
(7) Refused

34. {IF YES HEATING STOVE OR FIREPLACE}In the past 12 months how often did you have to burn wet, rotted, diseased, or moldy wood
to keep warm?

(1) Never
(2) Once
(3) Sometimes
(4) Often
(5) Most of the winter
(6) Don't Know/Not Sure
(7) Refused

35. What fuel does the cooking stove and/or oven use? CHECK ALL THAT APPLY

(1) Electricity
(2) Natural gas from underground pipes
(3) Propane (bottled gas)
(4) Fuel oil
(5) Kerosene
(6) Wood
(7) Some other fuel (Specify _____)
(8) No working stove or oven in the home

36. Is an exhaust fan that vents to the outside used regularly when cooking in your kitchen?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

37. In the past 12 months how often have you used your oven to heat your house?
(1) Never
(2) Rarely
(3) Sometimes
(4) Frequently
(5) All the time
(6) Don't Know/Not Sure
(7) Refused

38. Does your household use a microwave oven?
(1) Yes
(2) No (SKIP to 39)
(3) Don't Know/Not Sure
(4) Refused

38a. Which answer best describes how frequently your household uses the microwave to prepare hot meals and snacks in a typical week?
(1) Used to cook or reheat *most* meals and snacks
(2) Used to cook or reheat *about half* of meals and snacks
(3) Used to cook or reheat *a few* meals and snacks
(4) Used very little
(5) Don't Know/Not Sure
(6) Refused

39. Does your heating system have an air filter?
(1) Yes
(2) No (SKIP to 40)
(3) Don't know/Not Sure
(4) Refused

39a. Is the air filter in your heating system a High Efficiency Particulate Arresting (HEPA) filter?
(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

39b. Approximately, how often does someone in your household change (or clean) the air filter in your heating system?
(1) Monthly
(2) Every three months
(3) Every six months
(4) Once a year
(5) Once every two years
(6) Don't change (or clean) it
(7) Air filter is changed by service company
(8) Don't Know/Not Sure
(9) Refused

40. {IF YES FURNACE}Do you know when was the last time your furnace received maintenance service by a furnace contractor to ensure optimum and safe operation?

(1) Yes
(2) No (SKIP to Q41)
(3) Refused

40a. How many years and months ago did this occur? _____

41. Do you have a CO (or carbon monoxide) monitor in your house?

(1) Yes
(2) No (SKIP to Q 42)
(3) Don't know/Not Sure
(4) Refused

41a. Is your CO monitor currently working?

(1) Yes
(2) No
(3) Don't know/Not Sure
(4) Refused

42. Do you have one or more smoke detectors in your house?

(1) Yes
(2) No (SKIP to Q43)
(3) Don't know/Not Sure
(4) Refused

42a. How many smoke detectors are there in your house?

Enter Number _____
(1) Don't Know/Not Sure
(2) Refused

42b. How many of these smoke detectors are currently working?

Enter Number _____
(1) Don't Know/Not Sure
(2) Refused

43. In the past 12 months how many times has the fire department been called to put out a fire in your home during the past year? _____

44. In the past 12 months did any fire start in your home as a result of using an alternate *heating* source, such as space heaters, electric blankets, your kitchen stove or oven, heating stove, furnace, or your fireplace?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

45. In the past 12 months, how many individuals needed medical attention because of fire?

Enter Number_____

Now I have some questions about cooling your home.

46. (IF NO TO AIR CONDITIONING FROM PREVIOUS SECTION SKIP TO CEILING FAN USE Q47) Central air conditioning requires that the system have ducts to carry the cooled air to the individual rooms. These ducts may also carry warm air for space heating. Does your home have ducts like these?

(1) Yes
(2) No (SKIP to 47)
(3) Don't Know/Not Sure
(4) Refused

46a. Does the central air conditioning equipment that cools your home also cool any other apartments, condos, households, businesses, or farm buildings?

(1) Yes
(2) No

46b. Which of the statements shown best describes the way your central air conditioning system was used last summer?

(1) Not used at all (if volunteered)
(2) Turned on only a few days or nights when really needed
(3) Turned on quite a bit
(4) Turned on just about all summer

47. Which of the following statements best describes the way your household used the *most used* window/wall air conditioning unit last summer?

(1) Turned on only a few days or nights when really needed
(2) Turned on quite a bit
(3) Turned on just about all summer
(4) No working window/wall units in home

48. Which of the following statements best describes the way your household used a *Swamp or Evaporative Air Cooler* last summer?

(1) Turned on only a few days or nights when really needed
(2) Turned on quite a bit
(3) Turned on just about all summer
(4) No swamp/evaporative air cooler in home.

49. How many ceiling fans does your household have?

Enter Number_____
(1) None (SKIP to Q 50)
(2) Don't Know/Not Sure
(3) Refused

49a. How many ceiling fans does your household use?

Enter Number of ceiling fans_____
(1) None (SKIP to 50)
(2) Don't Know/Not Sure
(3) Refused

49b. Thinking about the ceiling fan *that you use the most*, how often was this fan used last *summer*? Is it . . .

(1) Used only a few days or nights, when it's really needed,
(2) Used quite a bit, or
(3) Used just about all summer?
(4) Not used at all
(5) Don't Know/Not Sure
(6) Refused

49c. Thinking about the ceiling fan *that you use the most*, how often was this fan used last *winter*? Is it . . .

(1) Used only a few days or nights,
(2) Used quite a bit, or
(3) Used just about all winter?
(4) Not used at all
(5) Don't Know/Not Sure
(6) Refused

50. Opening windows on opposite sides of the house to cool the indoor temperature is called natural cross ventilation. In the past 12 months, has your household used window fans to assist with natural cross ventilation in the warmer months?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

51. How often are your windows open in the summer?

(1) Never
(2) Rarely
(3) Sometimes
(4) Frequently
(5) All the time
(6) Don't Know/Not Sure
(7) Refused

52. How often are your windows open in the winter?

(1) Never
(2) Rarely
(3) Sometimes
(4) Frequently
(5) All the time
(6) Don't Know/Not Sure
(7) Refused

53. Do any large trees shade your home from the afternoon summer sun?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

54. Do you close the drapes, curtains, shades, and/or blinds during the day to block out the sun during the summer?

(1) Never
(2) Rarely
(3) Sometimes
(4) Frequently
(5) All the time
(6) Don't Know/Not Sure
(7) Refused

INTERVIEWER INSTRUCTION: RECORD ANY INFORMATION HERE ABOUT THE AIRCONDITIONING EQUIPMENT IN THIS HOUSING UNIT AND ITS' USAGE THAT MIGHT PROVIDE CLARIFICATION TO THE RESPONDENT'S ANSWERS.

_____

_____

_____

Now I have some questions on the indoor air temperature of your home.

55. Does your home have a thermostat that controls the heating and/or cooling in your home?

(1) Yes
(2) No (SKIP to Q 64)
(3) Don't Know
(4) Refused

55a. What equipment does your thermostat control?

(1) Central heating only
(2) Central cooling only
(3) Central heating and cooling
(4) Don't know

56. Some thermostats can be programmed so that the temperature changes automatically at different times of the day; for example, the heat can be automatically turned down or lowered at night when you go to bed, then automatically adjusted up again in the morning. Is the thermostat that controls your main [heating and/or cooling] equipment programmable?

(1) Yes
(2) No (SKIP to Q57)
(3) Don't know/Not Sure
(4) Refused

56a. Do you or someone else in your household know how to use the programmable thermostat?

(1) Yes
(2) No (SKIP to Q57)
(3) No, someone who does not live in my home programs the thermostat for use
(4) Don't know/Not Sure
(5) Refused

56b. Is your thermostat programmed to change the temperature at different times of the day?

(1) Yes
(2) No (SKIP to Q56d)
(3) Don't know/Not Sure
(4) Refused

56c. Please indicate how the programmable thermostat is used. (Select all that apply.)

(1) Thermostat is automatically adjusted to a lower temperature at night during the winter
(2) Thermostat is automatically adjusted to a lower temperature during the day when no one is home during the winter
(3) Thermostat is automatically adjusted to a higher temperature at night during the summer
(4) Thermostat is automatically adjusted to a higher temperature during the day when no one is home during the summer
(5) Other _____
(6) Don't know/Not Sure
(7) Refused

56d. Which statement best describes your programmable thermostat…

(1) It is very easy to use
(2) It is somewhat easy to use
(3) It is neither easy nor difficult to use
(4) It is somewhat difficult to use
(5) It is very difficult to use
(6) Refused

56e. Typically, how often is your programmable thermostat reprogrammed, that is, the time schedule and desired indoor temperature setting changed permanently?

(1) Daily
(2) Weekly
(3) Monthly
(4) Every three months of so
(5) Once a year
(6) Less than once a year
(7) Never
(8) Don't know/Not Sure
(9) Refused

56f. How often is the current temperature setting "overridden" temporarily and why?

(1) Daily
(2) Weekly
(3) Monthly
(4) Every three months of so
(5) Once a year
(6) Less than once a year
{IF ANSWERED ANY OF THE ABOVE} Please explain why_____
(7) Never
(8) Don't know/Not Sure
(9) Refused

56g. How often is the “hold” mode used and why?

Daily
(2) Weekly
(3) Monthly
(4) Every three months of so
(5) Once a year
(6) Less than once a year
{IF ANSWERED ANY OF THE ABOVE} Please explain why._____
(7) Never
(8) Don’t know/Not Sure
(9) Refused

56h. Please indicate what features need improvement in your programmable thermostat.

(1) Size of words and numbers?
(2) Ease of programming?
(3) Additional features, such as the energy use in my home?
(4) Being able to change its settings using a cell phone, Internet?
(5) Other features. Please Specify. _____
(6) Don’t Know/Not Sure
(7) Refused

56i. Is there anyone in your home who doesn’t operate the programmable thermostat? Why? (select all that apply)

(1) It’s too complicated/too difficult
(2) We do not have an instruction manual / Nobody showed us how
(3) We haven’t needed to
(4) Other (Specify)_____
(5) Don’t Know/Not Sure
(6) Refused

56j. {IF NO TO 56b. or ANSWERED (7)NEVERTO 56e}Why is your programmable thermostat not programmed to automatically change the temperature? (select all that apply)

(1) We change the temperature manually/don’t need to program
(2) It takes too much effort to use
(3) Household members cannot agree on what temperatures at which to set the thermostat
(4) It is better to always keep the temperature setting always the same. (Why?)
(5) There is always somebody at home
(6) Other (Specify)_____
(7) Don’t Know/Not Sure
(8) Refused

57. During the winter, what is the temperature when *someone is inside* your home *during the day?* [IF NO ANSWER, PROBE 1: THEN AT WHAT TEMPERATURE IS THE THERMOSTAT SET? PROBE 2: CAN I JUST HAVE YOUR BEST ESTIMATE?]

Enter degrees Fahrenheit_____

58. During the winter, what is the temperature when *no one is inside* your home *during the day*? [IF NO ANSWER, PROBE 1: THEN AT WHAT TEMPERATURE IS THE THERMOSTAT SET? PROBE 2: CAN I JUST HAVE YOUR BEST ESTIMATE?]

Enter degrees Fahrenheit_____

59. During the winter, what is the temperature inside your home *at night*? [IF NO ANSWER, PROBE 1: THEN AT WHAT TEMPERATURE IS THE THERMOSTAT SET? PROBE 2: CAN I JUST HAVE YOUR BEST ESTIMATE?]

Enter degrees Fahrenheit_____

Now I would like you to think about the temperature inside your home when using your central air conditioning equipment last summer. [If NUMTHERM>1: *Earlier you reported having [FILL: NUMTHERM] thermostats. For the next questions, if the thermostats are set at different temperatures, only report for the thermostat that affects the rooms where most of the people are.*]

60. During the summer, what is the temperature when *someone is inside* your home *during the day?* IF NO ANSWER, PROBE 1: THEN AT WHAT TEMPERATURE IS THE THERMOSTAT SET? PROBE 2: WHAT'S YOUR BEST ESTIMATE?

Enter degrees Fahrenheit _____
Air-conditioner Turned Off

61. During the summer, what is the temperature when *no one is inside* your home *during the day*? IF NO ANSWER, PROBE 1: THEN AT WHAT TEMPERATURE IS THE THERMOSTAT SET? PROBE 2: WHAT'S YOUR BEST ESTIMATE?

Enter degrees Fahrenheit _____
Air-conditioner Turned Off

62. During the summer, what is the temperature inside your home *at night*? IF NO ANSWER, PROBE 1: THEN AT WHAT TEMPERATURE IS THE THERMOSTAT SET? PROBE 2: WHAT'S YOUR BEST ESTIMATE?

Enter degrees Fahrenheit _____
Air-conditioner Turned Off

63. Answer the following statements -- true or false:

a. If the thermostat is turned up very high in the winter, my home will get warmer faster.
(1) True
(2) False

b. The thermostat controls the temperature of the air coming from the heating/cooling unit into my home.
(1) True
(2) False

c. The thermostat only senses the temperature in the air in the room where the thermostat is located. It turns the heating unit off when the temperature in the room reaches the temperature on the thermostat setting.

(1) True
(2) False

d. If the thermostat is turned down at night or when no one is home, then more energy is used than saved when your home is heated up again.

(1) True
(2) False

64. In the past 12 months, was your household unable to use any of the following equipment because it was broken? CHECK ALL THAT APPLY

(1) Main Heating Equipment
(2) Central Air Conditioner
(3) Room Air Conditioner
(4) Don't Know/Not Sure
(5) Refused

65. Which of the following statements best describes the indoor temperature of your home during the winter:

(1) Very cold
(2) Cold
(3) Comfortable (SKIP)
(4) Hot
(5) Very hot
(6) Other _____
(7) Refused

66. Which of the following statements best describes the indoor temperature of your home during the summer:

(1) Very cold
(2) Cold
(3) Comfortable (SKIP TO NEXT Q….)
(4) Hot
(5) Very hot
(6) Other _____
(7) Refused

67. In the past 12 months, has a landlord controlled the temperature inside your home?

(1) Yes
(2) No
(3) Do not have landlord
(4) Don't Know/Not Sure
(5) Refused

68. In the past 12 months how often did your household keep your home at a temperature that you felt was unsafe or unhealthy?

(1) Almost every month
(2) Some months
(3) 1 or 2 months
(4) Never
(5) Don't Know/Not Sure
(6) Refused

69. In the past 12 months, has anyone in the household needed medical attention because your home was too cold?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

70. In the past 12 months did anyone in your household need medical attention because your home was too hot?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

71. During the past 12 months, how often have you or other members of your household found your home too drafty? Would you say it is. . .

(1) All the time,
(2) Most of the time,
(3) Some of the time, or
(4) Never
(5) Don't Know/Not Sure
(6) Refused

The next group of questions is about laundry appliances and water use in your home.

72. Is a clothes washing machine used in your home? Do not include community clothes washers that are located in the basement or laundry room of your apartment building.

(1) Yes
(2) No (SKIP to Q73)
(3) Refused

72a. In an average week, how many loads of laundry are washed in your clothes washer?

(1) 1 load or less each week
(2) 2 to 4 loads each week
(3) 5 to 9 loads each week
(4) 10 to 15 loads each week
(5) More than 15 loads each week
(6) Don't Know/Not Sure
(7) Refused

72b. Does your household wash only full loads of laundry?

(1) Always
(2) Most of the time
(3) Some of the time
(4) Never
(5) Don't know/Not Sure
(6) Refused

72c. What water temperature setting is usually used for the *wash* cycle of your clothes washer? Is it hot, warm, or cold water?

(1) Hot
(2) Warm
(3) Cold
(4) Don't Know/Not Sure
(5) Refused

72d. What water temperature setting is usually used for the *rinse* cycle of your clothes washer? Is it hot, warm, or cold water?

(1) Hot
(2) Warm
(3) Cold
(4) Don't Know/Not Sure
(5) Refused

73. Do you use a clothes dryer in your home? Do not include community clothes dryers that are located in the basement or laundry room of your apartment building.

(1) Yes
(2) No (SKIP TO Q74)
(3) Don't Know/Not Sure
(4) Refused

73a. Does your household dry only full loads of laundry….?

(1) Always
(2) Most of the time
(3) Some of the time
(4) Never
(5) Don't Know/Not Sure
(6) Refused

73b. Does your clothes dryer vent directly to the outdoors?

(1) Yes
(2) No
(3) Dryer is ventless
(4) Don't Know/Not Sure
(5) Refused

73c. Do you clean your clothes dryer's lint filter after every use?

(1) Yes
(2) No
(3) Dryer has not lint filter
(4) Don't Know/Not Sure
(5) Refused

74. How frequently does your household hang clothes to dry?
(1) Very frequently
(2) Frequently
(3) Infrequently
(4) Very infrequently
(5) Never
(6) Don't Know/Not Sure
(7) Refused

75. In the last 12 months, has the temperature of your hot water heater been adjusted?
(1) Yes, the temperature is much warmer
(2) Yes, the temperature is warmer
(3) No adjustment has been made to the temperature
(4) Yes, the temperature is cooler
(5) Yes, the temperature is much cooler
(6) Hot water heater was not in working order for the last 12 months
(7) No water heater
(8) Don't Know/Not Sure
(9) Refused

76. Over the past 12 months, has the duration of the showers taken by household members changed?
(1) Increased a lot
(2) Increased some
(3) No change
(4) Decreased some
(5) Decreased a lot
(6) No Shower
(7) Don't Know/Not Sure
(8) Refused

77. Does your main bathroom have a ventilation fan in it that works?
(1) Yes
(2) No (SKIP to Q78)
(3) Don't know/Not Sure (SKIP to Q50)
(4) Refused

77a. How often do you or members of your household operate the fan while showering?
(1) Never
(2) Rarely
(3) Sometimes
(4) Frequently
(5) All the time
(6) Don't Know/Not Sure
(7) Refused

77b. How long after showering do you or members of your household operate the fan?

(1) Don't turn the fan on for showers
(2) The fan is turned off when leaving the shower area
(3) A few minutes
(4) Several minutes
(5) Until the steam in the shower area is gone
(6) Don't know/Not Sure
(7) Refused

78. Electric dehumidifiers remove moisture from the air and are often used in the summer. Is a dehumidifier used in your home?

(1) Yes
(2) No (SKIP to Q79)
(3) Don't Know/Not Sure
(4) Refused

78a. In the past 12 months, how many months was the dehumidifier used?

(1) 1 to 3 months, 4 to 6 months,
(2) 7 to 9 months,
(3) 10 to 11 months, but not all year, or is it
(4) Turned on all year long?
(5) Don't Know/Not Sure
(6) Refused

Now I have some questions about lights inside your home and energy efficiency.

79. How often do you find lights left on in rooms that are not occupied?

(1) Never
(2) Almost never
(3) Sometimes
(4) Most of the time
(5) All the time
(6) Don't Know/Not Sure
(7) Refused

80. Do members of your household purchase or intentionally seek out and install compact fluorescent bulbs in your home?

(1) Yes
(2) No (SKIP to Q81)
(3) I do not know what compact fluorescent bulbs are (SKIP to Q81)
(4) Don't know/Not Sure
(5) Refused

80a. How do you dispose of compact fluorescent light bulbs that are broken or no longer working?_

(1) Directly in household garbage
(2) Doubled bagged in plastic in household garbage
(3) Transport to local recycling center
(4) Other (Please Specify)_____
(5) Don't Know/Not Sure
(6) Refused

81. Are you familiar with the Energy Star® label?
(1) Yes
(2) No (SKIP to 82)
(3) Refused

81a. Has your household bought or intentionally installed appliances or consumer electronics that have an Energy Star® label?
(1) Yes
(2) No
(3) Don't know/Not Sure
(4) Refused

82. Do you unplug any appliances like TVs, VCRs, stereos, radios, clocks, or computers to save energy when they are turned off?
(1) Yes
(2) No
(3) Don't know/Not Sure
(4) Refused

In this next set of questions, I will ask you about other conditions of your home.

83. How much outdoor noise do you hear indoors when the windows are closed?
(1) A great deal
(2) Some
(3) Hardly any
(4) None at all
(5) Don't know/Not Sure
(6) Refused

84. Please rate the outside appearance of your home:
(1) Very attractive
(2) Attractive
(3) Neither attractive nor unattractive
(4) Unattractive
(5) Very unattractive
(6) Refused

85. Over the past 12 months, how has the property value of your home changed?
(1) Very much higher
(2) Higher
(3) No change
(4) Lower
(5) Very much lower
(6) Not applicable, don't own the home or live in an apartment
(7) Don't know/Not Sure
(8) Refused

86. How infested is your home with cockroaches or other insects or spiders?
(1) Extremely infested
(2) Very infested
(3) Somewhat infested
(4) Hardly infested
(5) Not infested at all (SKIP to Q87)
(6) Don't know/Not Sure
(7) Refused

86a. What have you done about the cockroaches, other insects or spiders?
(1) Nothing
(2) Used insecticides, bug sprays, or poison
(3) Hired an exterminator or other professional
(4) Other. Please specify._____
(5) Don't Know/Not Sure
(6) Refused

87. How infested is your home with rats or mice?
(1) Extremely infested
(2) Very infested
(3) Somewhat infested
(4) Hardly infested
(5) Not infested at all (SKIP to Q88)
(6) Don't know/Not Sure
(7) Refused

87a. What have you done about the pests?
(1) Nothing
(2) Used bait or poison
(3) Hired an exterminator or other professional
(4) Other. Please specify._____
(5) Don't Know/Not Sure
(6) Refused

88. Does your home frequently have a mildew odor or musty smell?
(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

89. How often do you observe standing water anywhere in your home?
(1) Never
(2) Rarely
(3) Sometimes
(4) Often
(5) Always
(6) Don't Know/Not Sure
(7) Refused

90. Have you seen mold in your home in the past 12 months?
(1) Yes
(2) No {SKIP to Q91}
(3) Don't know/Not Sure
(4) Refused

90a. {If YES MOLD}What have you done about the mold?
(1) Nothing
(2) Cleaned with bleach
(3) Cleaned with other chemical mold remover
(4) Cleaned with natural mold remover (vinegar or natural product)
(5) Air Conditioned
(6) Ventilation (fans)
(7) Used a dehumidifier
(8) Contacted a Professional
(9) Other. Please Specify _____
(10) Don't know/Not Sure
(11) Refused

Now I would like to ask you a few questions about your energy bills.
Some households may have faced challenges in paying home energy bills. The following questions ask about challenges your household may have had paying home energy bills or maintaining heating and cooling equipment. When thinking about these questions, include all of your experiences in the past 12 months.

91. Some energy utilities and suppliers offer *budget* payment plans that allow a household to pay the same amount on the home energy bill each month. In the past 12 months, did your household use a *budget* plan for any home energy bill?
(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

INTERVIEWER INSTRUCTION: BUDGET PLANS ARE NOT USUALLY RELATED TO LATE OR DISCONNECT NOTICES AND ARE NOT A WAY TO PAY DOWN PAST DUE BALANCES.

92. How well do you understand the information on your energy bill other than the amount owed (e.g., information about how much energy your household used during the billing period compared to the same billing period one year ago)?
(1) Very well
(2) Well
(3) Neither well nor not well
(4) Not well
(5) Not well at all
(6) Don't know/Not Sure
(7) Refused

93. How hard is it to pay your energy bills?
(1) Very hard
(2) Hard
(3) Neither hard or not hard
(4) Not hard
(5) Not hard at all
(6) Don't know/Not Sure
(7) Refused

94. Has your household ever had to move in the past 5 years because your household could not pay the energy bills?
(1) Yes
(2) No (go to Q20)
(3) Don't know (go to Q 20)

95. Over the past 12 months, how often has your household not paid energy bills in order to pay other utility bills (PROBE: water/sewage/telephone/Secondary energy fuel type)?
(1) Every month
(2) Every other month
(3) Every few months
(4) Every six months
(5) Once in twelve months
(6) Never
(7) Don't Know/Not Sure
(8) Refused

96. Over the past 12 months, how often has your household not paid other utilities in order to pay the primary energy bill (PROBE: water/sewage/telephone/Secondary energy fuel type)?
(1) Every month
(2) Every other month
(3) Every few months
(4) Every six months
(5) Once in twelve months
(6) Never (SKIP to Q97)
(7) Don't Know/Not Sure
(8) Refused

96 a. What utilities were not paid for in order to pay an energy bill? (Check all that apply)
(1) Water
(2) Sewage
(3) Telephone
(4) Secondary energy fuel type
(5) Other_____
(6) Don't Know/Not Sure
(7) Refused

97. Over the past 12 months, how often has your household not purchased food in order to pay an energy bill?

(1) Every month
(2) Every other month
(3) Every few months
(4) Every six months
(5) Once in twelve months
(6) Never
(7) Don't Know/Not Sure
(8) Refused

98. Over the past 12 months, how often has your household not paid energy bills in order to purchase food?

(1) Every month
(2) Every other month
(3) Every few months
(4) Every six months
(5) Once in twelve months
(6) Never
(7) Don't Know/Not Sure
(8) Refused

99. In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

100. In the past four weeks, did you worry that your household members would not have nutritious food?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

101. Some households receive additional assistance to help pay for food. In the past 12 months did you or any members of your household receive food stamps or WIC assistance (Women, Infants, and Children nutrition program)? (ASK ONCE/DO NOT REPEAT QUESTION FOR EACH INDIVIDUAL)

(1) Yes
(2) No; Did not apply
(3) No; Applied for, but rejected
(4) Don't Know/Not Sure
(5) Refused

102. In the past 5 years have you or anyone in the household experienced any of the following as a result of energy bills? (Check all that apply)

(1) Eviction from home
(2) Foreclosure on mortgage
(3) Moved in with friends or family
(4) Moved into a shelter or been homeless
(5) Family Separation
(6) Refused

102a. {If YES FAMILY SEPARATION}In what way or ways was the family separated?

(1) Adult partners only separated
(2) One adult partner separated from partner and children
(3) One parent separated from children only
(4) Both parents separated from children
(5) Elder parent or relative separated from family
(6) Refused

103. In the past 12 months how often did your household pay an amount less than what you owed on your home energy bill, because you were unable to afford the whole home energy bill?

(1) Almost every month
(2) Some months
(3) 1 or 2 months
(4) Never
(5) Don't Know/Not Sure
(6) Refused

104. In the past year, have you used any of the following to assist with paying your energy bill?

(1) Payday loan
(2) Tax Refund Anticipation Loan
(3) Car Title loan
(4) Other type of short term, high-interest loan
(5) Pawn shop
(6) Don't Know/Not Sure
(7) Refused

104a. {If YES to any of the above}In the past year, in order to pay your home energy bill, how often did you need to use a payday loan, a Tax Refund Anticipation Loan, a car title loan, another type of short-term, high-interest loan, or pawn shop?

(1) Almost every month
(2) Some months
(3) 1 or 2 months
(4) Never
(5) Don't Know/Not Sure
(6) Refused

105. When home energy bills are not paid on time, it is common for energy utilities and suppliers to send late notices. If the bill is very late, they will send a disconnect, shut-off, or non-delivery notice. How often did you receive a disconnect, shut-off, or non-delivery notice?

(1) Almost every month
(2) Some months
(3) 1 or 2 months
(4) Never (SKIP to Q106)
(5) Don't Know/Not Sure
(6) Refused

105a. Did you enter into a payment arrangement with your energy utility or supplier in response to the disconnect shut-off, or non-delivery notice?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

106. In the past 12 months was your electricity or natural gas ever disconnected because you were unable to pay your home energy bill?

(1) Yes
(2) No (SKIP to Q107)
(3) Don't Know/Not Sure
(4) Refused

106a. While your electricity or natural gas was disconnected, was there a time when you wanted to use your main source of heat but were unable to?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

106b. While your electricity was disconnected, was there a time when you wanted to use your air conditioner but were unable to?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

107. In the past 12 months did your fuel oil, kerosene, propane, or wood ever run out because you were unable to pay for a home energy delivery?

(1) Yes
(2) No (SKIP to Q108)
(3) Don't Know/Not Sure
(4) Refused

107a. When you ran out of your fuel oil, kerosene, propane, or wood was there a time when you wanted to use your main source of heat but were unable to?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

Next, I will be asking about health care and coverage.

108. In the past 12 months have you had any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare?
(1) Yes (SKIP to Q108b)
(2) No
(3) Refused

108a. {IF NO COVERAGE} According to the information given, you do NOT have health care coverage of any kind. Do you have health insurance or coverage through a plan I might have missed? (INTERVIEWER: REVIEW PLANS IF INFORMANT IS UNSURE.)
(1) NO/NOT COVERED BY ANY PLAN (SKIP to Q109)
(2) HEALTH INSURANCE PLAN FROM A
(3) CURRENT OR PAST EMPLOYER/
(4) UNION/SCHOOL
(5) A HEALTH INSURANCE PLAN BOUGHT ON HIS/HER OWN/PROF. ASSN
(6) A PLAN BOUGHT BY SOMEONE WHO DOES NOT LIVE IN THIS HOUSEHOLD
(7) MEDICARE
(8) MEDICAID/STATE NAME
(9) CHAMPUS/CHAMP-VA, TRICARE, VA,
(10) OTHER MILITARY
(11) INDIAN HEALTH SERVICE
(12) [FILL STATE PLAN]
(13) OTHER PLAN [SPECIFY]
(14) DON'T KNOW/NOT SURE
(15) REFUSED

108b. {IF YES COVERAGE} During the past 12 months was there any time that you did not have any health insurance coverage?
(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

108c. Does your health plan pay for at least some of the cost of prescription medicines prescribed by a doctor?
(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

109. During the past 12 months, was there any time your household members needed prescription medicines but didn't get them because you couldn't afford it?
(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

110. Over the past 12 months, how often did members of your household not fill a prescription or took less than the full dose of a prescribed medicine in order to pay the utility bill?

(1) Every month
(2) Every other month
(3) Every few months
(4) Every six months
(5) Once in twelve months
(6) Never
(7) Don't Know/Not Sure
(8) Refused

111. Over the past 12 months, how frequently has your household not paid energy bills in order to purchase prescription medicines?

(1) Every month
(2) Every other month
(3) Every few months
(4) Every six months
(5) Once in twelve months
(6) Never
(7) Don't Know/Not Sure
(8) Refused

112. Was there a time in the past 12 months when you needed to see a doctor but could not because of cost?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

113. During the past 12 months, have you or other adults in your household had any problems paying medical bills?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

{Note: Ask these questions of the adult in the household most involved with all the other members of the household because proxy responses are required.}

114. Including yourself, how many people normally live in this household? Do not include anyone who is just visiting, those away in the military, or children who are away at college.

Enter Number _____

115. Can you please tell me their first names, gender and age, and your relationship to the person?

	First Name	Gender	Age	Relationship	In school (Y/N)
Person 1.					
Person 2.					
Person 3.					
Person 4.					
Person 5.					
Person 6.					
Person 7.					
Person 8.					
Person 9.					
Person 10.					

116. On a typical week day is there someone at home most or all of the day?
(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

For this section, I will be asking health related questions.

117. Now thinking about physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?
(1) Number of days_____
(2) None
(3) Don't know / Not sure
(4) Refused

118. Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?
(1) Number of days_____
(2) None
(3) Don't know / Not sure
(4) Refused

119. During the past 30 days, for about how many days have you felt you did not get enough rest or sleep?
(1) Number of days_____
(2) None
(3) Don't know / Not sure
(4) Refused

120. During the past 30 days, for about how many days have you felt very healthy and full of energy?
(1) Number of days_____
(2) None
(3) Don't know / Not sure
(4) Refused

121. During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?

(1) Number of days _____
(2) None
(3) Don't know / Not sure
(4) Refused

Next, I am going to ask you whether you have had some particular health problems in the last 3 months. In the past 3 months, have you had . . .

122. Shortness of breath when lying down, waking up, or with light work or light exercise?

(1) Yes
(2) No
(3) Don't know/Not Sure
(4) Refused

123. Headaches that are either new or more frequent or severe than ones you have had before?

(1) Yes
(2) No
(3) Don't know
(4) Refused

In the past 12 months were you or anyone else in the household ever told by a doctor or health professional that you or they have… (Check all that apply)

124. Lead poisoning

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

{IF YES}Please list all individuals, including yourself:

_____
_____
_____

125. Three or more ear infections per year
(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

{IF YES} Please list all individuals, including yourself:
_____
_____
_____

126. Any kind of respiratory allergy
(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

{IF YES} Please list all individuals, including yourself:
_____
_____
_____

127. Flu
(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

{IF YES} Please list all individuals, including yourself:
_____
_____
_____

128. Persistent Cold symptoms lasting more than 14 days (SYMPTOMS INCLUDE COUGHING, SORE THROAT, SNEEZING, SINUS PAIN, CONGESTION, FEVER, FATIGUE, AND HEADACHE)
(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

{IF YES} Please list all individuals, including yourself:
_____
_____
_____

129. Sinus infection or Sinusitis
(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

{IF YES} Please list all individuals, including yourself:
_____
_____
_____

130. Bronchitis
(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

{IF YES} Please list all individuals, including yourself:
_____
_____
_____

131. Have you ever been told by a doctor or other health professional that you have asthma?
(1) Yes
(2) No (SKIP to Q132)
(3) Don't Know/not sure
(4) Refused

131a. Do you still have asthma?
(1) Yes
(2) No
(3) Don't Know/Not sure
(4) Refused

131b. During the past 12 months, how many times did you see a doctor or health professional for a routine checkup for your asthma? _____

READ: Symptoms of asthma include coughing, wheezing, shortness of breath, chest tightness or phlegm production when you have a cold or respiratory infection.

131c. How long has it been since you last had any symptoms of asthma?
(1) Never
(2) Less than one day ago
(3) 1-6 Days ago
(4) 1 week to less than 3 months ago
(5) 3 months to less than 1 year ago
(6) 1 year to less than 3 years ago
(7) 3 years to 5 years ago
(8) More than 5 years ago
(9) Don't Know/Not sure
(10) Refused

131d. During the past 12 months did you have to stay overnight in the hospital because of asthma?
(1) Yes
(2) No
(3) Don't know/Not Sure
(4) Refused

131e. Not counting hospitalizations, during the past 12 months, did you go to an emergency room because of asthma?
(1) Yes
(2) No
(3) Don't know/Not Sure
(4) Refused

These next questions are about cigarette smoking.

132. Which one of the following statements best describes the rules about smoking in your home…
(1) No one is allowed to smoke anywhere inside your home
(2) Smoking is allowed at some places or at sometimes
(3) Smoking is permitted anywhere
(4) Don't know/Not sure
(5) Refused

133. Have you smoked at least 100 cigarettes in your entire life?
(1) Yes
(2) No
(3) Don't know/Not sure
(4) Refused

134. Do you now smoke cigarettes every day, some days or not at all?
(1) Everyday
(2) Some days
(3) Not at all
(4) Don't Know/Not sure
(5) Refused

135. In the past 12 months has anyone in the household been food poisoned from eating food inside your home and therefore went to see a medical professional?

(1) Yes
(2) No
(3) Don't Know/Not sure
(4) Refused

136. In the past 12 months, has anyone in the household been poisoned by breathing in carbon monoxide, and therefore went to see a medical professional?

(1) Yes
(2) No
(3) Don't Know/Not sure
(4) Refused

137. In the past 12 months, has anyone in the home been burned from scalding hot water coming out of a faucet or showerhead in your home?

(1) Yes
(2) No (SKIP to Q138)
(3) Don't Know/Not Sure
(4) Refused

137a. {IF YES BURN}Did you talk to or see a medical professional about this injury?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

138. I am going to read some statements about health and medical care.
Usually, you go to the doctor as soon as you start to feel bad. Is that:

(1) definitely true,
(2) mostly true,
(3) mostly false, or
(4) definitely false?
(5) Don't Know/Not Sure
(6) Refused

139. You will do just about anything to avoid going to the doctor. Is that . . .

(1) definitely true,
(2) mostly true,
(3) mostly false, or
(4) definitely false?
(5) Don't Know/Not Sure
(6) Refused

In this last section I will be asking employment and school related questions.

140. Are you or primary wage earner in the household currently…?
(1) Employed for wages
(2) Self-employed
(3) Out of work for more than 1 year (SKIP to Q140c)
(4) Out of work for less than 1 year (SKIP to Q140c)
(5) A Homemaker (SKIP to Q141)
(6) A Student
(7) Retired (SKIP to Q141)
(8) Unable to work (SKIP to Q141)
(9) Refused

140a. Are you or the primary wage earner in the household employed full-time or part-time?
(1) Full-time
(2) Part-time
(3) Don't Know/Not Sure
(4) Refused

140b. How many hours per week do you or the primary wage earner usually work at all of your jobs?
Enter _____ hrs

140c. {IF ANSWERED (3) or (4) to Q140} Have you/Has the primary wage earner looked for work during the last 4 weeks?
(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

140d. {IF ANSWERED (3) or (4) to Q140}What is the main reason you were/the primary wage earner was not looking for work during the LAST 4 WEEKS? CHECK ALL THAT APPLY (DO NOT READ LIST)
(1) Believes no work available in line of work or area
(2) Couldn't find any work
(3) Lacks necessary schooling, training, skills or experience
(4) Employers think too young or too old
(5) Other types of discrimination
(6) Can't arrange child care
(7) Family responsibilities
(8) In school or other training
(9) Ill health, physical disability
(10) Transportation problems
(11) Other
(12) Don't Know/Not Sure
(13) Refused

141. Does a physical, mental or emotional problem NOW keep you or the primary wage earner from working at a job or business?

(1) Yes
(2) No
(3) Don't know/Not Sure
(4) Refused

142. In the past 12 months did anyone in the household receive income from any of the following sources? (Check all that apply)

(1) Supplemental Security Income (SSI)
(2) Welfare payments or case assistance
(3) Veteran's payments (VA Benefits)
(4) Unemployment Compensation
(5) Don't Know/Not Sure
(6) Refused

143. During the past 12 months have you or the primary wage earner had more than one job (or business), including part time, evening, or weekend work?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

144. {IF ANSWERED (1), (2), (4), or (6) to Q140}Thinking about the last 12 months, is your or the primary wage earner's main job, where you work(ed) the most amount of hours, considered seasonal?

(1) Yes
(2) No (SKIP to Q145)
(3) Don't Know/Not Sure
(4) Refused

144a. In what season do you/does the primary wage earner work the least amount of hours?

(1) Winter
(2) Spring
(3) Summer
(4) Fall

145. {IF ASWERED (1) or (2) TO Q 140}In the past 12 months, about how many days of work did you or the primary wage earer miss work at a job or business because of illness or injury (DO NOT INCLUDE MATERITY LEAVE}.

Enter Number_____

(1) None
(2) Don't Know/Not Sure
(3) Refused

146. {IF ASWERED (1) or (2) TO Q 140}In the past 12 months, about how many days of work did you or the primary wage earner miss because of illness or injury of another household member?

Enter Number_____

(1) None
(2) Don't Know/Not Sure
(3) Refused

147. In the past 12 months, about how many days of school have you, the primary wage earner, and/or those in the household enrolled in school, missed because of illness or injury? {IF PRE-SCHOOLER IN HOME}Please tell us about the preschooler who has missed the most number of days. {IF SCHOOL AGED CHILD IN HOME} Please tell us about the school aged child who has missed the most number of days.

Enter Number:

Main Respondent _____ days

(1) Not in School
(2) Don't Know/Not Sure
(3) Refused

Primary Wage Earner _____ days

(1) Not in School
(2) Don't Know/Not Sure
(3) Refused

Pres-School Child who has missed the most amount of school_____ days

(1) None
(2) Don't Know/Not sure
(3) Refused

School Aged child who has missed the most amount of school_____ days

(1) None
(2) Don't Know/Not sure
(3) Refused

148. {IF STUDENT}In the past 12 months, how frequently did you find it hard to study in your home because of excessive heat or cold?

(1) Very frequently
(2) Frequently
(3) Not frequently or infrequently
(4) Infrequently
(5) Very infrequently
(6) Never
(7) Does not study at home
(8) Don't Know/Not sure
(9) Refused

149. {IF SCHOOL AGED CHILDREN IN THE HOME} In the past 12 months, how frequently does any school aged child in the home find it hard to study because of excessive heat or cold?

(1) Very frequently
(2) Frequently
(3) Not frequently or infrequently
(4) Infrequently
(5) Very infrequently
(6) Never
(7) Does not study at home
(8) Don't Know/Not sure
(9) Refused

That is the end of the survey. Thank you for your participation! You will receive your $25 gift card in the mail to compensate you for your time. Could you please verify your mailing address:

Address: _____
_____
_____
_____

{INTERVIEWER: ADMINISTER AS A SEPARATE SURVEY POST-WEATHERIZATION}

PART II. Client Satisfaction

{Note: Ask these questions of the adult in the household most involved with the weatherization of the home or the head of the household}

Approximate Date of Weatherization Job: _____

1. How long have you known about your local weatherization program?
ENTER THE RESPONSE IN YEARS _____

2. How did you find out about your local weatherization program? CHECK ALL THAT APPLY

(1) A call from the weatherization agency
(2) Information received in the mail from the weatherization agency
(3) Local newspaper
(4) Found the program on the Internet
(5) Relative or friend mentioned the weatherization program
(6) Neighbor who had their home weatherized
(7) Agency providing utility assistance such as LIHEAP
(8) Email from an organization with which you are a member
(9) Church
(10) Other (Specify_____)

3. How long ago did you request that your home be weatherized?
ENTER THE RESPONSE IN YEARS _____

4. How satisfied are you with the length of time between your request to have your home weatherized and when it actually was weatherized?

(1) Very satisfied
(2) Satisfied
(3) Not satisfied or dissatisfied
(4) Dissatisfied
(5) Very dissatisfied

5. How easy was it to request that your house be weatherized?

(1) Very easy
(2) Easy
(3) Not easy or difficult
(4) Difficult
(5) Very difficult

6. How easy was it to schedule the initial audit of your home?

(1) Very easy
(2) Easy
(3) Not easy or difficult
(4) Difficult
(5) Very difficult

7. How timely were those who did the initial audit of your home?

(1) Early or On Time
(2) <30 Minutes Late
(3) 30-60 Minutes Late
(4) 1 to 3 Hours Late
(5)More than 4 Hours Late
(6) Did not show up on scheduled day

8. How courteous were those who did the initial audit of your home?

(1) Very Courteous
(2) Courteous
(3) Not Courteous or Rude
(4) Rude
(5) Very Rude

9. How easy was it to schedule the time for the weatherization crew to come to your home?

(1) Very easy
(2) Easy
(3) Not easy or difficult
(4) Difficult
(5) Very difficult

10. How timely was the weatherization crew?

(1) Early or On Time
(2) <30 Minutes Late
(3) 30-60 Minutes Late
(4) 1 to 3 Hours Late
(5)More than 4 Hours Late
(6) Did not show up on scheduled day

11. How courteous was the weatherization crew?
(1) Very Courteous
(2) Courteous
(3) Not Courteous or Rude
(4) Rude
(5) Very Rude

12. How careful of your home and belongings was the weatherization crew?
(1) Very careful
(2) Careful
(3) Neither careful or careless
(4) Careless
(5) Very careless

13. Overall, how clean did the weatherization crew leave the inside of your home?
(1) Very clean
(2) Clean
(3) Neither clean nor dirty
(4) Dirty
(5) Very dirty

13a. Overall, how clean did the weatherization crew leave the outside of your home?
(1) Very clean
(2) Clean
(3) Neither clean nor dirty
(4) Dirty
(5) Very dirty

14. Overall, how satisfied are you with final condition the inside of your home was left in?
(1) Very satisfied
(2) Satisfied
(3) Not satisfied or dissatisfied
(4) Dissatisfied
(5) Very dissatisfied

14a. Overall, how satisfied are you with final condition the outside of your home was left in?
(1) Very satisfied
(2) Satisfied
(3) Not satisfied or dissatisfied
(4) Dissatisfied
(5) Very dissatisfied

15. How easy was it to schedule the final inspection of your home?
(1) Very easy
(2) Easy
(3) Not easy or difficult
(4) Difficult
(5) Very difficult
(6) Final inspection was not done (go to Q18)

16. How timely were those who did the final inspection of your home?
    (1) Early or On Time
    (2) <30 Minutes Late
    (3) 30-60 Minutes Late
    (4) 1 to 3 Hours Late
    (5)More than 4 Hours Late
    (6) Did not show up on scheduled day

17. How courteous were those who did the final inspection of your home?
    (1) Very Courteous
    (2) Courteous
    (3) Not Courteous or Rude
    (4) Rude
    (5) Very Rude

18. How satisfied are you with the work performed in your home?
    (1) Very satisfied
    (2) Satisfied
    (3) Not satisfied or dissatisfied
    (4) Dissatisfied
    (5) Very dissatisfied

19. How satisfied are you with any new equipment installed in house?
    (1) Very satisfied
    (2) Satisfied
    (3) Not satisfied or dissatisfied
    (4) Dissatisfied
    (5) Very dissatisfied

20. Do you feel that other things should have been installed in your home to help you save energy?
    (1) Yes
    (2) No (go to Q21)

20a. What other things? _____

21. How satisfied are you with the energy savings achieved after having your home weatherized?
    (1) Very satisfied
    (2) Satisfied
    (3) Not satisfied or dissatisfied
    (4) Dissatisfied
    (5) Very dissatisfied
    (6) Too soon to tell
    (7) Don't know

22. Did the weatherization agency staff check your home for major repairs (e.g., fixing roof)?
    (1) Yes
    (2) No (go to Q23)

22a. Were major repairs needed in your home?
    (1) Yes
    (2) No (go to Q23)

22b. Were major repairs done to your home?
(1) Yes
(2) No
(3) Not yet but expecting repairs to be done

23. Did the weatherization staff ask you about the health of the member(s) of your household?
(1) Yes (go to Q24a)
(2) No

24. Without the weatherization staff asking, did you provide to them any information about the health of the member(s) of your household?
(1) Yes
(2) No (SKIP to Q25)

24a. Were any of the members of your household in need of care that they were not receiving at the time?
(1) Yes
(2) No (go to Q25)

24b. Did the weatherization staff help you to obtain the needed care?
(1) Yes
(2) No

25. Did your weatherization agency refer you to any other housing and/or social service programs?
(1) Yes
(2) No (go to Q26)

25a. What program or programs? _____

26. Did you file a complaint about the weatherization services provided?
(1) Yes
(2) No (go to Q27)

26a. What was the complaint about?_____

26b. How satisfied are you with the resolution of the situation you complained about?
(1) Very satisfied
(2) Satisfied
(3) Not satisfied or dissatisfied
(4) Dissatisfied
(5) Very dissatisfied

26c. How might the agency have done a better job of resolving your complaint?_____

27. Did you get any information on ways to save energy in your home from the people who weatherized your home?
(1) Yes
(2) No (go to Q33)

28. How much time did the weatherization agency staff talk to you about ways to save energy?

(1) Less than 5 minutes
(2) 5 to 14 minutes
(3)15 to 29 minutes
(4) 30 to 60 minutes
(5) More than one hour

29. How well did you understand what the weatherization agency staff said to you about saving energy?

(1) Very well (go to Q30)
(2) Well (go to Q30)
(3) Neither well or not well (go to Q30)
(4) Not well
(5) Not well at all

29a. Why did you not understand what the weatherization agency staff said?
CHECK ALL THAT APPLY

(1) The staff person did not speak my primary language
(2) The staff person was confusing
(3) The staff person did not speak well
(4) The staff person was hurried
(5) The staff person was boring
(6) I did not get along with the staff person
(7) Other_____

30. What materials about saving energy did the weatherization agency staff give you? (Check all that apply)

(1) One or more brochures, booklets, or manuals
(2) One or more compact discs (CDs), videos, or DVDs
(3) Hardware kit of weatherization materials
(4) No materials were provided (go to Q31)
(5) Weatherization staff spent time demonstrating how to save energy (go to Q31)

30a. How much time have you spent reading/reviewing the materials about saving energy that the weatherization agency staff gave you?

(1) No time (go to Q31)
(2) Less than 5 minutes
(3) 5 to 14 minutes
(4) 15 to 29 minutes
(5) 30 to 59 minutes
(6) More than one hour

30b. How well did you understand the energy savings materials that the weatherization agency staff gave you?

(1)Very well
(2)Well
(3)Neither well or not well
(4)Not well
(5)Not well at all

30c. How useful have the energy savings materials been to you?

(1) Very useful
(2) Useful
(3) Neither useful or not useful
(4) Not useful
(5) Not very useful

30d. What about the materials were particularly useful? _____

30e. How could the materials have been improved for your use? _____

31. How satisfied are you with the ways that the weatherization agency provided you with information about saving energy?

(1) Very satisfied
(2) Satisfied
(3) Not satisfied or dissatisfied
(4) Dissatisfied
(5) Very dissatisfied

32. Did you get any information on ways to improve health and safety in your home from the people who weatherized your home?

(1) Yes
(2) No (go to Q38)

33. How much time did the weatherization agency staff talk to you about ways to improve health and safety?

(1) Less than 5 minutes
(2) 5 to 14 minutes
(3) 15 to 29 minutes
(4) 30 to 59 minutes
(5) More than one hour

34. How well did you understand what the weatherization agency staff said to you about improving health and safety?

(1) Very well (go to Q36)
(2) Well (go to Q36)
(3) Neither well or not well (go to Q36)
(4) Not well
(5) Not well at all

34a. Why did you not understand what the weatherization agency staff said?
(Check all that apply)

(1) The staff person did not speak my primary language
(2) The staff person was confusing
(3) The staff person did not speak well
(4) The staff person was hurried
(5) The staff person was boring
(6) I did not get along with the staff person
(7) Other_____

35. What materials about improving health and safety did the weatherization agency staff give you? (Check all that apply)

(1) One or more brochures, booklets and manuals
(2) One or more compact discs
(3) One or more videos (including DVD's)
(4) No materials were provided (go to Q36)

35a. How much time have you spent reading/reviewing the materials about improving health and safety that the weatherization agency staff gave you?

(1) No time (go to Q36)
(2) Less than 5 minutes
(3) 5 to 14 minutes
(4) 15 to 29 minutes
(5) 30 to 59 minutes
(6) More than one hour

35b. How well did you understand the improving health and safety materials that the weatherization agency staff gave you?

(1) Very well
(2) Well
(3) Neither well or not well
(4) Not well
(5) Not well at all

35c. How useful have the improving health and safety materials been to you?

(1) Very useful
(2) Useful
(3) Neither useful or not useful
(4) Not useful
(5) Not very useful

35d. What about the materials were particularly useful? _____

35e. How could the materials have been improved for your use? _____

36. How satisfied are you with the ways that the weatherization agency provided you with information about improving health and safety?

(1) Very satisfied
(2) Satisfied
(3) Not satisfied or dissatisfied
(4) Dissatisfied
(5) Very dissatisfied

37. How could the agency improve the ways that it provides households with information about improving health and safety? _____

38. What are some of the greatest benefits your household received by participating in the weatherization program? _____

39. What suggestions do you have for how the weatherization program can be improved? _____

40. In the last 12 months, have you informed other people who might be interested in receiving weatherization services of the program?

(1) Yes
(2) No

41. Do you know if these people have had their homes weatherized or are scheduled to have their home weatherized, as a result of your suggestion?

(1) Yes
(2) No

42. Why did you apply for the Weatherization Assistance Program?[38]

(1) Reduce energy bills
(2) Support environmental efforts to conserve energy
(3) Make home more comfortable
(4) Receive free services
(5) Other
(6) Don't know

43. Prior to receiving weatherization services, in what ways did your household attempt to weatherize your home?
Please Explain_____
_____
_____

44. Would you say your household is now less likely to move from your current home as a result of weatherization?

(1) Yes
(2) No
(3) Don't Know/Not Sure
(4) Refused

45. Please rate the chances of your household's moving during the next 12 months for any reason or combination of reasons:

(1) Very high
(2) High
(3) Medium
(4) Low
(5) Very low
(6) No chance

46. Were you asked about preexisting health conditions that you or your family members living in the home may have?
a. Yes
b. No

[38] Ohio REACH

47. Did the crew take precautions so that those conditions were not made worse?
a. Yes
b. No
c. Don't Know
d. N/A

48. How do you feel as far as the health and safety of your home since weatherization was conducted?
a. Much better
b. Better
c. Neither better or worse
d. Worse
e. Much Worse

49. Finally, please rate your overall satisfaction with the weatherization program.
(1) Very satisfied
(2) Satisfied
(3) Not satisfied or dissatisfied
(4) Dissatisfied
(5) Very dissatisfied

QUESTIONS TO BE ADDED TO CLIENT SATISFACTION PART

Financial Programs – Household Participants

1. Do you understand the terms of the loan/on-bill payment agreement?
a. Yes
b. No
If not, what do you not understand? Please explain _____

2. Have you noticed a change in your utility bills since your home was weatherized?
a. Yes, bills have gone down substantially
b. Yes, bills have gone down somewhat
c. No, no change
d. Yes, bills have gone up somewhat
e. Yes, bills have gone up substantially
f. Don't know

3. Have you been able to afford the loan/ on-bill payments?
a. No
b. Yes, but just barely
c. Yes

4. In retrospect, would you make the same decision to participate in this loan/on-bill payment program?
a. Yes
b. No
If No, please explain _____

5. How did you hear about this program?
a. Advertisement
b. Directly contacted by program
c. From relatives/friends
d. Browsing the Internet
e. Other _____

Financial Programs --Multi-family renting residents
1. Do you know that your building owner is participating in a program that subsidizes weatherization of your building?
a. No
b. Yes

2. Did the owner consult with you and other tenants about the program before signing up for it?
a. No
b. Yes

3. Did your building association consult with you about the program?
a. No
b. Yes
c. N/A, there is no building association

4. Has your rent increased since XXXX?
a. Yes, rent has gone down substantially
b. Yes, rent has gone down somewhat
c. No, no change
d. Yes, rent has gone up somewhat
e. Yes, rent has gone up substantially
f. Don't know

5. Have your utility bills changed since XXXX?
a. Yes, bills have gone down substantially
b. Yes, bills have gone down somewhat
c. No, no change
d. Yes, bills have gone up somewhat
e. Yes, bills have gone up substantially
f. Don't know
g. I do not pay utility bills

6. Over the past XXXX months, please rate the changes in the following in your building and/or your unit:

	Much Better	**Better**	**No Change**	**Worse**	**Much Worse**	**Not Applicable**
Hallway lighting						
Stairway lighting						
Entrance lighting						
Comfort of your unit in winter						(If survey is administered prior to their experiencing a winter since the retrofit)
Comfort of your unit in the summer						Same as above.

7. Have you received any education about how to reduce energy consumption in your unit during the past 12 months?
a. No
b. Yes

To those who received new technology (active):
Are you aware that you received ???? in conjunction with the Weatherization Program you applied for?
a. Yes
b. No

Did you receive ???? at the same time as the organization weatherized your home?
a. Yes
b. No
c. Don't Know

Did the agency mention anything different about ???? as compared to the other improvements they made in your home?
a. Yes
b. No

1. Do you understand how ???? works?
a. No
b. Yes

2. Did you receive any education and/or training about how to operate ?????
a. No
b. Yes
c. N/A

3. Did you receive any education and/or training about how to maintain ????
a. No
b. Yes
c. N/A

4. Does ???? seem to work?
a. Yes (go Q7)
b. No
c. Don't Know

5. In your opinion, did ???? ever work?
a. No (go to Q7)
b. Yes

6. How long ago do you think that ???? stopped working?
a. 1-2 months
b. 2-4 months
c. 5-6 months
d. 7-8 months
e. more than 8 months ago

7. Have your utility bills changed since ???? was installed?
a. Yes, bills have gone down substantially
b. Yes, bills have gone down somewhat
c. No, no change
d. Yes, bills have gone up somewhat
e. Yes, bills have gone up substantially
f. Don't know

8. Have you experienced any other benefits to yourself or your household since ???? was installed?
a. No
b. Yes
If yes, please explain _____

9. Do you have any worries about ????
a. No
b. Yes
If yes, please explain _____

10. Are you glad, in retrospect, to have ????? installed?
a. No
b. Yes

11. Have any of your friends and/or relatives asked you about your new ?????
a. No
b. Yes

12. If so, does it seem as though they would also be interested in having ???? installed in their homes?
a. Yes, most are interested
b. Yes, some are interested
c. No, none seem interested

In-home monitors in addition

1. Do you understand the information that the in-home monitor provides to you?
a. Yes
b. No
If no, please explain _____

2. How often do you read the information in the in-home monitor?
a. Several times a day
b. About once a day
c. Once every few days
d. Once a week
e. Once every couple of weeks
f. Once a month
g. Fewer than once a month
h. Never

3. How easy is the in-home monitor to read?
a. Very easy
b. Easy
c. Neither easy or hard
d. Hard
e. Very hard

4. Did you receive education about how to read the in-home monitor?
a. No
b. Yes

5. From your perspective, how could the in-home monitor be improved? _____

6. Has the in-home monitor influenced how your household uses energy?
a. No
b. Yes
If yes, please explain _____

7. Do you change thermostat settings in the winter based on information from the in-home monitor?
a. No
b. Sometimes
c. Frequently

8. Do you change thermostat settings in the summer based on information from the in-home monitor?
a. No
b. Sometimes
c. Frequently

Financial Programs – Household Participants

1. How did you hear about this program?
a. Local weatherization agency
b. From relatives or friends
c. Advertisement on TV, radio or in newspaper
d. Other _____
e. Don't know

2. Have you noticed a change in your utility bills since your home was weatherized?
a. Yes, bills have gone down substantially
b. Yes, bills have gone down somewhat
c. No, no change
d. Yes, bills have gone up somewhat
e. Yes, bills have gone up substantially
f. Don't know

3. Have you been able to afford the loan/ on-bill payments?
a. No
b. Yes, but just barely
c. Yes

4. Do you understand the terms of the loan/on-bill payment agreement?
a. Yes
b. No
If not, what do you not understand? Please explain _____

5. In retrospect, would you make the same decision to participate in this loan/on-bill payment program?
a. Yes
b. No
If No, please explain _____

Financial Programs --Multi-family renting residents
1. Do you know that your building owner is participating in a program that subsidizes weatherization of your building?
a. No
b. Yes

2. Did the owner consult with you and other tenants about the program before signing up for it?
a. No
b. Yes

3. Did your building association consult with you about the program?
a. No
b. Yes
c. N/A, there is no building association

4. Has your rent increased since XXXX?
a. Yes, rent has gone down substantially
b. Yes, rent has gone down somewhat
c. No, no change
d. Yes, rent has gone up somewhat
e. Yes, rent has gone up substantially
f. Don't know

5. Have your utility bills changed since XXXX?
a. Yes, bills have gone down substantially
b. Yes, bills have gone down somewhat
c. No, no change
d. Yes, bills have gone up somewhat
e. Yes, bills have gone up substantially
f. Don't know
g. I do not pay utility bills

6. Over the past XXXX months, please rate the changes in the following in your building and/or your unit:

	Much Better	**Better**	**No Change**	**Worse**	**Much Worse**	**Not Applicable**
Hallway lighting						
Stairway lighting						
Entrance lighting						
Comfort of your unit in winter						(If survey is administered prior to their experiencing a winter since the retrofit)
Comfort of your unit in the summer						Same as above.

7. Have you received any education about how to reduce energy consumption in your unit during the past 12 months?
a. No
b. Yes

To those who received new technology (active):

1. Are you aware that you received ???? in conjunction with the Weatherization Program you applied for?
c. Yes
d. No

2. Did you receive ???? at the same time as the organization weatherized your home?
d. Yes
e. No
f. Don't Know

3. Did the agency mention anything different about ???? as compared to the other improvements they made in your home?
c. Yes
d. No

4. Do you understand how ???? works?
a. No
b. Yes

5. Did you receive any education and/or training about how to operate ?????
a. No
b. Yes
c. N/A

6. Did you receive any education and/or training about how to maintain ????
a. No
b. Yes
c. N/A

7. Does ???? seem to work?
a. Yes (go Q7)
b. No
c. Don't Know

8. In your opinion, did ???? ever work?
a. No (go to Q7)
b. Yes

9. How long ago do you think that ???? stopped working?
a. 1-2 months
b. 2-4 months
c. 5-6 months
d. 7-8 months
e. more than 8 months ago

10. Have your utility bills changed since ???? was installed?
a. Yes, bills have gone down substantially
b. Yes, bills have gone down somewhat
c. No, no change
d. Yes, bills have gone up somewhat
e. Yes, bills have gone up substantially
f. Don't know

11. Have you experienced any other benefits to yourself or your household since ???? was installed?
a. No
b. Yes
If yes, please explain _____

12. Do you have any worries about ????
a. No
b. Yes
If yes, please explain _____

13. Are you glad, in retrospect, to have ????? installed?
a. No
b. Yes

14. Have any of your friends and/or relatives asked you about your new ?????
a. No
b. Yes

15. If so, does it seem as though they would also be interested in having ???? installed in their homes?
a. Yes, most are interested
b. Yes, some are interested
c. No, none seem interested

In-home monitors installed in homes

1. Do you understand the information that the in-home monitor provides to you?
a. Yes
b. No
If no, please explain _____

2. How often do you read the information in the in-home monitor?
a. Several times a day
b. About once a day
c. Once every few days
d. Once a week
e. Once every couple of weeks
f. Once a month
g. Fewer than once a month
h. Never

3. How easy is the in-home monitor to read?
a. Very easy
b. Easy
c. Neither easy or hard
d. Hard
e. Very hard

4. Did you receive education about how to read the in-home monitor?
a. No
b. Yes

5. From your perspective, how could the in-home monitor be improved? _____

6. Has the in-home monitor influenced how your household uses energy?
a. No
b. Yes
If yes, please explain _____

7. Do you change thermostat settings in the winter based on information from the in-home monitor?
a. No
b. Sometimes
c. Frequently

8. Do you change thermostat settings in the summer based on information from the in-home monitor?
a. No
b. Sometimes
c. Frequently

That is the end of the survey. Thank you for your participation! You will receive your $10 gift card in the mail to compensate you for your time. Could you please verify your mailing address:

Address: _____
_____
_____
_____

APPENDIX L – DF9 OCCUPANT SURVEY INFORMATION DATA FORM

DF9: Contact Information from Agencies for Occupant Survey

This information is being collected to choose a sample of homes that are expected to receive weatherization in order to administer a survey to the occupants. The information will be used to build a sampling frame to use to randomly select homes for this survey.

Public reporting burden for this collection of information is estimated to average one hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Records Management Division, IM-11, Paperwork Reduction Project (1910-5151), U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project (1910-5151), Washington, DC 20503.

Introduction: As part of the national evaluation of the Weatherization Assistance Program, occupants of housing units weatherized in Program Year 2010 will be surveyed before and after weatherization to obtain information on their health and demographics, determine their energy consumption behavior and knowledge, evaluate non-energy benefits, and establish their satisfaction with the Program. In addition, occupants of households that have received (or will receive) assistance from the Low-Income Home Energy Assistance Program (LIHEAP) but whose houses have not been (or will not be) weatherized will be surveyed to serve as a control group for the occupant survey.

We would like to survey several such occupants served by your agency. In order for us to randomly select several weatherized households, please provide us with the names and contact information for clients currently in the queue (i.e., in line) for receiving audits using the first attached form. Similarly, please use the second attached form to provide us with the names and contact information for clients your agency has provided, or will provide, LIHEAP assistance in Program Year 2010 so we can select several control households (provide a maximum of 20 names). [NOTE: If weatherization services and LIHEAP assistance are provided by two separate organizations, then similar instructions and forms will be used that only request information on weatherization clients or LIHEAP recipients.]

The information that you provide and that we obtain from the occupants will be protected and will remain confidential. When results of the survey are reported, information collected from the occupants will not be associated with their names in any way. In order to maintain the integrity of the survey, we will not be able to tell you which clients have been selected for the survey. We will be paying the occupants a small incentive to participate in the survey, so an undo burden will not be placed on your clients.

Clients in Queue for Audits

Agency name: _____

State: _____

Date: _____

Please provide the following information for clients currently in the queue to receive audits by your agency.

	Name	Address	City	State	Zip Code	Phone Number	Expected Audit Date
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							
16.							
17.							
18.							
19.							
20.							

APPENDIX M. S4: OCCUPANT SURVEY

This data is being collected to conduct a survey of occupants about their experiences with the Weatherization Assistance Program and benefits they believe they have received from the program. The data you supply will be used to describe occupant satisfaction with the program as well as changes in energy education and non-energy benefits provided by the program.

Public reporting burden for this collection of information is estimated to average two hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Records Management Division, IM-11, Paperwork Reduction Project (**XXXX-XXXX**), U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project (**XXXX-XXXX**), Washington, DC 20503.

Lastly, all of the information obtained from this survey will be protected and will remain confidential. The data will be analyzed in such a way that the information provided cannot be associated back to you or your household. Your answers will not be shared with or reported back to anyone within the agency that served you or your state.

PRE-WEATHERIZATION SURVEY
{INTERVIEWER: STATE PRIOR TO PRE-WEATHERIZATION SURVEY ONLY}I will need to ask these questions of the adult in the household most involved with the weatherization of the home or the head of the household. Am I speaking to the right person?

POST-WEATHERIZATION SURVEY
{INTERVIEWER: VERIFY RESPONDENT IS THE SAME RESPONDENT FROM THE PRE-WEATHERIZATION SURVEY}Before we begin, I need to verify that this is the same person who completed this survey before your home received weatherization services. Am I speaking to the same person?

PLEASE RECORD RESPONDENT'S NAME, GENDER and AGE

	Name	Gender	Age
Main Respondent:			

1. How long have you lived in your current home?
   {If less than one year} Enter: _____ months
   Enter: _____ years

1a. {IF RESPONDENT HAS LIVED IN THE HOME < ONE YEAR} Has ANY OTHER ADULT living in the household lived in the home for more than one year?

(3) Yes
(4) No

{IF YES} Name _____
{IF NO: STOP SURVEY}

PART I. Energy Consumption, Non-Energy Impacts, Health and Demographics

2. Are you currently…?

(8) Married
(9) Divorced
(10) Widowed
(11) Separated
(12) Never married
(13) A member of an unmarried couple
(14) Refused

3. What is the highest degree or level of school you have completed?

(11) No Schooling Completed
(12) Kindergarten to grade 12 (No Diploma)
(13) High school diploma or GED
(14) Some college, no degree
(15) Associate's degree (for example: AA, AS)
(16) Bachelor's degree (for example: BA, BS)
(17) Master's degree (for example: MA, MS, MBA)
(18) Professional degree (for example: MD, JD)
(19) Doctorate degree (for example: PhD, EdD)
(20) Refused

4. Do you consider yourself to be of Hispanic or Latino origin, such as Mexican, Puerto Rican, Cuban, or other Spanish background?

(5) Yes
(6) No
(7) Don't know/Not Sure
(8) Refused

5. Which describes your race? You can select one or more categories.

(9) White
(10) Black or African-American
(11) American Indian or Alaska Native
(12) Asian
(13) Native Hawaiian or Other Pacific Islander
(14) Other (if volunteered)
(15) Hispanic or Latino (if volunteered)
(16) Refused

5a. {IF MORE THAN ONE} Which ONE of these groups best represents your race? You can select one or more categories.

(9) White
(10) Black or African-American
(11) American Indian or Alaska Native
(12) Asian
(13) Native Hawaiian or Other Pacific Islander
(14) Other (if volunteered)
(15) Hispanic or Latino (if volunteered)
(16) Refused

6. Were you born a citizen of the United States or did you become a citizen of the United States through naturalization?

(5) Born
(6) Naturalized
(7) Neither
(8) Refused

In this next section, I will be asking you about your home and your use of energy.

7. Do you rent or own your current residence?

(4) Rent
(5) Own
(6) Neither (Please describe the housing agreement).

_____

8. Which of the following best describes the location of your home? Do you live in a city, a town, the suburbs, or in a rural area?

(7) City
(8) Town
(9) Suburbs
(10) Rural
(11) Don't Know/Not Sure
(12) Refused

9. In the past 12 months has anyone in your household owned or had the regular use of any cars, trucks, vans, sports-utility-vehicles or similar vehicles? DO NOT INCLUDE MOTORCYCLES OR MOPEDS.

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

INTERVIEWER: "REGULAR USE" MEANS THE VEHCILE IS KEPT AT HOME AND IS AVAILABLE FOR SOME PERSONAL USE.

10. Thinking of the area where you live, in the past 12 months, have members of your household had regular access to public transportation? {PROBE: buses, trolley buses, trains, trams, rapid transit (metro/subway/underground), water taxi/ferries, free transportation offered by community services agencies, Medicaid covered transportation…)

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

11. Which of the following do you believe best describes your current home? Is it a… (INTERVIEWER: DEFINE EACH HOUSING TYPE IF NEEDED)

(6) Single-family detached house
(7) a Single-family attached house,
(8) an Apartment building with 2-4 units,
(9) an Apartment building with 5 or more units, or
(10) a Mobile home?

12. How many bedrooms do you have in your home? [*Include bedrooms in finished attics or finished basements*.] _____

13. Now think about other rooms in your home besides bedrooms and bathrooms. Not including unfinished areas, hallways, and closets, how many other rooms are there in your home?
_____

16. Is your home heated during the winter?

(5) Yes (SKIP to Q17)
(6) No
(7) Don't Know/Not Sure
(8) Refused

16a. {IF NO}You have just told me that you don't heat your home during the winter. Just to clarify, is it that you have heating equipment but don't use it, or does your home just not have any heating equipment?

(5) Have equipment, but don't use it (SKIP to Q8)
(6) Don't have any heating equipment
(7) Don't Know/Not Sure
(8) Refused

17. Last winter, did you heat all # (sum from Q12 ad Q13) rooms?

(9) Yes (SKIP to Q18)
(10) No
(11) Don't Know/Not Sure
(12) Refused

17a. How many of those rooms were not heated last winter?
Enter the number _____

18. Is any air conditioning equipment used in your home?

(13) Yes (SKIP to Q19)
(14) No
(15) Don't Know/Not Sure
(16) Refused

18a. (IF NO) Just to clarify, do you have air conditioning equipment but don't use it, or does your home just not have any air conditioning equipment?

(5) Have equipment, but don't use it (SKIP to Q 20)
(6) Don't have any air conditioning equipment
(7) Don't Know/Not Sure
(8) Refused

19. Last summer, did you air condition all # (sum Q12 and Q13) rooms?

(1) Yes (SKIP to Q20)
(2) No
(5) Don't Know/Not Sure
(6) Refused

19a.How many of those rooms were not cooled last summer?

Enter the number _____

20. Is any part of your home over a crawl space with exposed dirt as the floor?

(5) Yes
(6) No
(7) Don't Know/Not sure
(8) Refused

21. Is any part of your home over a basement?

(5) Yes
(6) No (SKIP TO 22)
(7) Don't Know/Not Sure
(8) Refused

21a. Do you use your basement for living space? That is, do you use it for work, play or sleep?

(5) Yes
(6) No (SKIP to Q22)
(7) Don't Know/Not Sure
(8) Refused

21b. Is the basement warm enough to be used as a living space in the winter?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

21c. Is the basement cool enough to be used as a living space in the summer?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

22. An attic is an area directly below the roof, accessible by stairs, with space for you to stand upright and easily move about. Does your home have an attic?

(5) Yes
(6) No (SKIP to Q23)
(7) Don't Know/Not Sure
(8) Refused

22a. Do you use the attic for living space? That is, do you use it for work, play or sleep?

(5) Yes
(6) No (SKIP to Q23)
(7) Don't Know/Not Sure
(8) Refused

22b. Is the attic warm enough to be used as a living space in the winter?

(6) Yes
(7) No
(8) Don't Know/Not Sure
(9) Refused
(10)

22c. Is the attic cool enough to be used as a living space in the summer?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

23. Does your home have a garage that is attached to or part of your home?

(5) Yes
(6) No (SKIP to 24)
(7) Don't Know/Not Sure
(8) Refused

23a. Do you warm up your vehicle in your garage?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

23b. Have you or anyone else living in your home observed the smell of vehicle exhaust inside your home?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

I have some questions about heating your home.

24.{IF NO TO HEAT FROM PREVIOUS SECTION SKIP TO COOLING} Let's start with the main source of heating in your home. Please tell me which type of heating equipment provides *most* of the heat for your home. Remember to include portable heaters, fireplaces, heating stoves and cooking stoves.

(12) Heat pump
(13) Central furnace with ducts to individual rooms
(14) Steam/Hot water system with radiators or pipes in each room
(15) Built-in electric units in each room installed in walls, ceilings, baseboards, or floors
(16) Built-in floor/wall pipeless furnace
(17) Built-in room heater burning gas, oil, or kerosene
(18) Heating stove burning wood, coal, or coke
(19) Portable heaters
(20) Fireplace
(21) Cooking stove used to heat your home as well as to cook
(22) Some other equipment (Specify _____)

25. Does the main heating equipment for your home also heat any other apartments, condos, households, businesses, or farm buildings?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

26. What is the *main* fuel used for heating your home? That is, which fuel is the one that provides the most heat for your home?

(12) Electricity
(13) Natural gas from underground pipes
(14) Propane (bottled gas)
(15) Fuel oil
(16) Kerosene
(17) Wood
(18) Biomass
(19) Solar or Wind
(20) Geothermal
(21) District steam
(22) Some other fuel (Specify _____)

27. You told me that [EQUIPM] is the main source of heat in your home. In the past 12 months, did you use any other types of heating equipment? Remember to include portable heaters, fireplaces, heating stoves and cooking stoves. CHECK ALL THAT APPLY

(13) No other equipment
(14) Heat pump
(15) Central furnace with ducts to individual rooms
(16) Steam/Hot water system with radiators or pipes in each room
(17) Built-in electric units in each room installed in walls, ceilings, baseboards, or floors
(18) Built-in floor/wall pipeless furnace
(19) Built-in room heater burning gas, oil, or kerosene
(20) Heating stove burning wood, coal, coke, or biomass (such as pellets or corn)
(21) Portable heaters
(22) Fireplace

(23) Cooking stove used to heat your home as well as to cook
(24) Some other equipment (Specify _____)

28. What fuel does the [FILL: EQUIPAUX] use?
(12) Electricity
(13) Natural gas from underground pipes
(14) Propane (bottled gas)
(15) Fuel oil
(16) Kerosene
(17) Wood
(18) Biomass (wood pellets or corn)
(19) Solar or Wind
(20) Geothermal
(21) District steam
(22) Some other fuel (Specify _____)

29. {IF YES WIND OR SOLAR FOR EITHER MAIN OR OTHER FUELS USED}
Do you have any on-site system that generates electricity such as a solar system or a small wind turbine?
(5) Yes
(6) No (SKIP to Q30)
(7) Don't Know/Not Sure
(8) Refused

29a. What type of on-site system do you have?
(5) Solar or Photovoltaic system
(6) Small wind turbine
(7) Combined Heat and Power system
(8) Other . Please specify_____

29b. Is your on-site system connected to the grid?
(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

30. {IF YES HEATING STOVE} Which statement best describes your heating stove?
(6) Manufactured before 1992
(7) Energy Star
(8) Neither
(9) Don't Know/Not Sure
(10) Refused

31. {IF YES FIREPLACE} Does this fireplace have a flue to the outside or is it entirely self-contained?
(5) Flue to the outside
(6) Flueless (self-contained)
(7) Don't Know/Not Sure
(8) Refused

32. {IF YES HEATING STOVE OR FIREPLACE} In the past 12 months how often did you have to burn garbage, cardboard, plastics, foam, colored ink, magazines, boxes, or wrappers to keep warm?

(8) Never
(9) Once
(10) Sometimes
(11) Often
(12) Most of the winter
(13) Don't Know/Not Sure
(14) Refused

33. {IF YES HEATING STOVE OR FIREPLACE} In the past 12 months how often did you have to burn coated, painted, or pressure-treated wood, driftwood, plywood, particle board, or any wood with glue in it to keep warm?

(8) Never
(9) Once
(10) Sometimes
(11) Often
(12) Most of the winter
(13) Don't Know/Not Sure
(14) Refused

34. {IF YES HEATING STOVE OR FIREPLACE} In the past 12 months how often did you have to burn wet, rotted, diseased, or moldy wood
to keep warm?

(8) Never
(9) Once
(10) Sometimes
(11) Often
(12) Most of the winter
(13) Don't Know/Not Sure
(14) Refused

35. What fuel does the cooking stove and/or oven use? (Check all that apply)

(9) Electricity
(10) Natural gas from underground pipes
(11) Propane (bottled gas)
(12) Fuel oil
(13) Kerosene
(14) Wood
(15) Some other fuel (Specify _____)
(16) No working stove or oven in the home

36. Is an exhaust fan that vents to the outside used regularly when cooking in your kitchen?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

37. In the past 12 months how often have you used your oven to heat your house?

(1) Never
(2) Rarely
(3) Sometimes
(4) Frequently
(5) All the time
(6) Don't Know/Not Sure
(7) Refused

38. Does your household use a microwave oven?

(5) Yes
(6) No (SKIP to 39)
(7) Don't Know/Not Sure
(8) Refused

38a. Which answer best describes how frequently your household uses the microwave to prepare hot meals and snacks in a typical week?

(7) Used to cook or reheat *most* meals and snacks
(8) Used to cook or reheat *about half* of meals and snacks
(9) Used to cook or reheat *a few* meals and snacks
(10).....Used very little
(11).....Don't Know/Not Sure
(12).....Refused

39. Does your heating system have an air filter?

(1) Yes
(2) No (SKIP to 40)
(3) Don't know/Not Sure
(4) Refused

39a. Is the air filter in your heating system a High Efficiency Particulate Arresting (HEPA) filter?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

39b. Approximately, how often does someone in your household change (or clean) the air filter in your heating system?

(1) Monthly
(2) Every three months
(3) Every six months
(4) Once a year
(5) Once every two years
(6) Don't change (or clean) it
(7) Air filter is changed by service company
(8) Don't Know/Not Sure
(9) Refused

40. {IF YES FURNACE} Do you know when was the last time your furnace received maintenance service by a furnace contractor to ensure optimum and safe operation?

(1) Yes
(2) No (SKIP to Q41)
(3) Refused

40a. How many years and months ago did this occur? _____

41. Do you have a CO (or carbon monoxide) monitor in your house?

(1) Yes
(2) No (SKIP to Q 42)
(3) Don't know/Not Sure
(4) Refused

41a. Is your CO monitor currently working?

(1) Yes
(2) No
(3) Don't know/Not Sure
(4) Refused

42. Do you have one or more smoke detectors in your house?

(1) Yes
(2) No (SKIP to Q43)
(3) Don't know/Not Sure
(4) Refused

42a. How many smoke detectors are there in your house?

Enter Number _____
(3) Don't Know/Not Sure
(4) Refused

42b. How many of these smoke detectors are currently working?

Enter Number _____
(3) Don't Know/Not Sure
(4) Refused

43. In the past 12 months how many times has the fire department been called to put out a fire in your home during the past year? _____

44. In the past 12 months did any fire start in your home as a result of using an alternate *heating* source, such as space heaters, electric blankets, your kitchen stove or oven, heating stove, furnace, or your fireplace?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

45. In the past 12 months, how many individuals needed medical attention because of fire?

Enter Number_____

Now I have some questions about cooling you home.

46. (IF NO TO AIR CONDITIONING FROM PREVIOUS SECTION SKIP TO CEILING FAN USE Q47) Central air conditioning requires that the system have ducts to carry the cooled air to the individual rooms. These ducts may also carry warm air for space heating. Does your home have ducts like these?

(5) Yes
(6) No (SKIP to 47)
(7) Don't Know/Not Sure
(8) Refused

46a. Does the central air conditioning equipment that cools your home also cool any other apartments, condos, households, businesses, or farm buildings?

(3) Yes
(4) No

46b. Which of the statements shown best describes the way your central air conditioning system was used last summer?

(5) Not used at all (if volunteered)
(6) Turned on only a few days or nights when really needed
(7) Turned on quite a bit
(8) Turned on just about all summer

47. Which of the following statements best describes the way your household used the *most used* window/wall air conditioning unit last summer?

(5) Turned on only a few days or nights when really needed
(6) Turned on quite a bit
(7) Turned on just about all summer
(8) No working window/wall units in home

48. Which of the following statements best describes the way your household used a *Swamp or Evaporative Air Cooler* last summer?

(5) Turned on only a few days or nights when really needed
(6) Turned on quite a bit
(7) Turned on just about all summer
(8) No swamp/evaporative air cooler in home.

49. How many ceiling fans does your household have?

Enter Number_____

(4) None (SKIP to Q 50)

(5) Don't Know/Not Sure

(6) Refused

49a. How many ceiling fans does your household use?

Enter Number of ceiling fans_____

(4) None (SKIP to 50)

(5) Don't Know/Not Sure

(6) Refused

49b. Thinking about the ceiling fan *that you use the most*, how often was this fan used last *summer*? Is it . . .

(7) Used only a few days or nights, when it's really needed,
(8) Used quite a bit, or
(9) Used just about all summer?
(10) Not used at all
(11) Don't Know/Not Sure
(12) Refused

49c. Thinking about the ceiling fan *that you use the most*, how often was this fan used last *winter*? Is it . . .

(7) Used only a few days or nights,
(8) Used quite a bit, or
(9) Used just about all winter?
(10) Not used at all
(11) Don't Know/Not Sure
(12) Refused

50. Opening windows on opposite sides of the house to cool the indoor temperature is called natural cross ventilation. In the past 12 months, has your household used window fans to assist with natural cross ventilation in the warmer months?

(5) Yes

(6) No

(7) Don't Know/Not Sure

(8) Refused

51. How often are your windows open in the summer?

(1) Never
(2) Rarely
(3) Sometimes
(4) Frequently
(5) All the time
(6) Don't Know/Not Sure
(7) Refused

52. How often are your windows open in the winter?
(1) Never
(2) Rarely
(3) Sometimes
(4) Frequently
(5) All the time
(6) Don't Know/Not Sure
(7) Refused

53. Do any large trees shade your home from the afternoon summer sun?
(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

54. Do you close the drapes, curtains, shades, and/or blinds during the day to block out the sun during the summer?
(1) Never
(2) Rarely
(3) Sometimes
(4) Frequently
(5) All the time
(6) Don't Know/Not Sure
(7) Refused

INTERVIEWER INSTRUCTION: RECORD ANY INFORMATION HERE ABOUT THE AIRCONDITIONING EQUIPMENT IN THIS HOUSING UNIT AND ITS' USAGE THAT MIGHT PROVIDE CLARIFICATION TO THE RESPONDENT'S ANSWERS.

_____
_____
_____

Now I have some questions on the indoor air temperature of your home.

55. Does your home have a thermostat that controls the heating and/or cooling in your home?
(5) Yes
(6) No (SKIP to Q 64)
(7) Don't Know
(8) Refused

55a. What equipment does your thermostat control?
(1) Central heating only
(2) Central cooling only
(3) Central heating and cooling
(4) Don't know

56. Some thermostats can be programmed so that the temperature changes automatically at different times of the day; for example, the heat can be automatically turned down or lowered at night when you go to bed, then automatically adjusted up again in the morning. Is the thermostat that controls your main [heating and/or cooling] equipment programmable?

(5) Yes
(6) No (SKIP to Q57)
(7) Don't know/Not Sure
(8) Refused

56a. Do you or someone else in your household know how to use the programmable thermostat?

(6) Yes
(7) No (SKIP to Q57)
(8) No, someone who does not live in my home programs the thermostat for use
(9) Don't know/Not Sure
(10) Refused

56b. Is your thermostat programmed to change the temperature at different times of the day?

(5) Yes
(6) No (SKIP to Q56d)
(7) Don't know/Not Sure
(8) Refused

56c. Please indicate how the programmable thermostat is used. (Select all that apply)

(8) Thermostat is automatically adjusted to a lower temperature at night during the winter
(9) Thermostat is automatically adjusted to a lower temperature during the day when no one is home during the winter
(10) Thermostat is automatically adjusted to a higher temperature at night during the summer
(11) Thermostat is automatically adjusted to a higher temperature during the day when no one is home during the summer
(12) Other _____
(13) Don't know/Not Sure
(14) Refused

56d. Which statement best describes your programmable thermostat…

(7) It is very easy to use
(8) It is somewhat easy to use
(9) It is neither easy nor difficult to use
(10) It is somewhat difficult to use
(11) It is very difficult to use
(12) Refused

56e. Typically, how often is your programmable thermostat reprogrammed, that is, the time schedule and desired indoor temperature setting changed permanently?

(1) Daily
(2) Weekly
(3) Monthly
(4) Every three months of so
(5) Once a year
(6) Less than once a year
(7) Never
(8) Don't know/Not Sure
(9) Refused

56f. How often is the current temperature setting "overridden" temporarily and why?

(1) Daily
(2) Weekly
(3) Monthly
(4) Every three months of so
(5) Once a year
(6) Less than once a year
{IF ANSWERED ANY OF THE ABOVE} Please explain why._____
(7) Never
(8) Don't know/Not Sure
(9) Refused

56g. How often is the "hold" mode used and why?

Daily
(2) Weekly
(3) Monthly
(4) Every three months of so
(5) Once a year
(6) Less than once a year
{IF ANSWERED ANY OF THE ABOVE} Please explain why._____
(7) Never
(8) Don't know/Not Sure
(9) Refused

56h. Please indicate what features need improvement in your programmable thermostat.

(8) Size of words and numbers?
(9) Ease of programming?
(10) Additional features, such as the energy use in my home?
(11) Being able to change its settings using a cell phone, Internet?
(12) Other features. Please Specify. _____
(13) Don't Know/Not Sure
(14) Refused

56i. Is there anyone in your home who doesn't operate the programmable thermostat? Why? (Select all that apply)

(7) It's too complicated/too difficult
(8) We do not have an instruction manual / Nobody showed us how
(9) We haven't needed to
(10) Other (Specify)_____
(11) Don't Know/Not Sure
(12) Refused

56j. {IF NO TO 56b. or ANSWERED (7) NEVER TO 56e}Why is your programmable thermostat not programmed to automatically change the temperature? (Select all that apply)

(9) We change the temperature manually/don't need to program
(10) It takes too much effort to use
(11) Household members cannot agree on what temperatures at which to set the thermostat
(12) It is better to always keep the temperature setting always the same. (Why?)
(13) There is always somebody at home
(14) Other (Specify)_____
(15) Don't Know/Not Sure
(16) Refused

57. During the winter, what is the temperature when *someone is inside* your home *during the day?* [IF NO ANSWER, PROBE 1: THEN AT WHAT TEMPERATURE IS THE THERMOSTAT SET? PROBE 2: CAN I JUST HAVE YOUR BEST ESTIMATE?]

Enter degrees Fahrenheit_____

58. During the winter, what is the temperature when *no one is inside* your home *during the day*? [IF NO ANSWER, PROBE 1: THEN AT WHAT TEMPERATURE IS THE THERMOSTAT SET? PROBE 2: CAN I JUST HAVE YOUR BEST ESTIMATE?]

Enter degrees Fahrenheit_____

59. During the winter, what is the temperature inside your home *at night*? [IF NO ANSWER, PROBE 1: THEN AT WHAT TEMPERATURE IS THE THERMOSTAT SET? PROBE 2: CAN I JUST HAVE YOUR BEST ESTIMATE?]

Enter degrees Fahrenheit_____

Now I would like you to think about the temperature inside your home when using your central air conditioning equipment last summer. [If NUMTHERM>1: *Earlier you reported having [FILL: NUMTHERM] thermostats. For the next questions, if the thermostats are set at different temperatures, only report for the thermostat that affects the rooms where most of the people are.*]

60. During the summer, what is the temperature when *someone is inside* your home *during the day?* IF NO ANSWER, PROBE 1: THEN AT WHAT TEMPERATURE IS THE THERMOSTAT SET? PROBE 2: WHAT'S YOUR BEST ESTIMATE?

Enter degrees Fahrenheit _____
Air-conditioner Turned Off

61. During the summer, what is the temperature when *no one is inside* your home *during the day*? IF NO ANSWER, PROBE 1: THEN AT WHAT TEMPERATURE IS THE THERMOSTAT SET? PROBE 2: WHAT'S YOUR BEST ESTIMATE?

Enter degrees Fahrenheit _____
Air-conditioner Turned Off

62. During the summer, what is the temperature inside your home *at night*? IF NO ANSWER, PROBE 1: THEN AT WHAT TEMPERATURE IS THE THERMOSTAT SET? PROBE 2: WHAT'S YOUR BEST ESTIMATE?

Enter degrees Fahrenheit _____
Air-conditioner Turned Off

63. Answer the following statements -- true or false:

a. If the thermostat is turned up very high in the winter, my home will get warmer faster.
(3) True
(4) False

b. The thermostat controls the temperature of the air coming from the heating/cooling unit into my home.
(3) True
(4) False

c. The thermostat only senses the temperature in the air in the room where the thermostat is located. It turns the heating unit off when the temperature in the room reaches the temperature on the thermostat setting.
(3) True
(4) False

d. If the thermostat is turned down at night or when no one is home, then more energy is used than saved when your home is heated up again.
(3) True
(4) False

64. In the past 12 months, was your household unable to use any of the following equipment because it was broken? CHECK ALL THAT APPLY
(6) Main Heating Equipment
(7) Central Air Conditioner
(8) Room Air Conditioner
(9) Don't Know/Not Sure
(10) Refused

65. Which of the following statements best describes the indoor temperature of your home during the winter:

(8) Very cold
(9) Cold
(10) Comfortable (SKIP)
(11) Hot
(12) Very hot
(13) Other _____
(14) Refused

66. Which of the following statements best describes the indoor temperature of your home during the summer:

(8) Very cold
(9) Cold
(10) Comfortable (SKIP TO NEXT Q….)
(11) Hot
(12) Very hot
(13) Other _____
(14) Refused

67. In the past 12 months, has a landlord controlled the temperature inside your home?

(1) Yes
(2) No
(3) Do not have landlord
(4) Don't Know/Not Sure
(5) Refused

68. In the past 12 months how often did your household keep your home at a temperature that you felt was unsafe or unhealthy?

(7) Almost every month
(8) Some months
(9) 1 or 2 months
(10) Never
(11) Don't Know/Not Sure
(12) Refused

69. In the past 12 months, has anyone in the household needed medical attention because your home was too cold?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

70. In the past 12 months did anyone in your household need medical attention because your home was too hot?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

71. During the past 12 months, how often have you or other members of your household found your home too drafty? Would you say it is. . .

(7) All the time,
(8) Most of the time,
(9) Some of the time, or
(10) Never
(11) Don't Know/Not Sure
(12) Refused

The next group of questions is about laundry appliances and water use in your home.

72. Is a clothes washing machine used in your home? Do not include community clothes washers that are located in the basement or laundry room of your apartment building.

(4) Yes
(5) No (SKIP to Q73)
(6) Refused

72a. In an average week, how many loads of laundry are washed in your clothes washer?

(8) 1 load or less each week
(9) 2 to 4 loads each week
(10) 5 to 9 loads each week
(11) 10 to 15 loads each week
(12) More than 15 loads each week
(13) Don't Know/Not Sure
(14) Refused

72b. Does your household wash only full loads of laundry?

(1) Always
(2) Most of the time
(3) Some of the time
(4) Never
(5) Don't know/Not Sure
(6) Refused

72c. What water temperature setting is usually used for the *wash* cycle of your clothes washer? Is it hot, warm, or cold water?

(6) Hot
(7) Warm
(8) Cold
(9) Don't Know/Not Sure
(10) Refused

72d. What water temperature setting is usually used for the *rinse* cycle of your clothes washer? Is it hot, warm, or cold water?

(6) Hot
(7) Warm
(8) Cold
(9) Don't Know/Not Sure
(10) Refused

73. Do you use a clothes dryer in your home? Do not include community clothes dryers that are located in the basement or laundry room of your apartment building.

(5) Yes
(6) No (SKIP TO Q74)
(7) Don't Know/Not Sure
(8) Refused

73a. Does your household dry only full loads of laundry….?

(1) Always
(2) Most of the time
(3) Some of the time
(4) Never
(5) Don't Know/Not Sure
(6) Refused

73b. Does your clothes dryer vent directly to the outdoors?

(6) Yes
(7) No
(8) Dryer is ventless
(9) Don't Know/Not Sure
(10) Refused

73c. Do you clean your clothes dryer's lint filter after every use?

(6) Yes
(7) No
(8) Dryer has not lint filter
(9) Don't Know/Not Sure
(10) Refused

74. How frequently does your household hang clothes to dry?

(1) Very frequently
(2) Frequently
(3) Infrequently
(4) Very infrequently
(5) Never
(6) Don't Know/Not Sure
(7) Refused

75. In the last 12 months, has the temperature of your hot water heater been adjusted?

(10) Yes, the temperature is much warmer
(11) Yes, the temperature is warmer
(12) No adjustment has been made to the temperature
(13) Yes, the temperature is cooler
(14) Yes, the temperature is much cooler
(15) Hot water heater was not in working order for the last 12 months
(16) No water heater
(17) Don't Know/Not Sure
(18) Refused

76. Over the past 12 months, has the duration of the showers taken by household members changed?

(1) Increased a lot
(2) Increased some
(3) No change
(4) Decreased some
(5) Decreased a lot
(6) No Shower
(7) Don't Know/Not Sure
(8) Refused

77. Does your main bathroom have a ventilation fan in it that works?

(1) Yes
(2) No (SKIP to Q78)
(3) Don't know/Not Sure (SKIP to Q50)
(4) Refused

77a. How often do you or members of your household operate the fan while showering?

(1) Never
(2) Rarely
(3) Sometimes
(4) Frequently
(5) All the time
(6) Don't Know/Not Sure
(7) Refused

77b. How long after showering do you or members of your household operate the fan?

(1) Don't turn the fan on for showers
(2) The fan is turned off when leaving the shower area
(3) A few minutes
(4) Several minutes
(5) Until the steam in the shower area is gone
(6) Don't know/Not Sure
(7) Refused

78. Electric dehumidifiers remove moisture from the air and are often used in the summer. Is a dehumidifier used in your home?

(5) Yes
(6) No (SKIP to Q79)
(7) Don't Know/Not Sure
(8) Refused

78a. In the past 12 months, how many months was the dehumidifier used?

(7) 1 to 3 months, 4 to 6 months,
(8) 7 to 9 months,
(9) 10 to 11 months, but not all year, or is it
(10) Turned on all year long?
(11) Don't Know/Not Sure
(12) Refused

Now I have some questions about lights inside your home and energy efficiency.

79. How often do you find lights left on in rooms that are not occupied?
(1) Never
(2) Almost never
(3) Sometimes
(4) Most of the time
(5) All the time
(6) Don't Know/Not Sure
(7) Refused

80. Do members of your household purchase or intentionally seek out and install compact fluorescent bulbs in your home?
(1) Yes
(2) No (SKIP to Q81)
(3) I do not know what compact fluorescent bulbs are (SKIP to Q81)
(4) Don't know/Not Sure
(5) Refused

80a. How do you dispose of compact fluorescent light bulbs that are broken or no longer working?
(7) Directly in household garbage
(8) Doubled bagged in plastic in household garbage
(9) Transport to local recycling center
(10) Other (Please Specify)_____
(11) Don't Know/Not Sure
(12) Refused

81. Are you familiar with the Energy Star® label?
(4) Yes
(5) No (SKIP to 82)
(6) Refused

81a. Has your household bought or intentionally installed appliances or consumer electronics that have an Energy Star® label?
(5) Yes
(6) No
(7) Don't know/Not Sure
(8) Refused

82. Do you unplug any appliances like TVs, VCRs, stereos, radios, clocks, or computers to save energy when they are turned off?
(1) Yes
(2) No
(3) Don't know/Not Sure
(4) Refused

In this next set of questions, I will ask you about other conditions of your home.

83. How much outdoor noise do you hear indoors when the windows are closed?
    (7) A great deal
    (8) Some
    (9) Hardly any
    (10) None at all
    (11) Don't know/Not Sure
    (12) Refused

84. Please rate the outside appearance of your home:
    (7) Very attractive
    (8) Attractive
    (9) Neither attractive nor unattractive
    (10) Unattractive
    (11) Very unattractive
    (12) Refused

85. Over the past 12 months, how has the property value of your home changed?
    (9) Very much higher
    (10) Higher
    (11) No change
    (12) Lower
    (13) Very much lower
    (14) Not applicable, don't own the home or live in an apartment
    (15) Don't know/Not Sure
    (16) Refused

86. How infested is your home with cockroaches or other insects or spiders?
    (1) Extremely infested
    (2) Very infested
    (3) Somewhat infested
    (4) Hardly infested
    (5) Not infested at all (SKIP to Q87)
    (6) Don't know/Not Sure
    (7) Refused

86a. What have you done about the cockroaches, other insects or spiders?
    (7) Nothing
    (8) Used insecticides, bug sprays, or poison
    (9) Hired an exterminator or other professional
    (10) Other. Please specify._____
    (11) Don't Know/Not Sure
    (12) Refused

87. How infested is your home with rats or mice?

(2) Extremely infested
(2) Very infested
(3) Somewhat infested
(4) Hardly infested
(5) Not infested at all (SKIP to Q88)
(6) Don't know/Not Sure
(7) Refused

87a. What have you done about the pests?

(7) Nothing
(8) Used bait or poison
(9) Hired an exterminator or other professional
(10) Other. Please specify._____
(11) Don't Know/Not Sure
(12) Refused

88. Does your home frequently have a mildew odor or musty smell?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

89. How often do you observe standing water anywhere in your home?

(8) Never
(9) Rarely
(10) Sometimes
(11) Often
(12) Always
(13) Don't Know/Not Sure
(14) Refused

90. Have you seen mold in your home in the past 12 months?

(5) Yes
(6) No {SKIP to Q91}
(7) Don't know/Not Sure
(8) Refused

90a. {If YES MOLD} What have you done about the mold?

(12) Nothing
(13) Cleaned with bleach
(14) Cleaned with other chemical mold remover
(15) Cleaned with natural mold remover (vinegar or natural product)
(16) Air Conditioned
(17) Ventilation (fans)
(18) Used a dehumidifier
(19) Contacted a Professional
(20) Other. Please Specify _____
(21) Don't know/Not Sure
(22) Refused

Now I would like to ask you a few questions about your energy bills.
Some households may have faced challenges in paying home energy bills. The following questions ask about challenges your household may have had paying home energy bills or maintaining heating and cooling equipment. When thinking about these questions, include all of your experiences in the past 12 months.

91. Some energy utilities and suppliers offer *budget* payment plans that allow a household to pay the same amount on the home energy bill each month. In the past 12 months, did your household use a *budget* plan for any home energy bill?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

INTERVIEWER INSTRUCTION: BUDGET PLANS ARE NOT USUALLY RELATED TO LATE OR DISCONNECT NOTICES AND ARE NOT A WAY TO PAY DOWN PAST DUE BALANCES.

92. How well do you understand the information on your energy bill other than the amount owed (e.g., information about how much energy your household used during the billing period compared to the same billing period one year ago)?

(1) Very well
(2) Well
(3) Neither well nor not well
(4) Not well
(5) Not well at all
(6) Don't know/Not Sure
(7) Refused

93. How hard is it to pay your energy bills?
(8) Very hard
(9) Hard
(10) Neither hard or not hard
(11) Not hard
(12) Not hard at all
(13) Don't know/Not Sure
(14) Refused

94. Has your household ever had to move in the past 5 years because your household could not pay the energy bills?
(4) Yes
(5) No (go to Q20)
(6) Don't know (go to Q 20)

95. Over the past 12 months, how often has your household not paid energy bills in order to pay other utility bills (PROBE: water/sewage/telephone/Secondary energy fuel type)?
(9) Every month
(10) Every other month
(11) Every few months
(12) Every six months
(13) Once in twelve months
(14) Never
(15) Don't Know/Not Sure
(16) Refused

96. Over the past 12 months, how often has your household not paid other utilities in order to pay the primary energy bill (PROBE: water/sewage/telephone/Secondary energy fuel type)?
(9) Every month
(10) Every other month
(11) Every few months
(12) Every six months
(13) Once in twelve months
(14) Never (SKIP to Q97)
(15) Don't Know/Not Sure
(16) Refused

96 a. What utilities were not paid for in order to pay an energy bill? (Check all that apply)
(8) Water
(9) Sewage
(10) Telephone
(11) Secondary energy fuel type
(12) Other_____
(13) Don't Know/Not Sure
(14) Refused

97. Over the past 12 months, how often has your household not purchased food in order to pay an energy bill?

(9) Every month
(10) Every other month
(11) Every few months
(12) Every six months
(13) Once in twelve months
(14) Never
(15) Don't Know/Not Sure
(16) Refused

98. Over the past 12 months, how often has your household not paid energy bills in order to purchase food?

(9) Every month
(10) Every other month
(11) Every few months
(12) Every six months
(13) Once in twelve months
(14) Never
(15) Don't Know/Not Sure
(16) Refused

99. In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

100. In the past four weeks, did you worry that your household members would not have nutritious food?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

101. Some households receive additional assistance to help pay for food. In the past 12 months did you or any members of your household receive food stamps or WIC assistance (Women, Infants, and Children nutrition program)? (ASK ONCE/DO NOT REPEAT QUESTION FOR EACH INDIVIDUAL)

(6) Yes
(7) No; Did not apply
(8) No; Applied for, but rejected
(9) Don't Know/Not Sure
(10) Refused

102. In the past 5 years have you or anyone in the household experienced any of the following as a result of energy bills? CHECK ALL THAT APPLY.

(7) Eviction from home
(8) Foreclosure on mortgage
(9) Moved in with friends or family
(10) Moved into a shelter or been homeless
(11) Family Separation
(12) Refused

102a. {If YES FAMILY SEPARATION} In what way or ways was the family separated?

(7) Adult partners only separated
(8) One adult partner separated from partner and children
(9) One parent separated from children only
(10) Both parents separated from children
(11) Elder parent or relative separated from family
(12) Refused

103. In the past 12 months how often did your household pay an amount less than what you owed on your home energy bill, because you were unable to afford the whole home energy bill?

(7) Almost every month
(8) Some months
(9) 1 or 2 months
(10) Never
(11) Don't Know/Not Sure
(12) Refused

104. In the past year, have you used any of the following to assist with paying your energy bill?

(8) Payday loan
(9) Tax Refund Anticipation Loan
(10) Car Title loan
(11) Other type of short term, high-interest loan
(12) Pawn shop
(13) Don't Know/Not Sure
(14) Refused

104a. {If YES to any of the above}In the past year, in order to pay your home energy bill, how often did you need to use a payday loan, a Tax Refund Anticipation Loan, a car title loan, another type of short-term, high-interest loan, or pawn shop?

(7) Almost every month
(8) Some months
(9) 1 or 2 months
(10) Never
(11) Don't Know/Not Sure
(12) Refused

105. When home energy bills are not paid on time, it is common for energy utilities and suppliers to send late notices. If the bill is very late, they will send a disconnect, shut-off, or non-delivery notice. How often did you receive a disconnect, shut-off, or non-delivery notice?

(7) Almost every month
(8) Some months
(9) 1 or 2 months
(10) Never (SKIP to Q106)
(11) Don't Know/Not Sure
(12) Refused

105a. Did you enter into a payment arrangement with your energy utility or supplier in response to the disconnect shut-off, or non-delivery notice?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

106. In the past 12 months was your electricity or natural gas ever disconnected because you were unable to pay your home energy bill?

(5) Yes
(6) No (SKIP to Q107)
(7) Don't Know/Not Sure
(8) Refused

106a. While your electricity or natural gas was disconnected, was there a time when you wanted to use your main source of heat but were unable to?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

106b. While your electricity was disconnected, was there a time when you wanted to use your air conditioner but were unable to?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

107. In the past 12 months did your fuel oil, kerosene, propane, or wood ever run out because you were unable to pay for a home energy delivery?

(5) Yes
(6) No (SKIP to Q108)
(7) Don't Know/Not Sure
(8) Refused

107a. When you ran out of your fuel oil, kerosene, propane, or wood was there a time when you wanted to use your main source of heat but were unable to?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

Next, I will be asking about health care and coverage.

108. In the past 12 months have you had any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare?

(4) Yes (SKIP to Q108b)
(5) No
(6) Refused

108a. {IF NO COVERAGE} According to the information given, you do NOT have health care coverage of any kind. Do you have health insurance or coverage through a plan I might have missed? (INTERVIEWER: REVIEW PLANS IF INFORMANT IS UNSURE.)

(10) NO/NOT COVERED BY ANY PLAN (SKIP to Q109)
(11) HEALTH INSURANCE PLAN FROM A
(12) CURRENT OR PAST EMPLOYER/
(13) UNION/SCHOOL
(14) A HEALTH INSURANCE PLAN BOUGHT ON HIS/HER OWN/PROF. ASSN
(15) A PLAN BOUGHT BY SOMEONE WHO DOES NOT LIVE IN THIS HOUSEHOLD
(16) MEDICARE
(17) MEDICAID/STATE NAME
(18) CHAMPUS/CHAMP-VA, TRICARE, VA,
(10) OTHER MILITARY
(11) INDIAN HEALTH SERVICE
(12) [FILL STATE PLAN]
(13) OTHER PLAN [SPECIFY]
(14) DON’T KNOW/NOT SURE
(15) REFUSED

108b. {IF YES COVERAGE} During the past 12 months was there any time that you did not have any health insurance coverage?

(5) Yes
(6) No
(7) Don’t Know/Not Sure
(8) Refused

108c. Does your health plan pay for at least some of the cost of prescription medicines prescribed by a doctor?

(5) Yes
(6) No
(7) Don’t Know/Not Sure
(8) Refused

109. During the past 12 months, was there any time your household members needed prescription medicines but didn’t get them because you couldn’t afford it?

(5) Yes
(6) No
(7) Don’t Know/Not Sure
(8) Refused

110. Over the past 12 months, how often did members of your household not fill a prescription or took less than the full dose of a prescribed medicine in order to pay the utility bill?

(9) Every month
(10) Every other month
(11) Every few months
(12) Every six months
(13) Once in twelve months
(14) Never
(15) Don't Know/Not Sure
(16) Refused

111. Over the past 12 months, how frequently has your household not paid energy bills in order to purchase prescription medicines?

(9) Every month
(10) Every other month
(11) Every few months
(12) Every six months
(13) Once in twelve months
(14) Never
(15) Don't Know/Not Sure
(16) Refused

112. Was there a time in the past 12 months when you needed to see a doctor but could not because of cost?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

113. During the past 12 months, have you or other adults in your household had any problems paying medical bills?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

{Note: Ask these questions of the adult in the household most involved with all the other members of the household because proxy responses are required.}

114. Including yourself, how many people normally live in this household? Do not include anyone who is just visiting, those away in the military, or children who are away at college.

Enter Number _____

115. Can you please tell me their first names, gender and age, and your relationship to the person?

	First Name	Gender	Age	Relationship	In school (Y/N)
Person 1.					
Person 2.					
Person 3.					
Person 4.					
Person 5.					
Person 6.					
Person 7.					
Person 8.					
Person 9.					
Person 10.					

116. On a typical week day is there someone at home most or all of the day?
(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

For this section, I will be asking health related questions.

117. Now thinking about physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?
(5) Number of days_____
(6) None
(7) Don't know / Not sure
(8) Refused

118. Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?
(5) Number of days_____
(6) None
(7) Don't know / Not sure
(8) Refused

119. During the past 30 days, for about how many days have you felt you did not get enough rest or sleep?
(5) Number of days_____
(6) None
(7) Don't know / Not sure
(8) Refused

120. During the past 30 days, for about how many days have you felt very healthy and full of energy?
(5) Number of days_____
(6) None
(7) Don't know / Not sure
(8) Refused

121. During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?

(5) Number of days _____
(6) None
(7) Don't know / Not sure
(8) Refused

Next, I am going to ask you whether you have had some particular health problems in the last 3 months. In the past 3 months, have you had . . .

122. Shortness of breath when lying down, waking up, or with light work or light exercise?

(5) Yes
(6) No
(7) Don't know/Not Sure
(8) Refused

123. Headaches that are either new or more frequent or severe than ones you have had before?

(5) Yes
(6) No
(7) Don't know
(8) Refused

In the past 12 months were you or anyone else in the household ever told by a doctor or health professional that you or they have. (Check all that apply)

124. Lead poisoning

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

{IF YES} Please list all individuals, including yourself:

_____
_____
_____

125. Three or more ear infections per year

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

{IF YES} Please list all individuals, including yourself:

_____
_____
_____

126. Any kind of respiratory allergy

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

{IF YES} Please list all individuals, including yourself:

_____
_____
_____

127. Flu

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

{IF YES} Please list all individuals, including yourself:

_____
_____
_____

128. Persistent Cold symptoms lasting more than 14 days (SYMPTOMS INCLUDE COUGHING, SORE THROAT, SNEEZING, SINUS PAIN, CONGESTION, FEVER, FATIGUE, AND HEADACHE)

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

{IF YES} Please list all individuals, including yourself:

_____
_____
_____

129. Sinus infection or Sinusitis

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

{IF YES} Please list all individuals, including yourself:

_____
_____
_____

130. Bronchitis
(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

{IF YES} Please list all individuals, including yourself:
_____
_____
_____

131. Have you ever been told by a doctor or other health professional that you have asthma?
(1) Yes
(2) No (SKIP to Q132)
(3) Don't Know/not sure
(4) Refused

131a. Do you still have asthma?
(1) Yes
(2) No
(3) Don't Know/Not sure
(4) Refused

131b. During the past 12 months, how many times did you see a doctor or health professional for a routine checkup for your asthma? _____

READ: Symptoms of asthma include coughing, wheezing, shortness of breath, chest tightness or phlegm production when you have a cold or respiratory infection.

131c. How long has it been since you last had any symptoms of asthma?
(11) Never
(12) Less than one day ago
(13) 1-6 Days ago
(14) 1 week to less than 3 months ago
(15) 3 months to less than 1 year ago
(16) 1 year to less than 3 years ago
(17) 3 years to 5 years ago
(18) More than 5 years ago
(19) Don't Know/Not sure
(20) Refused

131d. During the past 12 months did you have to stay overnight in the hospital because of asthma?
(5) Yes
(6) No
(7) Don't know/Not Sure
(8) Refused

131e. Not counting hospitalizations, during the past 12 months, did you go to an emergency room because of asthma?

(5) Yes
(6) No
(7) Don't know/Not Sure
(8) Refused

These next questions are about cigarette smoking.

132. Which one of the following statements best describes the rules about smoking in your home…

(6) No one is allowed to smoke anywhere inside your home
(7) Smoking is allowed at some places or at sometimes
(8) Smoking is permitted anywhere
(9) Don't know/Not sure
(10) Refused

133. Have you smoked at least 100 cigarettes in your entire life?

(5) Yes
(6) No
(7) Don't know/Not sure
(8) Refused

134. Do you now smoke cigarettes every day, some days or not at all?

(6) Everyday
(7) Some days
(8) Not at all
(9) Don't Know/Not sure
(10) Refused

135. In the past 12 months has anyone in the household been food poisoned from eating food inside your home and therefore went to see a medical professional?

(5) Yes
(6) No
(7) Don't Know/Not sure
(8) Refused

136. In the past 12 months, has anyone in the household been poisoned by breathing in carbon monoxide, and therefore went to see a medical professional?

(5) Yes
(6) No
(7) Don't Know/Not sure
(8) Refused

137. In the past 12 months, has anyone in the home been burned from scalding hot water coming out of a faucet or showerhead in your home?

(5) Yes
(6) No (SKIP to Q138)
(7) Don't Know/Not Sure
(8) Refused

137a. {IF YES BURN} Did you talk to or see a medical professional about this injury?
(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

138. I am going to read some statements about health and medical care.
Usually, you go to the doctor as soon as you start to feel bad. Is that:
(7) definitely true,
(8) mostly true,
(9) mostly false, or
(10) definitely false?
(11) Don't Know/Not Sure
(12) Refused

139. You will do just about anything to avoid going to the doctor. Is that . . .
(7) definitely true,
(8) mostly true,
(9) mostly false, or
(10) definitely false?
(11) Don't Know/Not Sure
(12) Refused

In this last section I will be asking employment and school related questions.

140. Are you or primary wage earner in the household currently…?
(10) Employed for wages
(11) Self-employed
(12) Out of work for more than 1 year (SKIP to Q140c)
(13) Out of work for less than 1 year (SKIP to Q140c)
(14) A Homemaker (SKIP to Q141)
(15) A Student
(16) Retired (SKIP to Q141)
(17) Unable to work (SKIP to Q141)
(18) Refused

140a. Are you or the primary wage earner in the household employed full-time or part-time?
(5) Full-time
(6) Part-time
(7) Don't Know/Not Sure
(8) Refused

140b. How many hours per week do you or the primary wage earner usually work at all of your jobs?
Enter _____ hrs

140c. {IF ANSWERED (3) or (4) to Q140}Have you/Has the primary wage earner looked for work during the last 4 weeks?
(1) Yes
(2) No
(5) Don't Know/Not Sure
(6) Refused

140d. {IF ANSWERED (3) or (4) to Q140} What is the main reason you were/the primary wage earner was not looking for work during the LAST 4 WEEKS? CHECK ALL THAT APPLY (DO NOT READ LIST)

(1) Believes no work available in line of work or area
(2) Couldn't find any work
(3) Lacks necessary schooling, training, skills or experience
(4) Employers think too young or too old
(5) Other types of discrimination
(6) Can't arrange child care
(7) Family responsibilities
(8) In school or other training
(9) Ill health, physical disability
(10) Transportation problems
(11) Other
(14) Don't Know/Not Sure
(15) Refused

141. Does a physical, mental or emotional problem NOW keep you or the primary wage earner from working at a job or business?

(5) Yes
(6) No
(7) Don't know/Not Sure
(8) Refused

142. In the past 12 months did anyone in the household receive income from any of the following sources? (Check all that apply)

(7) Supplemental Security Income (SSI)
(8) Welfare payments or case assistance
(9) Veteran's payments (VA Benefits)
(10) Unemployment Compensation
(11) Don't Know/Not Sure
(12) Refused

143. During the past 12 months have you or the primary wage earner had more than one job (or business), including part time, evening, or weekend work?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

144. {IF ANSWERED (1), (2), (4), or (6) to Q140}Thinking about the last 12 months, is your or the primary wage earner's main job, where you work(ed) the most amount of hours, considered seasonal?

(5) Yes
(6) No (SKIP to Q145)
(7) Don't Know/Not Sure
(8) Refused

144a. In what season do you/does the primary wage earner work the least amount of hours?

(5) Winter
(6) Spring
(7) Summer
(8) Fall

145. {IF ASWERED (1) or (2) TO Q 140}In the past 12 months, about how many days of work did you or the primary wage earner miss work at a job or business because of illness or injury (DO NOT INCLUDE MATERITY LEAVE)

Enter Number_____

(4) None
(5) Don't Know/Not Sure
(6) Refused

146. {IF ASWERED (1) or (2) TO Q 140}In the past 12 months, about how many days of work did you or the primary wage earner miss because of illness or injury of another household member?

Enter Number_____

(4) None
(5) Don't Know/Not Sure
(6) Refused

147. In the past 12 months, about how many days of school have you, the primary wage earner, and/or those in the household enrolled in school, missed because of illness or injury? {IF PRE-SCHOOLER IN HOME}Please tell us about the preschooler who has missed the most number of days. {IF SCHOOL AGED CHILD IN HOME} Please tell us about the school aged child who has missed the most number of days.

Enter Number:

Main Respondent _____ days
(4) Not in School
(5) Don't Know/Not Sure
(6) Refused

Primary Wage Earner _____ days
(4) Not in School
(5) Don't Know/Not Sure
(6) Refused

Pres-School Child who has missed the most amount of school_____ days
(4) None
(5) Don't Know/Not sure
(6) Refused

School Aged child who has missed the most amount of school_____ days
(4) None
(5) Don't Know/Not sure
(6) Refused

148. {IF STUDENT} In the past 12 months, how frequently did you find it hard to study in your home because of excessive heat or cold?

(10) Very frequently
(11) Frequently
(12) Not frequently or infrequently
(13) Infrequently
(14) Very infrequently
(15) Never
(16) Does not study at home
(17) Don't Know/Not sure
(18) Refused

149. {IF SCHOOL AGED CHILDREN IN THE HOME}In the past 12 months, how frequently does any school aged child in the home find it hard to study because of excessive heat or cold?

(10) Very frequently
(11) Frequently
(12) Not frequently or infrequently
(13) Infrequently
(14) Very infrequently
(15) Never
(16) Does not study at home
(17) Don't Know/Not sure
(18) Refused

That is the end of the survey. Thank you for your participation! You will receive your $25 gift card in the mail to compensate you for your time. Could you please verify your mailing address:

Address: _____
_____
_____
_____

{INTERVIEWER: ADMINISTER AS A SEPARATE SURVEY POST-WEATHERIZATION}

PART II. Client Satisfaction

{Note: Ask these questions of the adult in the household most involved with the weatherization of the home or the head of the household}

Approximate Date of Weatherization Job: _____

1. How long have you known about your local weatherization program?
ENTER THE RESPONSE IN YEARS _____

2. How did you find out about your local weatherization program? (Check all that apply)

(1) A call from the weatherization agency
(2) Information received in the mail from the weatherization agency
(3) Local newspaper
(4) Found the program on the Internet
(5) Relative or friend mentioned the weatherization program
(6) Neighbor who had their home weatherized
(7) Agency providing utility assistance such as LIHEAP
(8) Email from an organization with which you are a member
(9) Church
(10) Other (Specify_____)

3. How long ago did you request that your home be weatherized?
ENTER THE RESPONSE IN YEARS _____

4. How satisfied are you with the length of time between your request to have your home weatherized and when it actually was weatherized?

(5) Very satisfied
(6) Satisfied
(7) Not satisfied or dissatisfied
(8) Dissatisfied
(5) Very dissatisfied

5. How easy was it to request that your house be weatherized?

(6) Very easy
(7) Easy
(8) Not easy or difficult
(9) Difficult
(10) Very difficult

6. How easy was it to schedule the initial audit of your home?

(1) Very easy
(2) Easy
(3) Not easy or difficult
(4) Difficult
(5) Very difficult

7. How timely were those who did the initial audit of your home?

(1) Early or On Time
(2) <30 Minutes Late
(3) 30-60 Minutes Late
(4) 1 to 3 Hours Late
(5)More than 4 Hours Late
(6) Did not show up on scheduled day

8. How courteous were those who did the initial audit of your home?

(1) Very Courteous
(2) Courteous
(3) Not Courteous or Rude
(4) Rude
(5) Very Rude

9. How easy was it to schedule the time for the weatherization crew to come to your home?
   (1) Very easy
   (2) Easy
   (3) Not easy or difficult
   (4) Difficult
   (5) Very difficult

10. How timely was the weatherization crew?
   (1) Early or On Time
   (2) <30 Minutes Late
   (3) 30-60 Minutes Late
   (4) 1 to 3 Hours Late
   (5)More than 4 Hours Late
   (6) Did not show up on scheduled day

11. How courteous was the weatherization crew?
   (1) Very Courteous
   (2) Courteous
   (3) Not Courteous or Rude
   (4) Rude
   (5) Very Rude

12. How careful of your home and belongings was the weatherization crew?
   (6)Very careful
   (7)Careful
   (8)Neither careful or careless
   (9)Careless
   (10) Very careless

13. Overall, how clean did the weatherization crew leave the inside of your home?
   (6) Very clean
   (7) Clean
   (8) Neither clean nor dirty
   (9) Dirty
   (10) Very dirty

13a. Overall, how clean did the weatherization crew leave the outside of your home?
   (6) Very clean
   (7) Clean
   (8) Neither clean nor dirty
   (9) Dirty
   (10) Very dirty

14. Overall, how satisfied are you with final condition the inside of your home was left in?

(5) Very satisfied
(6) Satisfied
(7) Not satisfied or dissatisfied
(8) Dissatisfied
(5) Very dissatisfied

14a. Overall, how satisfied are you with final condition the outside of your home was left in?

(6) Very satisfied
(7) Satisfied
(8) Not satisfied or dissatisfied
(9) Dissatisfied
(10) Very dissatisfied

15. How easy was it to schedule the final inspection of your home?

(1) Very easy
(2) Easy
(3) Not easy or difficult
(4) Difficult
(5) Very difficult
(6) Final inspection was not done (go to Q18)

16. How timely were those who did the final inspection of your home?

(1) Early or On Time
(2) <30 Minutes Late
(3) 30-60 Minutes Late
(4) 1 to 3 Hours Late
(5)More than 4 Hours Late
(6) Did not show up on scheduled day

17. How courteous were those who did the final inspection of your home?

(1) Very Courteous
(2) Courteous
(3) Not Courteous or Rude
(4) Rude
(5) Very Rude

18. How satisfied are you with the work performed in your home?

(5) Very satisfied
(6) Satisfied
(7) Not satisfied or dissatisfied
(8) Dissatisfied
(5) Very dissatisfied

19. How satisfied are you with any new equipment installed in house?
(5) Very satisfied
(6) Satisfied
(7) Not satisfied or dissatisfied
(8) Dissatisfied
(5) Very dissatisfied

20. Do you feel that other things should have been installed in your home to help you save energy?
(3) Yes
(4) No (go to Q21)

20a. What other things? _____

21. How satisfied are you with the energy savings achieved after having your home weatherized?
(8) Very satisfied
(9) Satisfied
(10) Not satisfied or dissatisfied
(11) Dissatisfied
(12) Very dissatisfied
(13) Too soon to tell
(14) Don't know

22. Did the weatherization agency staff check your home for major repairs (e.g., fixing roof)?
(1) Yes
(2) No (go to Q23)

22a. Were major repairs needed in your home?
(3) Yes
(4) No (go to Q23)

22b. Were major repairs done to your home?
(4) Yes
(5) No
(6) Not yet but expecting repairs to be done

23. Did the weatherization staff ask you about the health of the member(s) of your household?
(1) Yes (go to Q24a)
(2) No

24. Without the weatherization staff asking, did you provide to them any information about the health of the member(s) of your household?
(3) Yes
(4) No (SKIP to Q25)

24a. Were any of the members of your household in need of care that they were not receiving at the time?
(3) Yes
(4) No (go to Q25)

24b. Did the weatherization staff help you to obtain the needed care?
(3) Yes
(4) No

25. Did your weatherization agency refer you to any other housing and/or social service programs?
(3) Yes
(4) No (go to Q26)

25a. What program or programs? _____

26. Did you file a complaint about the weatherization services provided?
(1) Yes
(2) No (go to Q27)

26a. What was the complaint about?_____

26b. How satisfied are you with the resolution of the situation you complained about?
(1) Very satisfied
(2) Satisfied
(3) Not satisfied or dissatisfied
(4) Dissatisfied
(5) Very dissatisfied

26c. How might the agency have done a better job of resolving your complaint?_____

27. Did you get any information on ways to save energy in your home from the people who weatherized your home?
(1) Yes
(2) No (go to Q33)

28. How much time did the weatherization agency staff talk to you about ways to save energy?
(1) Less than 5 minutes
(2) 5 to 14 minutes
(3)15 to 29 minutes
(4) 30 to 60 minutes
(5) More than one hour

29. How well did you understand what the weatherization agency staff said to you about saving energy?
(1) Very well (go to Q30)
(2) Well (go to Q30)
(3) Neither well or not well (go to Q30)
(4) Not well
(5) Not well at all

29a. Why did you not understand what the weatherization agency staff said?
(Check all that apply)
(1) The staff person did not speak my primary language
(2) The staff person was confusing
(3) The staff person did not speak well
(4) The staff person was hurried
(5) The staff person was boring
(6) I did not get along with the staff person
(7) Other_____

30. What materials about saving energy did the weatherization agency staff give you? CHECK ALL THAT APPLY

(1) One or more brochures, booklets, or manuals
(2) One or more compact discs (CDs), videos, or DVDs
(3) Hardware kit of weatherization materials
(4) No materials were provided (go to Q31)
(5) Weatherization staff spent time demonstrating how to save energy (go to Q31)

30a. How much time have you spent reading/reviewing the materials about saving energy that the weatherization agency staff gave you?

(1) No time (go to Q31)
(2) Less than 5 minutes
(3) 5 to 14 minutes
(4) 15 to 29 minutes
(5) 30 to 59 minutes
(6) More than one hour

30b. How well did you understand the energy savings materials that the weatherization agency staff gave you?

(6) Very well
(7) Well
(8) Neither well or not well
(9) Not well
(10) Not well at all

30c. How useful have the energy savings materials been to you?

(1) Very useful
(2) Useful
(3) Neither useful or not useful
(4) Not useful
(5) Not very useful

30d. What about the materials were particularly useful? _____

30e. How could the materials have been improved for your use? _____

31. How satisfied are you with the ways that the weatherization agency provided you with information about saving energy?

(6) Very satisfied
(7) Satisfied
(8) Not satisfied or dissatisfied
(9) Dissatisfied
(5) Very dissatisfied

32. Did you get any information on ways to improve health and safety in your home from the people who weatherized your home?

(1) Yes
(2) No (go to Q38)

33. How much time did the weatherization agency staff talk to you about ways to improve health and safety?

(1) Less than 5 minutes
(2) 5 to 14 minutes
(3) 15 to 29 minutes
(4) 30 to 59 minutes
(5) More than one hour

34. How well did you understand what the weatherization agency staff said to you about improving health and safety?

(1) Very well (go to Q36)
(2) Well (go to Q36)
(3) Neither well or not well (go to Q36)
(4) Not well
(5) Not well at all

34a. Why did you not understand what the weatherization agency staff said?
(Check all that apply)

(1) The staff person did not speak my primary language
(2) The staff person was confusing
(3) The staff person did not speak well
(4) The staff person was hurried
(5) The staff person was boring
(6) I did not get along with the staff person
(7) Other_____

35. What materials about improving health and safety did the weatherization agency staff give you?
(Check all that apply)

(1) One or more brochures, booklets and manuals
(2) One or more compact discs
(3) One or more videos (including DVD's)
(4) No materials were provided (go to Q36)

35a. How much time have you spent reading/reviewing the materials about improving health and safety that the weatherization agency staff gave you?

(1) No time (go to Q36)
(2) Less than 5 minutes
(3) 5 to 14 minutes
(4) 15 to 29 minutes
(5) 30 to 59 minutes
(6) More than one hour

35b. How well did you understand the improving health and safety materials that the weatherization agency staff gave you?

(6) Very well
(7) Well
(8) Neither well or not well
(9) Not well
(10) Not well at all

35c. How useful have the improving health and safety materials been to you?

(1) Very useful
(2) Useful
(3) Neither useful or not useful
(4) Not useful
(5) Not very useful

35d. What about the materials were particularly useful? _____

35e. How could the materials have been improved for your use? _____

36. How satisfied are you with the ways that the weatherization agency provided you with information about improving health and safety?

(6) Very satisfied
(7) Satisfied
(8) Not satisfied or dissatisfied
(9) Dissatisfied
(5) Very dissatisfied

37. How could the agency improve the ways that it provides households with information about improving health and safety? _____

38. What are some of the greatest benefits your household received by participating in the weatherization program? _____

39. What suggestions do you have for how the weatherization program can be improved? _____

40. In the last 12 months, have you informed other people who might be interested in receiving weatherization services of the program?

(3) Yes
(4) No

41. Do you know if these people have had their homes weatherized or are scheduled to have their home weatherized, as a result of your suggestion?

(3) Yes
(4) No

42. Why did you apply for the Weatherization Assistance Program?[39]

(7) Reduce energy bills
(8) Support environmental efforts to conserve energy
(9) Make home more comfortable
(10) Receive free services
(11) Other
(12) Don't know

[39] Ohio REACH

43. Prior to receiving weatherization services, in what ways did your household attempt to weatherize your home?
Please
Explain_____
_____
_____

44. Would you say your household is now less likely to move from your current home as a result of weatherization?

(5) Yes
(6) No
(7) Don't Know/Not Sure
(8) Refused

45. Please rate the chances of your household's moving during the next 12 months for any reason or combination of reasons:

(7) Very high
(8) High
(9) Medium
(10) Low
(11) Very low
(12) No chance

46. Were you asked about preexisting health conditions that you or your family members living in the home may have?
a. Yes
b. No

47. Did the crew take precautions so that those conditions were not made worse?
a. Yes
b. No
c. Don't Know
d. N/A

48. How do you feel as far as the health and safety of your home since weatherization was conducted?
a. Much better
b. Better
c. Neither better or worse
d. Worse
e. Much Worse

49. Finally, please rate your overall satisfaction with the weatherization program.

(6) Very satisfied
(7) Satisfied
(8) Not satisfied or dissatisfied
(9) Dissatisfied
(10) Very dissatisfied

QUESTIONS TO BE ADDED TO CLIENT SATISFACTION PART

Financial Programs – Household Participants
1. How did you hear about this program?
a. Local weatherization agency
b. From relatives or friends
c. Advertisement on TV, radio or in newspaper
d. Other _____
e. Don't know

2. Have you noticed a change in your utility bills since your home was weatherized?
a. Yes, bills have gone down substantially
b. Yes, bills have gone down somewhat
c. No, no change
d. Yes, bills have gone up somewhat
e. Yes, bills have gone up substantially
f. Don't know

3. Have you been able to afford the loan/ on-bill payments?
a. No
b. Yes, but just barely
c. Yes

4. Do you understand the terms of the loan/on-bill payment agreement?
a. Yes
b. No
If not, what do you not understand? Please explain _____

5. In retrospect, would you make the same decision to participate in this loan/on-bill payment program?
a. Yes
b. No
If No, please explain _____

Financial Programs --Multi-family renting residents
1. Do you know that your building owner is participating in a program that subsidizes weatherization of your building?
a. No
b. Yes

2. Did the owner consult with you and other tenants about the program before signing up for it?
a. No
b. Yes

3. Did your building association consult with you about the program?
a. No
b. Yes
c. N/A, there is no building association

4. Has your rent increased since XXXX?
a. Yes, rent has gone down substantially
b. Yes, rent has gone down somewhat

c. No, no change
d. Yes, rent has gone up somewhat
e. Yes, rent has gone up substantially
f. Don't know

5. Have your utility bills changed since XXXX?
a. Yes, bills have gone down substantially
b. Yes, bills have gone down somewhat
c. No, no change
d. Yes, bills have gone up somewhat
e. Yes, bills have gone up substantially
f. Don't know
g. I do not pay utility bills

6. Over the past XXXX months, please rate the changes in the following in your building and/or your unit:

	Much Better	Better	No Change	Worse	Much Worse	Not Applicable
Hallway lighting						
Stairway lighting						
Entrance lighting						
Comfort of your unit in winter						(If survey is administered prior to their experiencing a winter since the retrofit)
Comfort of your unit in the summer						Same as above.

7. Have you received any education about how to reduce energy consumption in your unit during the past 12 months?
a. No
b. Yes

To those who received new technology (active):
1. Are you aware that you received ???? in conjunction with the Weatherization Program you applied for?
   e. Yes
   f. No

2. Did you receive ???? at the same time as the organization weatherized your home?
   g. Yes
   h. No

i. Don’t Know

3. Did the agency mention anything different about ???? as compared to the other improvements they made in your home?

e. Yes
f. No

4. Do you understand how ???? works?
a. No
b. Yes

5. Did you receive any education and/or training about how to operate ?????
a. No
b. Yes
c. N/A

6. Did you receive any education and/or training about how to maintain ????
a. No
b. Yes
c. N/A

7. Does ???? seem to work?
a. Yes (go Q7)
b. No
c. Don’t Know

8. In your opinion, did ???? ever work?
a. No (go to Q7)
b. Yes

9. How long ago do you think that ???? stopped working?
a. 1-2 months
b. 2-4 months
c. 5-6 months
d. 7-8 months
e. more than 8 months ago

10. Have your utility bills changed since ???? was installed?
a. Yes, bills have gone down substantially
b. Yes, bills have gone down somewhat
c. No, no change
d. Yes, bills have gone up somewhat
e. Yes, bills have gone up substantially
f. Don’t know

11. Have you experienced any other benefits to yourself or your household since ???? was installed?
a. No
b. Yes
If yes, please explain _____

12. Do you have any worries about ????

a. No
b. Yes
If yes, please explain _____

13. Are you glad, in retrospect, to have ????? installed?
a. No
b. Yes

14. Have any of your friends and/or relatives asked you about your new ?????
a. No
b. Yes

15. If so, does it seem as though they would also be interested in having ???? installed in their homes?
a. Yes, most are interested
b. Yes, some are interested
c. No, none seem interested

In-home monitors installed in homes

1. Do you understand the information that the in-home monitor provides to you?
a. Yes
b. No
If no, please explain _____

2. How often do you read the information in the in-home monitor?
a. Several times a day
b. About once a day
c. Once every few days
d. Once a week
e. Once every couple of weeks
f. Once a month
g. Fewer than once a month
h. Never

3. How easy is the in-home monitor to read?
a. Very easy
b. Easy
c. Neither easy or hard
d. Hard
e. Very hard

4. Did you receive education about how to read the in-home monitor?
a. No
b. Yes

5. From your perspective, how could the in-home monitor be improved? _____

6. Has the in-home monitor influenced how your household uses energy?
a. No
b. Yes
If yes, please explain _____

7. Do you change thermostat settings in the winter based on information from the in-home monitor?
a. No
b. Sometimes
c. Frequently

8. Do you change thermostat settings in the summer based on information from the in-home monitor?
a. No
b. Sometimes
c. Frequently

That is the end of the survey. Thank you for your participation! You will receive your $10 gift card in the mail to compensate you for your time. Could you please verify your mailing address:

Address: _____
_____
_____
_____

OMB Control Number: XXXX-XXXX

APPENDIX N: DF11 - WEATHERIZATION STAFF SURVEY DATA FORM

This information is being collected to help implement the Weatherization Staff Survey. Public reporting burden for this collection of information is estimated to average fifteen minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Records Management Division, IM-11, Paperwork Reduction Project (XXXX-XXXX), U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project (XXXX-XXXX), Washington, DC 20503.

Thank you in advance for completing this data form.

1. Please identify your local weatherization agency. _____

2. Please provide the following information about each individual who has conducted energy audits for you agency so far in XXXX:

NAME	TELEPHONE NUMBER	EMAIL ADDRESS

APPENDIX O. SAMPLE SIZE JUSTIFICATION

This appendix addresses sample sizes needed for the various WAP evaluation component surveys. Populations to be sampled are discussed in Section O.1. In addition to dependencies on weather, weatherization data tends to be noisy because of complex and frequently changing behavior of occupants. Wide confidence intervals often occur for estimates computed even from relatively large samples. Equivalently, relatively large samples are often required to achieve specified levels of accuracy. The WAP evaluation will require statistical sampling of weatherization agencies is discussed in Section O.2. Statistical sampling associated with the Weatherization Innovation Pilot Project, Sustainable Energy Resources for Consumers, Deferral, and Social Network Studies are found in Sections O.3-O.6, respectively.

The usual approach taken in justifying a survey sample size is to identify a main quantity to be estimated, to justify a sample size necessary for estimating it, and to argue that additional information to be collected in the survey will be obtained at little or no additional burden to either subjects or analysts. The sample size calculation ordinarily requires (1) a preliminary assessment of the variability of the main quantity to be estimated (for example, a preliminary estimate of its coefficient of variation, and (2) a specification of the accuracy required of the main quantity to be estimated—for example "to within 10% of its true value with 90% confidence." Also, in cases of complex (multi-stage, stratified, probability-sampled, and control-adjusted) designs, as is proposed for the WAP evaluation, sample size formulas for simpler (e.g., simple random sampling) designs are often used as an approximation. The sample design in preliminary/pilot studies is usually much simpler anyway. These approaches are taken below.

Much of the material in these sections will be used directly for the WAP evaluation OMB Paperwork Reduction Act (PRA) submission and Supporting Statement required for surveys employing statistical methods (www.whitehouse.gov/omb/inforeg/83i-fill.pdf). Some of the discussion is therefore written in that context. Section O.7 contains additional notes about topics such as nonresponse that will also have to be addressed in the OMB PRA submission.

O.1 POPULATIONS SAMPLED

The WAP evaluation will require statistical sampling of weatherization agencies. Agency weatherization staff and weatherization and control homes/occupants will be subsampled. WAP management will also be interviewed, and 100% of State weatherization programs will be surveyed. WAP management and State weatherization programs will be sampled completely (i.e., 100%) rather than statistically, because these populations are small and it is expedient to sample them that way. (For PRA purposes, DOE program management interviews are not considered a "collection of information," because the information acquired is to be used for a specific purpose (i.e., the WAP evaluation) rather than general statistical purposes—"'Collection of information' includes questions posed to…employees of the United States, if the results are to be used for general statistical purposes…" [5CFR1320.3].)

A justification for taking a complete sample rather than a statistical subsample of State agencies, which ***is*** required by OMB, is given by OMB (2006): "When the target population is small and each unit is unique, a census is likely to be preferred over a sample survey. For example, when an agency evaluates a Federal program that is implemented by the states (each one perhaps somewhat differently), a census of state program directors may provide higher quality information with little cost difference from a sample survey of a slightly smaller number of states. In this case, there may also be concerns about missing practices of some states that were not included in the sample if a census were not conducted."

Several case studies will also be conducted as components of the WAP evaluation. The case studies will not involve statistical sampling or inference, however, or they will be below the PRA threshold of ten or more observations. They do not require OMB approval because either the sample size will be less than ten or they will be conducted by direct observations by social scientists or weatherization experts of homes or workers during the execution of normal weatherization activities, and such information collections are not subject to the PRA: "'Information' does not generally include items in the following categories...Facts or opinions obtained through direct observation by an employee or agent of the sponsoring agency or through nonstandardized oral communication in connection with such direct observations;" [5CFR1320.3]. Sample sizes for the case-studies will be based on judgment rather than formal statistical calculations.

O.2 AGENCY SAMPLING

O.2.1 Agency sampling for energy benefits (billing data analysis)

As in the 1990 evaluation (Brown et al, 1993), occupant-level energy consumption and dwelling characteristic data will be obtained by first sampling agencies and then acquiring occupant-level data from the agencies. In the 1990 evaluation, 400 agencies were sampled, 361 agencies responded, and one third of the records for the weatherized units and one third of the records for the control units were sub-sampled for each agency that responded (ibid.). This rate applied to single-family detached dwellings as well as mobile homes. To properly determine weatherization savings in multifamily buildings, all units in each selected building must be analyzed. Therefore, multifamily buildings were selected at the rate of one third of buildings.

The 1990 evaluation (ibid.) lead to the following mean ± standard error control-adjusted natural gas and electricity savings estimates per weatherized unit per year:

Primary Heating Fuel	Average Savings per Weatherized Unit	Standard Error of Average	Precision
Natural gas	17.8 MMBtu/year	1.8 MMBtu/year	10%
Electricity	1,830 kWh/year	358 kWh/year	20%

The precision obtained in the 1990 evaluation was subsequently found to adequate for that evaluation and is assumed adequate for the proposed evaluation as well. Thus the basic objective of the proposed study is to update the 1990 evaluation by repeating it today. However, the proposed evaluation will incorporate several minor refinements and additions.

The 1990 evaluation was stratified by agency size and geographic region. The agency size strata were sampled at the same rate except for the largest-size stratum which was certainty (100%) sampled. Thus, with the exception of the very largest agencies, large agencies had no greater chance of selection than small ones. Yet, in general, the larger the agency, the greater its contribution to total energy savings. In the proposed evaluation probability proportional to size (PPS) sampling with size measured as agency funding will provide a refinement of the 1990 stratification by agency size by allowing agency size to be continuously reflected in the sampling probabilities, with the effect that all agencies will be statistically represented, but larger agencies will be sampled preferentially.[40]

[40]An alternative measure of an agency's size is the number of units it weatherizes. The number of units weatherized is not as good a measure of size, however, because of an accounting feature in the WinSAGA database (see following discussion) in which units weatherized with only one dollar of DOE funding can

The geographic stratification in the proposed evaluation will also be a refinement of the 1990 study's. The earlier study employed ten climate subregions, which were approximations of standard climate regions based on state boundaries. For the proposed study, in addition to representing all climate zones, it was considered politically advantageous to guarantee representation of all states. (Furthermore some states may commission add-on survey components of their own.) Therefore stratification for the proposed study will be by state.

Although the sampling for the proposed study is thus a refinement of the 1990 sampling, the two studies will still be substantially similar, and the 1990 study is by far the best available source of prior information for the proposed one. For the purpose of sample size calculations, it is reasonable to regard the proposed evaluation as emulating the 1990 study. Therefore 400 agencies will be sampled in the proposed study, as in the 1990 evaluation.

For each sampled agency, houses (or buildings for multifamily buildings) will be randomly sampled. In general, the rate of sampling within agencies will be fixed for all agencies. That rate will be approximately one-in-three and will thus achieve the same overall sample size and precision achieved in the 1990 evaluation. However, the exact sampling rate for each agency will depend on the following factors that must be determined during the course of the study: (1) The target population of weatherized and control units must be restricted to "DOE" units, that is, units weatherized primarily with DOE funds. Agencies weatherize homes using various funding sources (states and utilities also provide funding), and use different bookkeeping methods for counting weatherized units, and in particular, DOE units. The target population of DOE weatherized and control units has to be determined for each agency on a case-by-case basis. Target population sizes are expected be smaller than in the 1990 evaluation, and sampling proportions will be larger to achieve a comparable sample overall size. (2) In the proposed study, more so than in 1990, some agencies will be able to deliver complete sets of data in electronic formats. However, the extent to which this happens and the ease of compliance of agencies with requests for data in general is unclear. Recent interaction with a few agencies has shown that many agencies still rely on paper record keeping and that delivery by an agency of a complete electronic database is still likely to be more the exception than the rule. Nevertheless, agencies that can just as easily deliver all of their data as sample part of it will be asked to do so. (3) As in the 1990 evaluation, some utilities will not comply with requests for data. Utility nonresponse is considered independent of agency weatherization performance, however, and is thus nonbiasing. Utility nonresponse is also likely to be lower than in the in the 1990 evaluation, because of advances in electronic bookkeeping.

A listing of weatherization agencies along with their planned dollar allocation and units sampled can be obtained from the WinSAGA (Systems Approach to Grants Administration for Windows) data base.[41] As of 2005, there were 927 agencies. A PPS sample of 400 agencies with the 2005 funding allocation as the measure of PPS size and stratified by state was selected in order to see what the PPS sampling of agencies and one-third subsampling of units would likely translate to in terms of allocation dollars and weatherized units in the actual sample. A ten percent nonresponse rate was assumed. Because of constraints on PPS sampling, the very largest agency had to be sampled with certainty. Thus 361 agencies were actually sampled (as in the 1990 evaluation). Results of the sample are summarized in Table 1.

After deducting the nonresponders, 361 agencies were sampled, which is 39% of the 927. Of course the sample of 361 agencies represents all 927 agencies in a statistical sense. Because size is agency funding allocation, although the sample accounts for 39% of agencies, it accounts for 65% of funding. The sample

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be counted as DOE weatherized units.

[41]WinSAGA data kindly provided by Christine Askew, Office of the Weatherization and Intergovernmental Program, Energy Efficiency and Renewable Energy, U.S. DOE.

also accounts for 63% of weatherized units. (The reason for the differences in the funding percentage (65%) and the units percentage (63%) may be related to the way units are counted in the WinSAGA database, with only one dollar of DOE funding necessarily required for a unit to be counted as a DOE unit.)

Table 1 also shows the units actually sampled (17,232) in a one-in-three subsample of units, and, assuming (as in the 1990 evaluation) that 60% of units are gas or electric, the number of units (10,339) potentially available for billing the analyses. Utility nonresponse will depreciate this number. However, the final column in the table shows that if data is obtained for 46% of the units potentially available for billing the analysis, then the number of units sampled will equal the number sampled in the 1990 evaluation. The 46% acquisition rate is reasonable and similar to the corresponding rate in the 1990 evaluation (ibid.).

O.2.2 Agency sampling for program characterization and process assessment

In addition to energy use and savings data, information about the weatherization process and program, also necessary for the evaluation, will be obtained from the 400 sampled agencies. The justification for collecting this additional information is based on the above for the metered fuel (natural gas and electric) savings studies and that the additional burden in collecting/delivering this information from agencies from which energy use and savings data is already being collected is small.

Table O.1 WAP 2005 National and Approximate PPS Sample Totals
Size = 2005 Dollar Allocation and 10% Nonresponse

National Agencies (2005 Listing)	Agencies Sampled	Agencies Responding	Percent of National Agencies Responding	2005 National Allocation	Allocation Represented by Responders	Percent Allocation Represented by Responders
929	400	361	39%	$258,231,144	$168,535,723	65%

2005 National Units Planned	Units Represented by Responders	Percent of Units Represented by Responders	Units Subsampled (at 33%)	Gas/Elec Units Subsampled (60% Approx)	Capture Rate To Achieve 1990 Number Usable (4,796)
82,701	51,695	63%	17,232	10,339	46%

O.2.3 Agency staff subsampling

A subsample of agency staff members will be taken from a list compiled from the agency staff contact information. To ensure adequate representation, the sample will be stratified by staff functional classification (crew, supervisor, auditor/inspector) with equal-size strata. A computer assisted telephone interviewing (CATI) survey will be conducted of the sampled staff. Several technical questions will be posed to the staff members to characterize current staff understanding and awareness of weatherization methods and technologies. The primary endpoint of interest is the combined proportion of correct

responses and how it relates to staff training experience. The proportion of correct responses is expected also to serve as a baseline for future studies.

Sampling will be implemented by random sampling from staff lists identified by the sampled agencies. As an approximation in reckoning sample sizes, we ignore the agency sampling weights, though they will be accounted for in the data analysis. The proportions of correct responses in each sampling strata (crew, supervisor, auditor/inspector) will be estimated to within five percentage points with 90% confidence. The standard error of the combined proportion of correct responses can be no greater than the standard error of an individual (correct/incorrect) response, which cannot exceed $.5/n^{1/2}$ (maximum standard error of binomial proportion). This will be achieved if $1.645 \times .5/n^{1/2} = .05$, that is, if $n = 271$, where n is the sample size in each stratum. Nonresponse in this survey is expected to be negligible, because the survey will be of agency employees whose contact information has been provided by the agencies. The total sample size will be $271 \times 3 = 813$.

O.3 WEATHERIZATION INNOVATION PILOT PROGRAM SAMPLING

The WIPP currently comprises sixteen projects, all of which have been selected for evaluation. Various project components will be evaluated, not all of which necessarily require OMB approval or even statistical planning. For example, because each project is unique and there is only one grantee per project, it seems unlikely that substantially the same question will be asked to all sixteen grantees, in which case the PRA would not apply to the grantee evaluation. Similarly, case studies probably also will not involve asking substantially the same question to ten or more individuals. However other WIPP evaluation components will most likely involve asking the same questions to ten or more individuals. These include (1) occupant surveys, (2) home inspections, (3) utility bill analyses, and (4) weatherization staff surveys. These four evaluation components are discussed below.

Occupant Surveys and Home Inspections

Table 1 below lists the sixteen WIPP projects, the numbers of homes slated for weatherization, and the federal requests for the projects.

Table 1. WIPP Projects, Numbers of Units to be Weatherized, and Federal Funding

WIPP Project	Number of Units	Federal Request ($)	Percent of Total Request
Green and Healthy Homes Initiative	220	2,400,000	8.00
In Home Monitoring	2,500	2,400,000	8.00
Performance-based Revolving Loan Pilot...	450	850,000	2.83
Energy Pioneer Solutions Weatherization...	250	2,400,000	8.00
SAHF Energy Performance Contracting...	2,500	810,000	2.70
Connecticut Green and Healthy Homes...	2,285	3,000,000	10.00
Streamlined Weatherization Improvements...	800	2,000,000	6.67
Leveraging Smart Grid Technology to...	550	720,000	2.40
YouthBuild USA Weatherization...	998	1,400,000	4.67
Habitat for Humanity Weatherization...	1,770	3,000,000	10.00
Community Environmental Center...	1,200	3,000,000	10.00
Building Deep Efficiency...	425	600,000	2.00
Project with the City matching federal...	300	1,015,746	3.39
Tackling the Problem of Weatherizing...	1,700	1,898,938	6.33
Replicable, Innovative, Sustainable...	2,240	3,000,000	10.00
People Working Cooperatively...	340	1,500,000	5.00
All Projects	18,528	29,994,684	100.00

Although the units in Table 1 cannot yet be listed in a population frame, they are well-defined. A table such as Table 2 can be used to suggest a sample size for sampling from all 18,528 of the units. The table gives the sample sizes needed to estimate a proportion (e.g., proportion of customers who say they are satisfied) to within the specified margin of error with the specified statistical confidence.

Table 2. Suggested Sample Sizes for Sampling Units (for Occupant Survey/Home Inspections)

Confidence	Margin of Error	Infinite Population Sample Size	Corrected Sample Size (For Finite Population of 18,528)
90	0.10	68	68
	0.05	271	267
	0.03	752	723
95	0.10	97	96
	0.05	385	377
	0.03	1,068	1,009

Occupant surveys will be conducted by telephone interviewing. The 3% margin of error and 95% statistical confidence (03-95 criteria, last row of Table 2) are standard for this kind of telephone survey. For home inspections, because of the much higher expense per subject, a 10% margin of error and 90% statistical confidence (10-90 criteria, first row of Table 2) are more appropriate. For these criteria, sample sizes of 1,009 and 68 are needed for the occupant survey and home inspections respectively. However, Table 2 is for simple random sampling, and we will stratify the sampling by the sixteen WIPP projects. As the stratification is expected to improve the survey's precision, however, the figures in Table 2 are slightly higher than actually necessary.

We use the projects' percentage of the total federal request for the sixteen projects to allocate the sample across the sixteen WIPP projects. As shown in Table 3, for each project, a sample of the specified size will be sampled from a frame of the corresponding number of units. Because the necessary number in each stratum was rounded up to the next whole number, the numbers in Table 3 add to slightly more than the targets of 68 units for inspection and 1,009 occupants.

Table 3. Housing Unit Sample Sizes Allocated Across the Sixteen WIPP Projects

WIPP Project	Number of Units	Sample Size for 10-90	Sample Size for 03-95
Green and Healthy Homes Initiative	220	6	81
In Home Monitoring	2,500	6	81
Performance-based Revolving Loan Pilot...	450	2	29
Energy Pioneer Solutions Weatherization...	250	6	81
SAHF Energy Performance Contracting...	2,500	2	28
Connecticut Green and Healthy Homes...	2,285	7	101
Streamlined Weatherization Improvements...	800	5	68
Leveraging Smart Grid Technology to...	550	2	25
YouthBuild USA Weatherization...	998	4	48
Habitat for Humanity Weatherization...	1,770	7	101
Community Environmental Center...	1,200	7	101
Building Deep Efficiency...	425	2	21
Project with the City matching federal...	300	3	35
Tackling the Problem of Weatherizing...	1,700	5	64
Replicable, Innovative, Sustainable...	2,240	7	101
People Working Cooperatively...	340	4	51
All Projects	18,528	75	1,016

Utility Bill Analysis

In each of the sixteen WIPP projects, billing data or equivalent or better energy use data will be collected for each weatherized unit. The billing data--for all weatherized units--can be obtained in conjunction with the DF4 surveys (lists of units and buildings weatherized). Comparison data will be collected from an equal or greater number of units from the comparison (i.e., not weatherized) group data collected in the retrospective evaluation. Units will be matched as closely as possible by city, heating and cooing degree days (when not matched on city), size, construction type, and other characteristics. The billing data for all sixteen projects will be analyzed by the evaluation team.

Staff Survey

A survey of staff members, analogous to the occupant survey, will be conducted for the sixteen WIPP projects. As in the occupant survey, a sampling frame (in this case a list of project staff members) has not yet been compiled but will be compiled for each project, and the overall sample will be allocated to the individual projects in proportion to federal funding. Table 4, for staff members, is analogous to Table 1 for weatherized units:

Table 4. WIPP Projects, Jobs Created or Retained, and Federal Funding

WIPP Project	Number of Jobs	Federal Request ($)	Percent of Total Request
Green and Healthy Homes Initiative	96	2,400,000	12.64
In Home Monitoring	120	2,400,000	12.64
Performance-based Revolving Loan Pilot...	38	850,000	4.48
Energy Pioneer Solutions Weatherization...	25	2,400,000	12.64
SAHF Energy Performance Contracting...	123	810,000	4.27
Connecticut Green and Healthy Homes...	593	3,000,000	15.81
Streamlined Weatherization Improvements...	25	2,000,000	10.54
Leveraging Smart Grid Technology to...	16	720,000	3.79
YouthBuild USA Weatherization...	74	1,400,000	7.38
Habitat for Humanity Weatherization...	168	3,000,000	15.81
Community Environmental Center...	63	3,000,000	10.00
Building Deep Efficiency...	28	600,000	2.00
Project with the City matching federal...	10	1,015,746	3.39
Tackling the Problem of Weatherizing...	85	1,898,938	6.33
Replicable, Innovative, Sustainable...	169	3,000,000	10.00
People Working Cooperatively...	673	1,500,000	5.00
All Projects	2,306	18,980,000	100.00

A table such as Table 5 (analogous to Table 3) can be used to suggest a sample size for sampling from the (approximately) 2,306 staff members. The table gives the sample sizes needed to estimate a proportion (e.g., proportion of customers who say they are satisfied) to within the specified margin of error with the specified statistical confidence.

Table 5. Suggested Sample Sizes for Sampling Staff Members

Statistical Confidence	Margin of Error	Infinite Population Sample Size	Corrected Sample Size (For Finite Population of 2,306)
90	0.10	68	66
	0.05	271	243
	0.03	752	567
95	0.10	97	93
	0.05	385	330
	0.03	1,068	730

Staff survey interviews are not as critical to the evaluation as occupant surveys. (Presumably the staff will also be studied in assessing the affects of the ARRA.) Therefore, for the staff survey, we use the 90% statistical confidence and .05 margin of error criteria, which suggests a sample size of 243. Again the overall sample is allocated across the sixteen WIPP programs in proportion to funding. Table 6 shows the allocated sample sizes (rounded up to the next whole number) for the individual projects.

Table 6. Staff Sample Sizes Allocated Across the Sixteen WIPP Projects

WIPP Project	Number of Jobs	Sample Size for 05-90
Green and Healthy Homes Initiative	96	20
In Home Monitoring	120	20
Performance-based Revolving Loan Pilot...	38	7
Energy Pioneer Solutions Weatherization...	25	20
SAHF Energy Performance Contracting...	123	7
Connecticut Green and Healthy Homes...	593	25
Streamlined Weatherization Improvements...	25	17
Leveraging Smart Grid Technology to...	16	6
YouthBuild USA Weatherization...	74	12
Habitat for Humanity Weatherization...	168	25
Community Environmental Center...	63	25
Building Deep Efficiency...	28	5
Project with the City matching federal...	10	9
Tackling the Problem of Weatherizing...	85	16
Replicable, Innovative, Sustainable...	169	25
People Working Cooperatively...	673	13
All Projects	2,306	252

O.4 SUSTAINABLE ENERGY RESOURCES FOR CONSUMERS SAMPLING

This subsection is still under development.

O.5 DEFERRAL STUDY SAMPLING

Ten states and ten agencies will be sampled for this a deferral study, and the deferral incidence and process (e.g., quality assurance) will be examined for a random sample of weatherized units from each sampled agency. The number of units to be sampled is (at least tentatively) specified in the draft Evaluation Plan as "200 occupants engaged in the deferral process." Deferral rates encountered by some agencies are reckoned by agency staff to be as high as twenty percent.

Agency selection will be purposive for agencies for which deferrals are understood to be troublesome. Inferences will therefore be restricted to the ten sampled agencies. However the ten sampled agencies will serve collectively as anecdotal evidence about the extent to which deferrals can be a problem, and the

overall deferral rate for the ten sampled agencies will thus be a parameter of primary interest in the analysis. Since we'll ask substantially the same question to each of the agencies, we need to develop a formal OMB 83-i submission for this. Note that if (1) we sampled only nine agencies instead of ten, and (2) the information about the deferral could be obtained directly from agency staff, without posing additional questions to home owners, we might be able to circumvent the OMB submission. Whether or not we pursue such an approach, however, we still need to decide about how many of each agency's units to sample for the deferral analysis. That statistical question is considered in the next paragraph.

The specifications can be tweaked, of course, but suppose for the moment that we would like to estimate the overall deferral rate for the ten agencies to within five percentage points with 90% confidence. Given that deferral rates encountered by some agencies are reckoned by agency staff to be as high as 20%, suppose that the deferral rate for any sampled agency is no higher than 25%. This implies that the variance of the overall deferral rate estimate is maximum when the deferral rate is 25% for each sampled agency. That is, the worst-case (i.e., maximum) variance of the overall deferral rate estimate is .25(1-.25)/(10*n), where n is the number of units sampled per agency. Hence, letting Z = 1.645 (95th percentile of the standard normal distribution), the worst-case required sample size for the 5-percentage-point-90%-confidence specification is

n = Z*Z*.25(1-.25)/(10*(.05)**2) = 20.3 units per agency.

So the sample size of 200 units seems reasonable.

O.6 ADDITIONAL NOTES

The following notes taken from OMB guidance (OMB 2006) identify several additional issues of key importance in developing the evaluation plan.

O.6.1 Pretest/Pilot Studies

According to OMB (2006), “Agencies should always consider conducting pretests (small trials of the measurement process) or pilot studies (larger trials yielding statistical information) when planning for a new information collection or changing methods and procedures for an ongoing survey. These kinds of tests may provide critical information necessary to ensure the quality of the data and smoothness of operations needed in the full-scale information collection. They can provide essential information to the agency and result in higher data quality than would have been achieved without them and may be the only vehicle for measuring the effects of different changes an agency is considering implementing. Thus, agencies will need to weigh the importance and use of pretests against the time and resources needed to conduct them.”

The proposed evaluation uses the 1990 evaluation, which it is intended to emulate, and several other studies (Blasnik, 2006; Cavallo and Mapp, 2000; Levins and Ternes, 1994; Ternes and Levins, 1992) as a pilot studies.

The OMB (2006) guidance continues, “It is important that agencies test their survey questionnaires in all modes that they plan to use to collect information for the full-scale survey (see section on Questionnaire Design). Usability testing of computer survey instruments should also be included as part of questionnaire pretesting to identify problems either interviewers or respondents may have with the instrument....”

The survey instruments for the proposed evaluation are being pre-tested with internal and (fewer than ten) external personnel. They are also being peer-reviewed by subject matter experts.

O.6.2 Influential information

According to OMB (2006, Question 18), information is considered "influential" if "an agency can reasonably determine that dissemination of the information will have or does have a clear and substantial impact on important public policies or important private sector decisions," and agencies should "hold the information they designate as 'influential' to a higher standard of reproducibility and transparency than information that is not defined as influential."

The information collected for the proposed WAP evaluation is thus "influential."

O.6.3 Response rates

According to OMB (2006), "An agency's justification for a survey response rate should reflect, at least in part, the intended use of the data. For example, surveys collecting influential information or information that will otherwise have a substantial impact on an agency's programs or policies should be designed to minimize all sources of survey error (see question #20), including nonresponse bias...Agencies need to document in their ICRs the importance and use of the information and the methods they will use to achieve acceptable response rates for their collections… ICRs for surveys with expected response rates of 80 percent or higher need complete descriptions of the basis of the estimated response rate and a detailed description of steps that will be taken to achieve the expected response rate…"

In general, response rates in the proposed evaluation are expected to be high (much higher than 80%), because weatherization recipient contact information will be provided by weatherization agencies, and because recipients have received weatherization services. For various reasons including legal issues, utilities in the past have not always provided customer billing data requested by agencies. Although this is a form nonresponse, because it is independent of performance by the agencies in weatherizations, it is reasonable to treat it as nonbiasing and therefore not requiring adjustment in the analysis. In general, nonresponse is not expected to be a problem in the analysis of the weatherization data.

The OMB 83-i (www.whitehouse.gov/omb/inforeg/83i-fill.pdf) form requires a description of "methods to maximize response rates and to deal with issues of non-response." Methods that will be employed to accomplish this include

- contacting an appropriate person at each utility to identify and smooth out the data collection process
- planning the billing data requests so that data for multiple housing units and buildings are requested from each utility at the same time
- requesting billing data at regular intervals to reduce the chance that the utilities will not be able to provide data because it has been archived and no longer readily accessible, but limit the number of such requests so that utilities have to provide data just several times during the course of the evaluation
- soliciting assistance from utility regulatory commissions and similar organizations as needed.

O.6.4 REFERENCES

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APPENDIX P. BUILDING TYPE DEFINITIONS

The energy analyses methods are dependent on the building/housing type. Throughout the evaluation, housing units will be categorized into four building types as defined below:

- **Single-family**—A single-family housing unit, detached or attached, provides living space for one family or household and is contained within walls extending from the basement (or the ground floor, if there is no basement) to the roof. An attached house, such as a townhouse, row house, and duplex, is considered a single-family housing unit as long as it (a) is not divided into more than one housing unit, (b) there is no household living above another one within the walls extending from the basement to the roof to separate the units, and (c) it has an independent outside entrance.

- **Mobile home**—A mobile home is built on a movable chassis, moved to the site, and typically placed on a permanent or temporary foundation. If rooms are added to the structure, it is considered a mobile home if the added floor area is less than the mobile home's original floor area; otherwise, it is a single-family housing unit. A manufactured house assembled on site is a single-family housing unit, not a mobile home.

- **Small multifamily**—A small multifamily housing unit is in a building with two to four housing units (i.e., in a building structure that is divided into living quarters for two, three, or four families or households in which one household lives above or beside another). This category includes houses originally intended for occupancy by one family (or for some other use) that have since been converted to separate dwellings for two to four families. Typical arrangements in these types of living quarters are separate apartments downstairs and upstairs or one apartment on each of three or four floors.

- **Large multifamily**—A large multifamily housing unit is in a building with five or more housing units (i.e., in a building structure that contains living quarters for five or more families or households and in which one household lives above or beside another).

These definitions are consistent with those used in the Residential Energy Consumption Survey conducted by the DOE Energy Information Agency with one exception. Mobile homes with rooms added to the structure are considered to be single-family housing units in RECS in all cases. Mobile homes weatherized by the Program often have small rooms added to them (e.g., small rooms added to the front or back doors, rooms that connect to and extend the living room). Mobile homes with room additions will still be classified as mobile homes in this evaluation as long as the floor area of the additions is less than the floor area of the original mobile home for two reasons. First, these mobile homes are still treated in the Program using the diagnostic approaches, weatherization measures, and installation techniques unique to mobile homes. Second, the majority of Program expenditures are typically directed at improvements to the mobile home structure rather than the room additions. If room additions exceed the floor area of the original mobile home, then the house should be classified as a single-family housing unit.

These definitions are also generally consistent with those used in the 1990 National evaluation. The one uncertainty is with mobile homes because it is not known how mobile homes were defined in the 1990 National evaluation. However, it is believed that the categorization of mobile homes by weatherization agencies is more consistent with the definition developed for this evaluation than the RECS definition. Also, the 1990 National evaluation made a distinction between attached and detached single-family housing units that will not be made in this evaluation.

The Program uses three rather than four categories of housing unit types in its quarterly reporting and other functions. Mobile homes and large multifamily categories are conceptually the same as those defined above for this evaluation. However, the single-family category as defined by the Program includes the small multifamily category as defined for this evaluation. It is important to have a clear definition of small multifamily housing units and a separate category for these units for two reasons:

1. Small multifamily housing units were often mistakenly identified as belonging to the large multifamily housing category by agencies in the 1990 National evaluation. This led to considerable sampling and analysis problems. Providing a separate category for small multifamily housing units should help avoid this identification problem.

2. The energy analysis methods and approaches to be employed to study single family homes are different and/or will be applied differently than those for large multifamily units. The analyses methods and approaches for small multifamily housing units may also be unique because they have characteristics of both of these other two groups of houses.

APPENDIX Q. UNIT/BUILDING LEVEL ENERGY ANALYSIS

Q.1 SINGLE-FAMILY HOUSES AND MOBILE HOMES

Natural gas billing data will be collected on homes heated by natural gas as part of the comprehensive billing data sample. These data will be analyzed using the Princeton Scorekeeping Method (PRISM, Fels et al., 1995) to calculate annual, weather-normalized pre- and post-weatherization energy consumptions and energy savings for each individual home. Since natural gas can be used in these homes for water heating, cooking, and possibly clothes drying in addition to space heating, these energy consumptions and savings represent both space heating and baseload uses combined (i.e., natural gas consumption and savings for space heating will not be calculated separately from baseload).

The Network Planning Committee felt that the energy consumption and savings of houses heated by fuel oil and propane are critical to the evaluation and need to be measured. Billing/delivery data are usually insufficient for a PRISM type analysis because fuel oil and propane are typically delivered just several times a year to a house at infrequent intervals, and because household storage tanks are not always filled at each delivery (so that the amount of fuel delivered is not necessarily equal to consumption). Therefore, energy use in these homes must be specially monitored by submetering the space heating system or collecting more accurate and frequent delivery data. If submetered fuel oil and propane use along with indoor and outdoor temperatures are collected on houses heated by these fuels in the fuel-oil and propane monitored sample, then an energy use model will be developed for each house by regressing weekly or daily consumptions (the dependent variable) vs. the temperature difference between the indoors and outdoors (the independent variables) for each consumption period. Annual, weather-normalized pre- and post-weatherization energy consumptions and energy savings will be calculated using the regression models, historical weather for each home location, and a standard indoor temperature (e.g., 68 or 70°F) or the actual indoor temperature for each house. Uncertainty statistics and indicators of model reliability comparable to those calculated by PRISM will also be calculated. Since fuel oil and propane are not typically used in single-family or mobile homes for water heating or cooling, the annual energy consumptions and savings based on the analysis of submetered fuel oil and propane use typically represent just space-heating use. If more accurate and frequent delivery data are collected, then these data will be analyzed using PRISM or a simply calculating the ratio of energy use to heating degree days for the monitoring period.

Electricity billing data will be collected on all the homes sampled (not just those heated by electricity) as part of the billing data sample, fuel-oil and propane monitored sample, and hot climate submetered sample. These data will be analyzed using PRISM to calculate annual pre- and post-weatherization electricity consumptions and energy savings for each individual home. PRISM's model selection feature will be used to select the best PRISM model for each house (i.e., heating-only, cooling-only, or heating and cooling model). In homes heated by electricity, these electricity consumptions and savings include both space heating and baseload uses in addition to space cooling if employed. In non-electrically heated homes, these energy consumptions and savings include baseload uses, space cooling if employed, and any supplemental space heating that is done using electricity. Electricity consumptions and savings will not be broken down into their separate heating, cooling, and baseload components.

Although the Network Planning Committee felt that submetering and subsequent analysis of a sample of natural gas and electrically heated houses could improve accuracy and add context to the PRISM billing data analysis results, such sampling and analysis is not currently planned because of the costs that would be required.

Q.2 LARGE MULTIFAMILY BUILDINGS

The calculation of energy use and savings is complicated in large multifamily buildings for many reasons, including:

- some buildings have central building heating and/or hot water systems while in others each unit has its own heating (central apartment system or in-space heaters) and/or hot water system,
- the whole building is weatherized in some cases while in others only individual units are weatherized,
- some buildings have significant common areas (including recreation rooms, offices, and kitchens) while others have little or none,
- operating ventilation systems are present in some buildings and not in others,
- there are many billing meters in the building (especially those with individual heating systems) so rarely is there a complete and consistent set of data for all the meters (i.e., there is usually some gap in data for at least a few meters),
- occupancy turnover and vacancies can be prevalent, and
- many buildings use fuel oil which has the same problems with the delivery data as with single-family homes (i.e., fuel is delivered at infrequent and/or random intervals and the building storage tanks are not always filled at each delivery).

These complications can manifest themselves at different times during the analysis process, such as in estimating annual consumption, normalizing consumption to a per unit level, and/or aggregating the consumptions of various buildings or units together.

For the reasons outlined above, the process of calculating the energy use and savings in each multifamily building and determining how to include these values in the totals or averages with other multifamily buildings must be developed individually for each building. Although some basic analysis approaches are outlined below for the two primary building types that will be commonly encountered, experienced analysts will need to follow and analyze the data collected on each building individually since cookie-cutter approaches will not work.

Q.2.1 Buildings with central building heating systems

In buildings with central building heating systems, a whole building energy analysis is usually required because the weatherization activity in such buildings usually focuses on the central heating system rather than just selected apartment units. A whole building energy analysis will be performed as follows:

1. Depending on which fuel is used by the central building heating system, natural gas billing data for the building's master meter or fuel-oil delivery data will be collected as part of the large multifamily billing data sample. These data will be analyzed using PRISM to calculate annual pre- and post-weatherization energy consumptions and energy savings for the building. These energy consumptions and savings represent either just space heating, space heating and hot water, or space heating and baseload (e.g., hot water, cooking) depending on the fuel and what other

systems are connected to the master meter or fuel tank (e.g., central building hot water system, apartment stoves).

Although fuel-oil delivery data are usually insufficient for a PRISM type analysis in single family homes, there is a greater chance that such data can be analyzed for multifamily buildings, especially if several years of data can be collected, because deliveries may be more frequent (ratio of consumption to tank size may be greater) and/or fills may be more common.

As part of the monitored sample, fuel oil consumption will be specially monitored in some buildings either through submetering or collecting more accurate and frequent delivery data. Annual pre- and post-weatherization energy consumptions and energy savings for the building will be calculated using these data and PRISM if possible (if data during some non-heating periods can be collected) or using regression models and historical weather for each building (models developed by regressing weekly or daily consumptions vs. outdoor temperature or heating degree days).

2. Electricity billing data will be collected from all electric meters (building and apartment level) installed in the sampled buildings (not just those heated by electricity) as part of the billing data sample or fuel-oil and propane monitored sample. Apartment level data will be aggregated for each billing period and then analyzed using PRISM to calculate annual pre- and post-weatherization electricity consumptions and energy savings for each building. Some refinements will be needed to account for missing data and/or apartments for which no billing data can be collected. The building electricity data will be analyzed similarly either separately or by aggregating it with the apartment level data. PRISM's model selection feature will be used to select the best PRISM model for each building (i.e., heating-only, cooling-only, or heating and cooling model). In buildings with central building heating systems, these electricity consumptions and savings include apartment-level baseload uses (possibly including hot water if the building has individual hot water systems in each apartment fueled by electricity), common area electricity consumption, space cooling if employed, and any supplemental space heating that is done using electricity. The electricity consumptions and savings will not be broken down into their separate heating, cooling, and baseload components.

3. Natural gas billing data will be collected from any other building and apartment level natural gas meters installed in the sampled buildings (other than the master meter supplying the central building heating system) as part of the billing data sample or fuel-oil and propane monitored sample. These data will be analyzed using PRISM in a manner similar to that for electric billing data. In buildings with central building heating systems, these natural gas consumptions and savings include apartment-level baseload uses (cooking and possibly hot water if the building has individual hot water systems in each apartment fueled by natural gas) and any common area consumption.

4. Building-level energy consumptions and savings calculated above will be divided by the number of units in the building to calculate unit-level values which will facilitate comparison and aggregation with other buildings. In addition, natural gas and fuel oil consumptions and savings will be added into one value.

The Inverse Modeling Toolkit (IMT) is a software program available from the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) for calculating linear, change-point linear, variable-based degree-day, multilinear, and combined regression models (Kissock, Haberl, and Claridge, 2004). As such, it offers an alternative approach to PRISM in the analysis presented above. The use of IMT in this evaluation will be investigated. Depending on analytical difficulties encountered

with PRISM in the above analyses and the results of the IMT investigation, IMT will be used to supplement and/or supersede the PRISM analyses as warranted.

Q.2.2 Buildings with apartment-level heating systems

In buildings with apartment-level heating systems (e.g., central systems in the apartment, baseboard electric heaters), a whole building energy analysis will be performed if the whole building was weatherized. If just individual units in a multifamily building were weatherized, then the energy analysis will be performed on an apartment or unit basis. These two approaches are described below:

1. In buildings in which the whole building was weatherized, billing data will be collected as part of the large multifamily billing data sample for all building-level and apartment-level electricity meters and natural gas (if present) installed in the building (fuel oil is not usually used in such buildings). For each building, apartment-level and building-level electricity data will be aggregated for each billing period and then analyzed using PRISM to calculate annual building-level pre- and post-weatherization electricity consumptions and energy savings. PRISM's model selection feature will be used to select the best PRISM model for each building (i.e., heating-only, cooling-only, or heating and cooling model). If natural gas is used in the building, the same procedure as used for electricity will be followed to calculate annual building level pre- and post-weatherization natural gas consumptions and energy savings. Some refinements will be needed to account for missing data and/or apartments for which no billing data can be collected.

   The electricity consumptions and savings calculated above represent space heating, space cooling, and baseload use (for the apartments and common areas combined) depending on the specific end uses that electricity is used for. Likewise, the natural gas consumptions and savings calculated above can represent space heating and/or baseload use. The energy consumptions and savings will not be broken down into their separate heating, cooling, and baseload components.

   Building-level energy consumptions and savings calculated above will be divided by the number of units in the building to calculate unit-level values which will facilitate comparison and aggregation with other buildings. The use of IMT may be used to supplement and/or supersede the PRISM analyses as warranted.

2. In buildings in which just individual units were weatherized, annual energy consumptions and savings will be calculated as if they were single-family dwelling units (see Sect.3.2.1). Electricity billing data and natural gas billing data (if present) will be collected on such units as part of the large multifamily billing sample. These data will be analyzed using PRISM to calculate annual pre- and post-weatherization energy consumptions and energy savings for the individual dwelling (apartment) units. PRISM's model selection feature will be used to select the best PRISM model for each house when analyzing the electricity data (i.e., heating-only, cooling-only, or heating and cooling model).

   Since natural gas (if present) can be used in these homes for water heating, cooking, and possibly clothes drying in addition to space heating, the natural gas consumptions and savings represent both space heating and baseload uses combined. In units heated by electricity, the electricity consumptions and savings include both space heating and baseload uses in addition to space cooling if employed. In non-electrically heated units, these energy consumptions and savings include baseload uses, space cooling if employed, and any supplemental space heating that is done using electricity. The electricity and natural gas consumptions and savings will not be broken down into their separate heating, cooling, and baseload components.

Q.3 SMALL MULTIFAMILY BUILDINGS

Energy consumptions and savings in small multifamily buildings will be analyzed in a manner similar to that for large multifamily buildings (see Section D.2):

- **Small multifamily buildings with central building heating systems or with apartment-level heating systems that were weatherized as a building**—A whole building analysis will be performed because weatherization costs will likely be known at the building rather than unit level. Building level consumptions and savings will then be normalized to a per unit basis by dividing by the number of units in the building.

- **Buildings in which just individual apartments are weatherized**—A unit-level analysis will be performed.

This analysis approach will be applied primarily to electricity and natural gas billing data collected from the comprehensive billing sample. If fuel-oil consumption data are collected on small multifamily buildings as part of the monitored sample, then these data will be analyzed as described for single-family homes (see Sect. 3.2.1).

APPENDIX R. ORNL AGGREGATE MODEL

ORNL's aggregate model applies the basic logic of the PRISM approach to billing and weather databases aggregated over many houses to determine an overall program effect. It was developed and will be used in the national evaluation to support and supplement the PRISM analysis when needed.

Many factors that often occur in the low-income homes that the Program serves can mask weather-related correlations with fuel usage. These include:

- periods of zero or below normal consumption because of service shutoff due to nonpayment, household vacancies, and equipment breakdowns;
- erratic use of heating and/or cooling equipment by occupants;
- undersized heating and/or cooling equipment that runs at full capacity after a threshold outdoor temperature is reached;
- behavioral and occupancy changes; and
- availability of just few months of data for a house before and/or after weatherization

Use of PRISM, which relies on a linear model of the relationship between weather and energy consumption, can lead to high model failure rates at the individual household level (e.g., low R^2, high coefficient of variance on the normalized annual consumption estimate, unrealistic balance point temperature) because of these factors. Excluding large numbers of homes from the statistical analysis due to model failures likely introduces potential sample bias, making the measurement of representative Program impacts difficult because so many homes are eliminated. Although every effort will be made to reduce model failures (e.g., use of PRISM's flatness index, data collection design to ensure a year's worth of data before and after weatherization), an alternative approach is still needed.

The ORNL aggregate model examines and performs weather-normalizations on a group of houses to smooth out the confounding effects that occur at the individual house level. It is a simpler method than PRISM in that it does not assume that a linear model has to fit every house and does not attempt to produce house-specific savings estimates. Its advantages are that it can use "noisy" data and analyze data for a more complete and representative sample of houses. As a result, the ORNL aggregate model focuses on the overall Program (i.e., group) effect, rather than individual household savings, and reduces sample bias due to excessive exclusion of households from the analysis.

PRISM and the ORNL aggregate model can be compared and contrasted as follows:

PRISM	**ORNL Aggregate Model**
• Assumes a linear model of the relationship between energy consumption and heating degree days for each individual house.	• Assumes a linear model of the relationship between energy consumption and heating degree days for a group of houses.
• For each house, energy consumption and heating degree days for multiple billing periods are used to determine the model coefficients for the house (i.e., $\forall$ and $\exists$).	• For the group of houses, energy consumption and heating degree days over one time period for each house are used to determine the model coefficients for the group of houses (i.e., $\forall$ and $\exists$).
	• A fixed reference temperature (e.g., 65°F) is used for all houses to calculate heating degree days.
• Regression performed for "all possible" reference temperatures, and reference temperature and subsequent model coefficients chosen that gives the highest model R^2.	
• For group of houses, total or average consumption or savings calculating by adding or average values for individual houses.	• For group of houses, total or average consumption or savings calculated directly from model.

R.1 PRISM

The PRISM model can be written as:

$$e_i = \forall + \exists \text{ X } hdd_i(t) \qquad (1)$$

Where:

e_i = average <u>daily</u> energy use (e.g., Btu/day) for billing period i,
$\forall$ = average <u>daily</u> baseload (non-heating) energy use (e.g., Btu/day),
$\exists$ = heating slope (e.g., Btu/HDD), and
$hdd_i(t)$ = heating degree days <u>per day</u> for billing period i calculated at balance point temperature t (°F).

Typically, energy consumption data and daily outdoor temperatures corresponding to each billing period are obtained for a house (preferably about 12 monthly billing periods over a year). Knowing the number of days in each billing period, PRISM converts these data into an average <u>daily</u> energy use (e_i) and average <u>daily</u> heating degree days [$hdd_i(t)$] for each billing period and then uses these average daily values to estimate three parameters for the house using linear least-squared regression techniques: the average daily baseload energy use ($\forall$), heating slope ($\exists$), and balance point temperature (t) that produces the highest correlation coefficient (R^2). The normalized annual energy consumption (NAC) for the house can then be calculated using these estimated parameters as follows:

$$NAC = (\forall \text{ X } 365.25) + (\exists \text{ X } HDD_o(t_o)) \qquad (2)$$

Where:

NAC = normalized annual energy consumption (e.g., Btu), and
$HDD_o(t_o)$ = annual heating degree days calculated at the optimum balance point temperature t_o (°F) estimated by PRISM.

When data are available before and after a house is weatherized, the NAC before weatherization (NAC_{pre}) and after weatherization (NAC_{post}) can be calculated, and the normalized annual energy savings (NAS) for the house can be determined by:

$$NAS = NAC_{pre} \text{ ! } NAC_{post} \qquad (3)$$

Where:

NAS = normalized annual energy savings,
NAC_{pre} = normalized annual energy consumption before weatherization, and
NAC_{post} = normalized annual energy consumption after weatherization.

The average per household savings for a group of houses can be estimated using the NAS calculated for each house individually by:

$$AGS = (3NAS_i)/n \qquad (4)$$

Where:

AGS = average group savings,
NAS_i = normalized annual energy savings for house i, and
n = number of houses used in the summation.

If data are available for a group of control homes, the net savings of a weatherized group can be calculated by:

$$\text{Net savings} = AGS_{weatherized} \text{ ! } AGS_{control} \qquad (5)$$

Where:

$AGS_{weatherized}$ = average group savings of the weatherized houses, and
$AGS_{control}$ = average group savings of the control houses.

In Eqs. 1-5, statistical uncertainties associated with estimated parameters and calculated values can be determined using normal statistical procedures.

R.2 AGGREGATE PRISM

An aggregate version of PRISM exists in which a linear model of energy use vs. heating degree days is fit to a group of houses rather than to houses individually. In this case, each house must have the same number of billing periods and the billing periods must coincide for each house (e.g., bills were read on the 15th of each month for 12 months for each house), and all the houses must be in the same geographic area so that the heating degree days for the houses are the same. The energy consumption data for each billing period are averaged and used with Eq. 1 so that the $\forall$ and $\exists$ that are estimated represent an average house in the group. The NAC and the NAS for an average house can be calculated using Eqs. 2 and 3; in this case, the NAS is equivalent to the average group savings calculated using Eq. 4 for houses that were analyzed individually.

R.3 ORNL AGGREGATE MODEL

The PRISM model described by Eq. 1 above could be rewritten slightly as:

$$E_i = \forall \text{ X } D_i + \exists \text{ X } HDD_i(t) \qquad (6)$$

Where:

E_i = energy use (e.g., Btu) for billing period i,
$\forall$ = average <u>daily</u> baseload (non-heating) energy use (e.g., Btu/day),
D_i = number of days in billing period i,
$\exists$ = heating slope (e.g., Btu/HDD), and
$HDD_i(t)$ = heating degree days for billing period i calculated at balance point temperature t (°F).

Note that E_i and $HDD_i(t)$ are energy use and heating degree days for billing period i, whereas e_i and hdd_i in Eq. 1 are average daily values for billing period i ($e_i = E_i/D_i$ and $hdd_i(t) = HDD_i(t)/D_i$).
Data for an individual house could be applied to this model as before.

The ORNL aggregate model modifies Eq. 6 so that it can be applied to a group of houses simultaneously rather than to houses individually. The model is:

$$E_i = \forall \text{ X } D_i + \exists \text{ X } HDD_i(65) \qquad (7)$$

Where:

E_i = energy use (e.g., Btu) for house i over some time period,
$\forall$ = average daily baseload (non-heating) energy use (e.g., Btu/day),
D_i = number of days in the time period for house i,
$\exists$ = heating slope (e.g., Btu/HDD), and
$HDD_i(65)$ = heating degree days over the time period for house i calculated at a balance point temperature of 65°F.

Note that the subscript i in Eq. 7 identifies different houses, whereas the subscript i in Eq. 6 identifies different billing periods for the same house. Also note that the ORNL aggregate model uses heating degree days calculated at a fixed balance point temperature of 65°F for all houses, whereas PRISM calculates a house-specific balance point temperature.

To apply the ORNL model, the following three values must be known for each house: the energy use over a given time period, the number of days in the time period, and the number of heating degree days in the time period (calculated at the same balance point temperature of 65°F for each house). Typically, monthly billing data for each house are aggregated to obtain a single set of values for the house (e.g., 11 monthly bills for a house are combined so that the energy use, the number of days, and the number of heating degree days in the 11-month period are known for that house). The time periods and the length of the time periods do not need to be the same for each house. Houses do not need to be geographically constrained; houses from one area can be combined with houses from another area as long as the location appropriate heating degree days are calculated for the time period associated with each house and at the same base temperature.

These three values for many houses are used to estimate the average daily baseload energy use ($\forall$) and heating slope ($\exists$) for an average house in the group using least-squared regression techniques. A NAC for an average house in the group at a selected geographical location can then be calculated by:

$$NAC = \forall \text{ X } 365.25 + \exists \text{ X } HDD_o(65) \qquad (8)$$

Where:

NAC = normalized annual energy consumption (e.g., Btu), and
$HDD_o(65)$ = annual heating degree days for the chosen location calculated at a balance point temperature of 65°F.

By aggregating/totaling billing data for each house over time, some of the variability in the energy data is smoothed out and the influence of weather variations on consumption can be modeled more easily. By

analyzing a group of houses in an aggregate manner, unexplained variability seen at the individual house level is removed and a model of an average house that represents the group of houses is produced.

If data are available for the group of houses before and after each one is weatherized, the NAC_{pre} and NAC_{post} for an average house in the group at a selected geographical location can be calculated, and the NAS for such a house can be determine using Eq. 3.

If an average NAC and/or NAS were desired that was representative of all the houses weatherized, covering multiple locations, weighted annual heating degree days could be calculated and used in Eq. 8, or the annual heating degree days for each house could be used in Eq. 8 and the subsequent NACs averaged.

The ORNL aggregate model was presented in simplistic form above. In reality, pre- and post-weatherization differences in energy use can be modeled to avoid the need to model pre- and post-weatherization consumption separately and then subtracting to obtain savings. Energy savings can be modeled as follows:

$$)E_i = E_{i,\,pre} \;!\; E_{i,\,post} = [\forall_{pre} \text{ X } D_{i,\,pre} + \exists_{pre} \text{ X } HDD_{i,\,pre}(65)] \;!\; [\forall_{post} \text{ X } D_{i,\,post} + \exists_{post} \text{ X } HDD_{i,\,post}(65)] \quad (9)$$

Where:

$)E_i$ = energy use difference (e.g., Btu) between pre and post periods for house i,
$E_{i,\,pre}$ = energy use (e.g., Btu) for house i for pre-weatherization period,
$E_{i,\,post}$ = energy use (e.g., Btu) for house i for post-weatherization period,
$\forall_{pre}$ = average <u>daily</u> baseload energy use (e.g., Btu/day) for pre period,
$\forall_{post}$ = average <u>daily</u> baseload energy use (e.g., Btu/day) for post period,
$D_{i,\,pre}$ = number of days for house i in pre period,
$D_{i,\,post}$ = number of days for house i in post period,
$\exists_{pre}$ = heating slope (e.g., Btu/HDD) for pre period,
$\exists_{post}$ = heating slope (e.g., Btu/HDD) for post period,
$HDD_{i,\,pre}(65)$ = heating degree days for house i calculated at a balance point temperature of 65°F for pre period, and
$HDD_{i,\,post}(65)$ = heating degree days for house i calculated at a balance point temperature of 65°F for post period.

By modeling the difference in energy use, the correlation between pre- and post-weatherization consumption for the same household is dealt with much like in a paired t-test.

The model can be simplified and the statistical variability of the remaining parameters reduced if there is reason to assume that $\forall_{pre}$ and $\forall_{post}$ are equal to each other (because weatherization primarily impacts the degree-day parameters) and/or if the bias in making the parameters equal to each other is acceptable. The model can also be expanded to include control adjustments directly and, like PRISM, can include weather adjustment for cooling energy consumption using cooling degree days simultaneously with adjustment for heating energy consumption using heating degree days (although there is no provision for automatically selecting the model as in PRISM). Furthermore, additional terms can be added to the model (e.g., for climate region), with fitting occurring in one stage.

As with PRISM, the statistical uncertainties associated with estimated parameters and calculated values in Eqs. 7-9 can be determined using normal statistical procedures.

APPENDIX S. ASSESSMENT OF A POTENTIAL SPLIT-WINTER RCT CONFIRMATORY PROJECT

Despite the barriers to a classical RCT approach to WAP evaluation, we also consider here a hypothetical "split-winter" RCT that could be conducted in conjunction with the QE WAP evaluation study. By "split-winter," we mean that weatherization would be performed during one particular winter, and the total duration of the study would generally be less than in a full evaluation. Sample size calculations for the split-winter RCT suggest that, even if the legislative and cultural barriers could be circumvented, this alternative RCT approach would still not be a good idea because of very large (and therefore expensive) sample size requirements. This further supports the assumption that an RCT is not feasible in the WAP-ARRA context and that a carefully conducted QE study is a better approach.

Section S.I of this section presents additional background and some notation, and suggests another, control-only, validation study design, as a potential alternative to a split-winter RCT approach. Sample sizes calculations for the split-winter study are presented in Section S.II. Sample size calculations for the alternative control-only validation study are in Section S.III. Concluding remarks are in Section S.IV.

S.I Background. One objective (among many) of the WAP evaluation study will be to estimate the normalized annual savings (NAS) due to weatherization performed during a target time period, for example, a program year. In the QE approach, treated subjects are selected randomly from the population of subjects who received weatherization during the target time period. Control subjects are selected randomly from (i) WAP-eligible subjects who applied during the target time period but did not receive weatherization during that period, and (ii) eligible subjects who applied during a subsequent time period (and may or may have yet received weatherization). In either cases (i) or (ii), only pre-weatherization control-group consumption data is used to characterize the controls; post-weatherization control-group data is inadmissible.

Treated subjects in the QE approach are selected as they would be in a hypothetical RCT in which a random subset of subjects initially selected for treatment (per all priority constraints) are shunted off to serve as controls. However, control subjects in this RCT would differ statistically from the controls in the QE study. In the QE approach, the overall time periods (both beginning and ending dates) for the controls are shifted toward times later than the target time period for subjects who receive weatherization. In the RCT, by definition of RCT, the overall time periods must have exactly the same distribution for both the treatment and control groups. Therefore, either (1) the weatherization eventually performed for the controls must be delayed fairly long, or (2) the post-weatherization periods for the weatherized subjects and must be fairly short.

In both the QE and RCT approaches, pseudo-weatherization dates are assigned to control subjects so that the distribution of pseudo-weatherization dates for the controls is the same as the distribution of actual weatherization dates for the treated subjects. The pseudo-weatherization dates are used in the analysis of the control energy consumption data in the same way that the actual weatherization dates are used in the analysis of the weatherized subject data.

However, in the QE approach, unlike the RCT approach, if the WAP applicant population changes during the overall time-period (either for subjects who receive weatherization or controls), then the QE NAS estimates could be biased. Therefore it is reasonable to consider (at least hypothetically) an RCT-based check on potential bias in the QE NAS estimates. Although an across-the-board RCT approach would not be feasible, it might be feasible to implement a confirmatory RCT on a much smaller scale.

The following notation will be needed in discussing NAS estimates. We are trying to estimate the control-adjusted NAS (CNAS):

CNAS = NASW - NASC

where

NASW = Normalized Annual Savings, Weatherized = Cwb - Cwa
NASC = Normalized Annual Savings, Controls NASC = Ccb - Cca

where in turn

Cwb = weather-adjusted average annual consumption ***before*** weatherization for subjects who receive weatherization

Cwa = weather-adjusted average annual consumption ***after*** weatherization for subjects who receive weatherization

Ccb = weather-adjusted average annual consumption ***before*** pseudo-weatherization for controls

Cwa = weather-adjusted average annual consumption ***after*** pseudo-weatherization for controls

Note that the QE weatherized group sample is actually selected the same way as the weatherized group sample would be selected in an RCT in which selected subjects are randomly assigned to either the treatment or control groups. For this reason, in theory, a full RCT (e.g., a split-winter study) would not actually be needed to validate the QE CNAS estimate. Instead, a validation check on the QE estimate could be performed by (1) selecting an independent sample of controls (as in the RCT approach) from the same population (i.e., target time period) that the weatherized group is selected from, and then (2) estimating the NASC for the independent sample and comparing it to the NASC estimate from the QE study. A conclusion of no-difference between the two estimates supports the QE approach. This validation check would require only supplemental control subjects, not an entire supplemental RCT. However, as with the split-winter approach, either the control subjects would have to be denied treatment for a long time (and compensated accordingly), or the post-pseudo-weatherization study periods would have to be relatively short.

The longer weatherization is delayed, the less feasible a study becomes. Therefore, a control-only validation study with a randomly selected control group that matches the study period of the main QE study weatherization group may not be feasible. On the other hand, if the study period is shorter than the study period for the main study, then this kind of validation would be compromised. In view of this tradeoff, we will consider two studies supplemental to a main WAP QE evaluation study: (1) a split-winter RCT with post-weatherization periods shorter than the post-weatherization periods in the main QE study, and (2) a comparison study of the main QE control group with a set of controls randomly selected from subjects initially selected for weatherization in the QE study, and with weatherization delayed as needed for consistent comparisons with the main study weatherization group. In case (1) the main study CNAS estimate would be compared with the split-winter validation study CNAS. Agreement supports the main study CNAS estimates. In case (2) the main study control group would be compared with the validation study control reference group. Agreement supports the use of the main study control group and thus the main study CNAS estimates. Sample sizes for a split-winter RCT are considered in Section S.II. Sample sizes for the alternative control-only validation are discussed in Section S.III.

S.II Sample Size Requirements for a Split-Winter RCT Study To implement a split winter study requires installing submeters in homes to directly measure energy use. These studies are more expensive than billing history studies because of the cost of the submeters and staff to install and retrieve the submeters. To reckon sample sizes necessary for the split-winter study, we estimate the variability of both the RCT

and QE studies using estimates from the 1990 WAP evaluation.[42] We use the approximation that the RCT and QE designs with the same number of subgrantees and housing units (and assuming the same subsampling of housing units for both studies) have the same precision. This approximation may actually lead to underestimates of necessary sample size, because, in fact, the split-winter studies control estimates, although more accurate, are likely to be more variable than corresponding QE estimates. This is true for the reason discussed above, that for the RCT study, the control data period ends at the end of the split winter study, whereas the control data period is much longer for the QE study. This potential variability underestimation is discussed further below.

Consider the CNAS for the main national QE study and corresponding CNAS' for the RCT study, where because of differences in the study time periods, CNAS and CNAS' are not necessarily equal. As a check, we will test the hypothesis that they are. Let Δ = CNAS - CNAS'. We will test the null hypothesis Ho: $\Delta = 0$ with a hypothesis test constructed so that:

(1) the level of the test (i.e., probability of rejecting under the null hypothesis) is α (e.g., .05 or 0.1)

(2) for specified δ, a hypothetical difference between the main CNAS and the RCT CNAS, the power (i.e., probability of rejecting Ho) when $\Delta = \delta$ is at least a specified probability (e.g., .8 or .9)

Property (1) is to control the probability of false rejection, and property (2) is to control the probability of false acceptance, in particular at $\Delta = \delta$. (The probability of false acceptance is 1 minus the power.)

Given various values for α, δ, and the power, we can compute sample sizes for various validation RCTs. Here we compute the RCT sample size as a percentage of the main-study sample of 400 subgrantees. Appropriate values for δ are suggested by the 1990 study results: Tables 5.1 and 5.3 in the 1990 study report list the following CNAS estimates and standard errors:

Fuel	CNAS Estimate	Units	Standard Error
Electricity	1830	kwh/year	358
Natural Gas	173	ccf/year	18

[42] Brown, M., Berry, L., Balzer, R., Faby, E., National Impacts of the Weatherization Assistance Program in Single-Family Dwellings, ORNL/CON-326, Oak Ridge National Laboratory, Oak Ridge, Tennessee, May, 1993. Available at http://weatherization.ornl.gov/pdf/ORNL_CON-326.pdf.

We take δ to be either .5, 1, or 2 times the CNAS estimate from the 1990 evaluation. For α either .05 or .1, and for power of either .8 or .9, we then get the following tables of values for the necessary sample size for the corresponding RCT validation study, expressed as percentage of the main (1990 or 2010) study:

Fuel=Electricity, CNAS Estimate=1,830, CNAS Estimate StdErr=358, Units=kwh/year

δ	Factor	Test Level (α)	Power of Test at Δ=δ	Percentage of Main Study Needed
915	0.5	.05	.8	240.3
			.9	321.7
		.10	.8	189.3
			.9	262.2
1,830	**1.0**	**.05**	**.8**	**60.1**
			.9	**80.4**
		.10	**.8**	**47.3**
			.9	**65.5**
3,660	2.0	.05	.8	15.0
			.9	20.1
		.10	.8	11.8
			.9	16.4

Fuel=Natural Gas, CNAS Estimate=173, CNAS Estimate StdErr=18, Units=ccf/year

δ	Factor	Test Level (α)	Power of Test at Δ=δ	Percentage of Main Study Needed
87	0.5	.05	.8	68.0
			.9	91.0
		.10	.8	53.5
			.9	74.2
173	**1.0**	**.05**	**.8**	**17.0**
			.9	**22.7**
		.10	**.8**	**13.4**
			.9	**18.5**
346	2.0	.05	.8	4.2
			.9	5.7
		.10	.8	3.3
			.9	4.6

So, roughly speaking, to detect in the main national CNAS and the validation RCT CNAS' a difference the size of 100% of the main national CNAS (Factor = 1.0 in the tables) would require the supplemental validation RCT to be about 60-80% of the size of the national evaluation for electricity, and about 15-20% of the size of the national evaluation for natural gas. These percentages for even this limited RCT study are high enough to suggest skipping the split-winter RCT study completely. Note too that the value 1 (and .5 and 2) considered here for δ is rather large. Smaller values of δ entail even larger sample sizes. As discussed above, the use here of the approximation that the RCT and QE designs have the same precision may also lead to understated sampled sizes.

The large (e.g., 100% of CNAS) values for δ and the large necessary sample sizes (expressed as percentages of the national evaluation) reflect the high variability inherent in weatherization billing data and, ultimately, in the national CNAS estimates. The coefficients of variation (CV) of the 1990-study CNAS estimates are

$CV = 100 \times 358 / 1{,}830 = 19.6\%$ for Electricity
$CV = 100 \times 18 / 173 = 10.4\%$ for Natural Gas

which are quite high for overall estimates for a national study of that size. High variability seems to be a fact of life for domestic energy consumption and billing data. The estimated sample sizes, and the difference between the split-wither RCT and the QE study's time spans suggests that the RCT approach may not be worth pursuing at all in the context of WAP evaluation.

S.III Sample Size Requirements for an Alternative, Control-Only Validation Study Next consider the RCT validation study, with validation-study controls only, where a supplemental validation control group is selected for which weatherization is delayed for as long as the main-study weatherized group is observed. Except for the weatherization, such a validation control group would be statistically the same as the weatherized group from the main QE study. Only supplemental control subjects (no supplemental weatherized subjects) would be needed with this approach, and so the approach would require substantially less resources than the split-winter RCT. On the other hand, it would require longer delays in the weatherizations for the control subjects.

The hypothesis of interest in the validation is that the control group NASC from the main study and the validation control group NASC' are the same. Redefining Δ above so that Δ = NASC - NASC', we are again interested in testing the null hypothesis Ho: $\Delta = 0$, and in the power of the test when Δ assumes a particular value δ. For this control-only validation approach, however, the appropriate values for δ are still relative to the CNAS estimate, which is the ultimate objective of the study. Again from Tables 5.1 and 5.3 in the 1990 study:

Fuel	NASC Estimate	CNAS Estimate	Units	NASC Estimate Standard Error
Electricity	-963	1830	kwh/year	238
Natural Gas	-37	173	ccf/year	14

So again taking δ to be either .5, 1, or 2 times the CNAS estimate from the 1990 evaluation, α either .05 or .1, and the power to be either .8 or .9, we get the following tables of values for the necessary sample size for the alternative control-only validation study, again expressed as a percentage of the control group from the 1990 (or 2010) evaluation

Fuel=Electricity, CNAS Estimate=1,830, NASC Estimate StdErr=238, Units=kwh/year

δ	Factor	Test Level (α)	Power of Test at Δ=δ	Percentage of Main Control Group Needed
915	0.5	.05	.8	106.2
			.9	142.2
		.10	.8	83.7
			.9	115.9
1,830	**1.0**	**.05**	**.8**	**26.6**
			.9	**35.5**
		.10	**.8**	**20.9**
			.9	**29.0**
3,660	2.0	.05	.8	6.6
			.9	8.9
		.10	.8	5.2
			.9	7.2

Fuel=Natural Gas, CNAS Estimate=173, NASC Estimate StdErr=14, Units=ccf/year

δ	Factor	Test Level (α)	Power of Test at Δ=δ	Percentage of Main Control Group Needed
87	0.5	.05	.8	41.1
			.9	55.0
		.10	.8	32.4
			.9	44.9
173	**1.0**	**.05**	**.8**	**10.3**
			.9	**13.8**
		.10	**.8**	**8.1**
			.9	**11.2**
346	2.0	.05	.8	2.6
			.9	3.4
		.10	.8	2.0
			.9	2.8

So, roughly speaking, to detect in the main national NASC and validation NASC' a difference the size of 100% of the national CNAS (Factor = 1.0 in the tables) would require the supplemental validation control group to be about 20-30% of the size of main control group for electricity and 10-12% of the size of the main control group for natural gas. Although these sample sizes are much smaller than what is required for the split-winter study, they are still substantially, particularly in the context of (1) the 100% (or 50% or 200%) of the national CNAS that the study would be designed to detect, and (2) the procedural difficulty of extended delays in weatherization of the supplemental control group.

S.IV Observations

The sample-size requirements for a split-winter RCT are so substantial they suggest that RCTs are not feasible for a WAP evaluation. The sample-size requirements for an alternative validation approach involving only control subjects are more reasonable, but they are still substantial, particularly in view of the large differences they are designed to detect and the procedural constraints that would have to be circumvented with that approach. The sample sizes that would be needed for either of the split-winter RCT or control-only approaches suggest that these approaches are not be worth pursuing even as supplemental validation or partial-validation studies, and the RCT approach certainly does not seem worth pursuing as a design for a main WAP evaluation.

S.V. Conclusions

If a classical RCT approach is inappropriate, the encouragement design is limited in its scope, and a split-winter design is infeasible, the QE approach becomes a natural contender to consider as an alternative. The weatherization group in the QE approach is selected as it would be in an RCT. The issue in the QE approach, then, is whether because of application/weatherization time differences between the weatherized and comparison groups, differences between the comparison group and the ideal control group that would be selected in an RCT might be substantial enough to render the comparison group so flawed that the QE approach (and in that case most likely any other approach) should not be pursued at all.

The comparison group in the QE approach is an approximation. However, in a QE study, the comparison and weatherization groups are generally compared with respect to potentially influential characteristics (e.g., dwelling size, primary fuel, participant income), and if necessary the analysis can be stratified according to those characteristics. Of course, in weatherization studies, weather-adjustments are made for both weatherized and comparison dwellings. Thus the comparison group is examined and controlled in every feasible way to ensure its adequacy as an approximation. Analysts know if the approximation is inadequate.

The QE approach cannot be justified to the absolute standard that an RCT (were it feasible) might be justified to. As the GAO report points out, however, insistence on an absolute standard will "exclude many potentially effective and worthwhile practices." Thus the QE approach provides a viable alternative to an RTC as the design basis for a WAP evaluation.

APPENDIX T. S6: ALL STATES POST-ARRA SURVEY

The U.S. Department of Energy's (DOE) Weatherization Assistance Program received an unprecedented level of support from the American Recovery and Reinvestment Act (ARRA). The Program's grantees and subgrantees have successfully ramped up their efforts to meet the weatherization goals created for the ARRA-period. The next challenge facing the Program and its grantees and subgrantees is to transition to post-ARRA world. This survey is being administered to all of the Program's ARRA-period grantees. The data will assist the Program and its grantees and subgrantees to better manage this transition.

Public reporting burden for this collection of information is estimated to average one hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Records Management Division, IM-11, Paperwork Reduction Project (**XXXX-XXXX**), U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project (**XXXX-XXXX**), Washington, DC 20503.

All of the information obtained from this survey will be protected and will remain confidential. The data will be analyzed in such a way that the information provided cannot be associated back to your state, your agencies, or the housing units and clients that your state served.

1. Please indicate how leveraged funding changed from PY 2008 to PY2010 and you expect leveraged funding to change from PY2010 to PY2012.

Provide the amount of leveraged funding received in PY 2010 by source. Please forecast leveraging relationship for the post-ARRA period (i.e., during PY 2012).

Source of Leveraged Weatherization Funding Administered by State	**How did leveraged funding from this source to change from PY 2008 to PY 2010?** **1 = increased greatly** **2 = increased** **3 = no change** **4 = decreased** **5 = greatly decreased** **6 = don't know**	**How do you expect leveraged funding from this source to change from PY 2010 to the post-ARRA period in PY 2012?** **1 = increase greatly** **2 = increase** **3 = no change** **4 = decrease** **5 = greatly decrease** **6 = uncertainty is too great to answer this question**
LIHEAP		
Petroleum Violation Escrow (PVE)		
Other Federal Programs		
State Public Benefit Funds		
Other State		
Utilities		
Program Income		
In-Kind		
Non-Profits		
Other		

2. Under ARRA, the allowable average amount of investment was increased from $2500 to $6500. Moving forward, what level of average investment in homes does your state prefer?
a. $2500
b. $6500
c. Other _____
d. No preference

3. Under ARRA, the eligibility threshold was increased from 150% of the poverty level to 200%. Moving forward, what income eligibility threshold does your state prefer?
a. 150% of poverty threshold
b. 200% of poverty threshold
c. Other _____
d. No preference

4. Should the policy on re-weatherization of homes to those weatherized before 1994 be re-considered in light of program changes and new technology 'bumps'?
a. No
b. Yes
If yes, how should the policy be changed? _____

5. Should WAP endeavor to go ‘deeper’ into homes?
a. No
b. Yes
If yes, please explain _____

6. Should WAP formally incorporate water conservation into its program?
a. No
b. Yes

7. Does your state plan on increasing large multi-family weatherization post-ARRA?
a. Yes, increase substantially
b. Yes, increase somewhat
c. No Change
d. No, decrease somewhat
e. No, decrease substantially

8. Should DOE set goals for MF weatherization (i.e., to equal the percentage of multi-family units in the state)?
a. No
b. Yes
If yes, what should the goals be? _____

9. Does your state expect a pre-mature degradation in production as the ARRA period draws to a close in March, 2012?
a. No
b. Yes
If yes, please explain _____

10a. What specific types of training assistance can DOE provide to support post-ARRA ramp down? (check all that apply)
a. Multi-family
b. Health and Safety
c. Other _____

10b. What other types of assistance can DOE provide to support post-ARRA ramp down? (check all that apply)
a. Up-dating and expanding the national curriculum
b. Up-dating and expanding other national training resources
c. Support and expand a certification scheme for the weatherization workforce
d. Other _____

11. Will your state act to consolidate subgrantees post-ARRA?
a. No
b. Yes, limited consolidation
c. Yes, substantial consolidation

12. How many new staff have been added to your state weatherization office during the ARRA period? _____

13. How many staff from your state weatherization office will be laid-off post-ARRA? _____

14. What strategies are being used to retain new, young weatherization staff hired during ARRA by your state office? Please describe _____

15. Is the training capacity created by your state's program and agencies, community colleges, etc. sustainable after ARRA?
a. Yes
b. No
c. No new training capacity was added

16a. Does your state training plan include utilizing weatherization training centers for worker training?
a. Yes (go to 16c)
b. No

16b. If no, how does your state intend to provide worker training?
a. Staff resources- i.e. State monitors to provide worker training
b. Private, consultant trainers- i.e, Saturn, BMI, ECM etc.
c. Other _____
d. No future training is planned.

16c. Does your state training plan include funding a weatherization training center either existing or new?
a. Yes
b. No

16d. Will your state require that training resources be accredited weatherization training providers?
a. Yes
b. No

16e. In the future, will your state require weatherization workers to be certified in their job category (assuming that a national Weatherization certification is available)?
a. Yes
b. No

17. Is your state doing anything to transition workers to other jobs post-ARRA?
a. No
b. Yes
If yes, what?

18. Does your state have plans to use alternative workforces for weatherization (e.g., volunteer labor)?
a. No
b. Yes

19. How many weatherization jobs created during ARRA may be lost after ARRA in your state?
_____

20. How substantial will be the costs that are associated with workforce reductions (e.g., workers compensation) to local weatherization agencies in your state?
a. very substantial
b. substantial
c. not very substantial
d. no additional costs

21. Does your state see health and safety audits as a growing business for your subgrantees over the next five years?
a. No
b. Yes, somewhat
c. Yes, substantially

22. Which alternative financing mechanisms to support weatherization post-ARRA might your state pursue post-ARRA? (check all that apply)
a. revolving loan funds
b. on-bill payments
c. PACE programs
d. ESCO financing
e. carbon offsets
f. none of the above

23a. How can DOE provide support for expansion of the use of alternative third party financing mechanisms (e.g., interest in WAP funding in the form of a (e.g. revolving loans, loan loss reserves, rather than a grant ? One target property type for a revolving loan product are Low-Income Housing Tax Credit Properties)?

23b. What discussions have you had with third parties regarding financing? What has the response been?
_____

23c. Do you have any existing relationships with lenders?
a. Yes
b. No, but working on developing relationships
c. No

24. Over the next five years, what percentage of your state's subgrantees' service areas may become saturated with respect to low-income weatherization?
a. 0
b. 1-10%
c. 11-20%
d. 21-30%
e. 30+%

25. Where do you see the market for non-low income home retrofit in your state over the next five years?
a. greatly increasing
b. increasing
c. no change
d. decreasing
e. greatly decreasing

26. Have you heard of the Home Energy Score system?
a. No
b. Yes

27. If so, how might this initiative impact low-income weatherization in your state?
a. no impact
b. might lead to some funding increases
c. might lead to moderate funding increases
d. might lead to substantial funding increases

28. Post-ARRA, compared to pre-ARRA funding levels, how do you foresee the size of your state's weatherization assistance program?
a. Greatly expanded
b. Expanded
c. About the same
d. Reduced
e. Greatly reduced

29. On balance, how beneficial do you think that the ARRA funding will eventually be to the longer-term prospects for your state's WAP-program?
a. Extremely beneficial
b. Beneficial
c. No long-term impact
d. Unbeneficial
e. Extremely unbeneficial

APPENDIX U: S7: ALL AGENCIES POST-ARRA SURVEY

The U.S. Department of Energy's (DOE) Weatherization Assistance Program received an unprecedented level of support from the American Recovery and Reinvestment Act (ARRA). The Program's grantees and subgrantees have successfully ramped up their efforts to meet the weatherization goals created for the ARRA-period. The next challenge facing the Program and its grantees and subgrantees is to transition to post-ARRA world. This survey is being administered to all of the Program's ARRA-period subgrantees. The data will assist the Program and its grantees and subgrantees to better manage this transition.

Public reporting burden for this collection of information is estimated to average one hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Office of the Chief Information Officer, Records Management Division, IM-11, Paperwork Reduction Project (**XXXX-XXXX**), U.S. Department of Energy, 1000 Independence Ave SW, Washington, DC, 20585-1290; and to the Office of Management and Budget (OMB), OIRA, Paperwork Reduction Project (**XXXX-XXXX**), Washington, DC 20503.

All of the information obtained from this survey will be protected and will remain confidential. The data will be analyzed in such a way that the information provided cannot be associated back to your state, your agencies, or the housing units and clients that your state served.

1. Please provide the amount of leveraged funding received in PY 2010 by source. Please forecast leveraging relationship for the post-ARRA period (i.e., during PY 2012).

Source of PY 2010 Leveraged Weatherization Funding Administered by Agency	**How did leveraged funding from this source to change from PY 2008 to PY 2010?** **1 = increased greatly** **2 = increased** **3 = no change** **4 = decreased** **5 = greatly decreased** **6 = don't know**	**How do you expect leveraged funding from this source to change from PY 2010 to the post-ARRA period in PY 2012?** **1 = increase greatly** **2 = increase** **3 = no change** **4 = decrease** **5 = greatly decrease** **6 = uncertainty is too great to answer this question**
LIHEAP		
Petroleum Violation Escrow (PVE)		
Other Federal Programs		
State Public Benefit Funds		
Other State		
Utilities		
Program Income		
In-Kind		
Non-Profits		
Other		

2. Under ARRA, the allowable average amount of investment was increased from $2500 to $6500. Moving forward, what level of average investment in homes does your agency prefer?
a. $2500
b. $6500
c. Other _____
d. No preference

3. Under ARRA, the eligibility threshold was increased from 150% of the poverty level to 200%. Moving forward, what income eligibility threshold does your agency prefer?
a. 150% of poverty threshold
b. 200% of poverty threshold
c. Other _____
d. No preference

4. Should the policy on re-weatherization of homes to those weatherized before 1994 be re-considered in light of program changes and new technology 'bumps'?
a. No
b. Yes
If yes, how should the policy be changed? _____

5. Should WAP endeavor to go ‘deeper’ into homes?
a. No
b. Yes
If yes, please explain _____

6. Should WAP formally incorporate water conservation into its program?
a. No
b. Yes

7. Does your agency plan on increasing large multi-family weatherization post-ARRA?
a. Yes, increase substantially
b. Yes, increase somewhat
c. No Change
d. No, decrease somewhat
e. No, decrease substantially

8. Should DOE set goals for multi-family weatherization (i.e., to equal the percentage of multi-family units in the state)?
a. No
b. Yes
If yes, what should the goals be? _____

9. Does your agency expect a pre-mature degradation in production as the ARRA period draws to a close in March, 2012?
a. No
b. Yes
If yes, please explain _____

10. What assistance can DOE provide to support post-ARRA ramp down?
a. Health and safety audit training
b Support and expansion of a national weatherization certification scheme
c. Training assistance to prepare workers for certification
d. Other _____

11. How many new staff have been added to your agency’s weatherization program during the ARRA period? _____

12. How many staff from your agency’s weatherization program might be laid-off post-ARRA? _____

13. What strategies are being used to retain new, young weatherization or trained staff hired during ARRA by your agency? Please describe _____

14. Are expenses for new equipment, software, etc. purchased by your agency during ARRA sustainable after ARRA?
a. Yes
b. No
c. No new equipment, software, etc. was purchased

15. Is the training capacity created by your agency sustainable after ARRA?
a. Yes
b. No
c. No new training capacity was added

16. Is your agency doing anything to transition workers to other jobs post-ARRA?
a. No
b. Yes
If yes, what?

17. Does your agency have plans to dispose of extra trucks post-ARRA?
a. No, we do not have extra trucks
b. No, we may have extra trucks but we do not have a disposal plan yet
c. Yes, we have extra trucks and we have a disposal plan
If yes, please describe the disposal plan _____

18. Does your agency have plans to dispose of extra blower doors post-ARRA?
a. No, we do not have extra blower doors
b. No, we may have extra blower doors but we do not have a disposal plan yet
c. Yes, we have extra blower doors and we have a disposal plan
If yes, please describe the disposal plan _____

19. Does your agency have plans to dispose of extra infra-red and/or cameras post-ARRA?
a. No, we do not have extra cameras
b. No, we may have extra cameras but we do not have a disposal plan yet
c. Yes, we have extra cameras and we have a disposal plan
If yes, please describe the disposal plan _____

20. How will your agency cost-out unused equipment post-ARRA? _____

21. Does your agency have plans to use alternative workforces for weatherization (e.g., volunteer labor) post-ARRA?
a. No
b. Yes
If yes, please explain _____

22. How many weatherization jobs created during ARRA may be lost post-ARRA in your agency's jurisdiction?
_____

23. If your agency uses contractors to perform weatherization, how much will your contractor pool decrease post-ARRA?
a. 0%
b. 1-10%
c. 11-20%
d. 21-30%
e. 31-40%
f. more than 40%

24. Will some of your agency's contractors go out of business?
a. No
b. Yes
If yes, how many? _____

25. How substantial be will the costs that are associated with workforce reductions (e.g., workers compensation) to your agency?
a. very substantial
b. substantial
c. not very substantial
d. no additional costs

26. Will your agency abandon Davis-Bacon wages post-ARRA?
a. No
b. Yes

27. Does your agency see its weatherization clientele changing demographically over the next five years?
a. No
b. Yes
If yes, please explain _____

28. Does your agency see the types of homes in your weatherization program changing over the next five years?
a. No
b. Yes
If yes, please explain _____

29. As of the end of PY 2010, what is the demand for low-income weatherization services in your agency's jurisdiction?
a. extremely high
b. very high
c. high
d. moderate
e. low
f. very low

30. Does your agency see the demand for weatherization services changing over the next five years?
a. No
b. Yes
If yes, please explain _____

31. Will your agency explore fee for service projects post-ARRA?
a. No
b. Yes

32. Does your agency see health and safety audits as a growing business for your subgrantees over the next five years?
a. No
b. Yes, somewhat
c. Yes, substantially

33. Which new measures would your agency encourage DOE approving to be installed in homes over the next five years? _____

34. Which alternative financing mechanisms to support weatherization post-ARRA might your agency pursue post-ARRA? (Check all that apply)
a. revolving loan funds
b. on-bill payments
c. PACE programs
d. ESCO financing
e. carbon offsets
f. none of the above

35. What help can DOE provide to support expansion of the use of alternative third-party financing mechanisms? _____

36. Does your agency see the demographics of its weatherization workforce changing over the next five years?
a. No
b. Yes
If yes, please explain _____

37. What are your agency's major weatherization workforce challenges over following five years?
_____

38. Where do you see the market for non-low income home retrofit in your agency's jurisdiction over the next five years?
a. greatly increasing
b. increasing
c. no change
d. decreasing
e. greatly decreasing

39. Have you heard of the Home Energy Score system?
a. No (go to Q41)
b. Yes

40. If so, how might this initiative impact low-income weatherization conducted by your agency?
a. no impact
b. might lead to some funding increases
c. might lead to moderate funding increases
d. might lead to substantial funding increases

41. Post-ARRA, compared to pre-ARRA funding levels, how do you foresee the size of your agency's weatherization assistance program?
a. Greatly expanded
b. Expanded
c. About the same
d. Reduced
e. Greatly reduced

42. Is your agency resigned to going back to business as usual post-ARRA?
a. No
b. Yes

43. On balance, how beneficial do you think that the ARRA funding will eventually be to the longer-term prospects for your agency's WAP-program?
a. Extremely beneficial
b. Beneficial
c. No long-term impact
d. Unbeneficial
e. Extremely unbeneficial