

# Weatherization Works II – Summary of Findings From the ARRA Period Evaluation of the U.S. Department of Energy’s Weatherization Assistance Program



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## EXECUTIVE SUMMARY

In April 2009, the U.S. Department of Energy (DOE) tasked Oak Ridge National Laboratory (ORNL) with conducting an evaluation of DOE's low-income Weatherization Assistance Program (WAP). This directive came at the same time that the American Recovery and Reinvestment Act of 2009 (ARRA) was passed. The Recovery Act boosted WAP's funding from approximately \$230M per year to \$5B over a three-year period. The national weatherization community was expected to be 'shovel ready' to ramp up its production and dramatically increase employment in the field. Also, during this period of time weatherization funding was provided for the first time to five U.S. territories, including Puerto Rico. Because WAP during the Recovery Act period was expected to be so unlike WAP in previous years, the decision was made to evaluate WAP as it was administered both before and during the Recovery Act period. The former is known as the 'retrospective' evaluation of WAP and focuses on Program Year (PY) 2008.<sup>1</sup> The latter is known as the 'ARRA period or Recovery Act' evaluation and focuses on PY 2010. This report summarizes findings from the thirteen individual studies that comprise the ARRA period evaluation.

The ARRA period evaluation estimated program impacts (e.g., energy savings), assessed program administration, and conducted several special studies. To accomplish these tasks, the ARRA period evaluation collected a great deal of data, including:

- Housing characteristics and weatherization measures installed in ~12,000 single family and mobile homes, 1200 units in small multifamily buildings, and 2700 large multifamily buildings and units in these buildings.
- Fuel type and basic occupant characteristics for ~35,000 homes.
- Electricity and natural gas billing histories for ~16,000 weatherized and comparison single family and mobile homes collected from ~400 natural gas and electric utilities.
- Program implementation survey data from 50+ Grantees and ~900 Subgrantees.
- Demographic, energy use behavior, and client satisfaction survey data from ~150 treatment households in Puerto Rico.
- Follow-up, post-ARRA demographic and career-related survey data from ~500 weatherization auditors, crew leaders, crew members.
- Medicaid records from 49 households (treatment and comparison groups) to estimate the impacts on medical costs of the Opportunity Council's Weatherization Plus Health Program that installed asthma-reduction measures in addition to weatherization measures in homes where children with asthma reside.
- 777 interviews conducted by 74 weatherization recipients and staff from 10 local weatherization agencies to explore potential impacts of shared weatherization experiences on energy-related decisions by those in their social network.

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<sup>1</sup> Please see Tonn et al. (2014c) for a summary of the retrospective evaluation results.

- Data from eleven homes that were monitored to track cooling-system and whole-house electricity consumption before and after weatherization.
- Electricity use data from 397 refrigerators collected pre-weatherization.
- Information gathered from surveys and interviews with 43 Subgrantees and 119 clients about deferrals of weatherization services.
- Survey data from the directors of 35 DOE weatherization training centers.

In PY 2010, the impact component of the ARRA period evaluation found that:

- WAP funds supported the weatherization of 340,158 units in PY 2010: 65% single family site built (1-4 units)<sup>2</sup>, 15% mobile home, and 20% large multifamily (5+ units).
- DOE expenditures on WAP were \$2,000,000,000. Including leveraged funding, the total expenditures on units weatherized that included DOE funding were \$2,316,000,000. The total spent by the national weatherization network in PY 2010 for weatherization was \$2,715,000,000.
- The average cost to weatherize a DOE unit was \$6,812 (the DOE share for investments in units that received some DOE funding was 87%).<sup>3</sup>
- WAP and leveraged expenditures supported directly and indirectly ~28,000 jobs and increased national economic output by \$4 billion.
- The estimated first year program energy savings is 7,610,000 Million British Thermal Units (MMBtu).<sup>4</sup>
- Site built homes averaged 26.6 MMBtu of savings in the first year,<sup>5</sup> mobile homes 16.4 MMBtu, and units in large multifamily homes 15.9 MMBtu.
- The present value of the program energy cost savings using 2013 dollars is \$1,223,000,000 and the present value per unit weatherized is \$3700; the estimates using 2010 dollars are \$1,100,000,000 and \$3,190.
- Approximately 78% of these savings accrued to households and 22% to ratepayers of utilities that have Percentage of Income Payment Programs.
- Carbon emissions were reduced by 7,382,000 metric tons<sup>6</sup>; criteria pollutants by 17,000 short tons.
- The present value of the environmental emissions benefits for the program is \$645,000,000, with the present value per weatherized unit is \$1944; the water savings benefit is \$186 per unit for a total program benefit of \$49,000,000.

<sup>2</sup> For the PY 2010 analyses, single-family homes and small multifamily units (1-4 units) have been grouped into a collective category referred to as site built homes.

<sup>3</sup> A DOE unit is defined as any weatherized home that received at least \$1 dollar of DOE funds. The ARRA period evaluation only addressed energy savings in DOE homes.

<sup>4</sup> This is equivalent to nearly 1,340,000 barrels of oil.

<sup>5</sup> For comparison purposes, WAP saved an average of 17.6 MMBtu of energy in site built homes in PY 1989 (Brown et al. 1994).

<sup>6</sup> This is about the amount of carbon emitted by 1,972,000 average automobiles in the US.

- A cluster analysis of weatherized households indicated that ~25% of households coming into the weatherization program suffer an extensive set of household budget problems.
- On balance, households did not change their energy conservation behaviors (e.g., use of appliances) post-weatherization to reduce or increase energy consumption.
- Separate energy education visits to homes were the only aspect of energy education provided to households by Subgrantees that was statistically correlated with changes in energy conservation behavior post-weatherization.
- The present value of a limited set of health and household-related non-energy benefits for the WAP is approximately \$3,830,000,000; the present value per household (single family and mobile home) is \$14,148.
- The average electricity savings in homes weatherized by the new Puerto Rico program was 876 kWh per year (~15%).
- The social network study found that weatherization clients do share information about their weatherization experiences with members of their social networks and the communications led to actions taken (e.g., 55% reported changing their energy behaviors, 41% contacted someone for more information, 28% completed do-it-yourself (DIY) projects in their own homes).
- Analysis of Medicaid records indicates that the Opportunity Council's Weatherization Plus Health Program reduced the annualized costs associated treating children with asthma by \$421.
- The average annualized electricity consumption for a refrigerator in the study sample was 756 kWh/year. The median was 651 kWh/year. The preponderance of the refrigerators' inside temperatures was below the recommended 42 °F.
- The major causes of weatherization services being deferred include worker health and safety, mold and moisture, structural problems, severe water leaks, hoarding, and dangerous pets; 78% of clients interviewed understood why their homes were deferred, 5% did not, and 17% were not aware of or were not informed that the agency deferred services.
- Two years after participating in an initial survey, results of a second survey of weatherization staff indicated that 25% of auditors, 27% of crew chiefs, and 40% of crew members had left the field of low-income weatherization and only 5% of these individuals remained in the general 'home retrofit' field.
- The number of weatherization training centers expanded appreciably during the ARRA period, though subsequent reductions in funding levels may lead to the closure of a significant number of centers.

During the ARRA period, WAP's funding and production goals were unprecedented. Therefore, the process evaluation component of the evaluation focused on documenting the experiences of the Grantees and Subgrantees during the Recovery Act period. Among the challenges faced by these stakeholders were these:

- Davis-Bacon Act provisions delayed production ramp-up and increased operations and administrative costs for the Subgrantees.

- Federal and Grantee oversight increased for Subgrantees, which in turn increased administrative costs.
- Both Grantees and Subgrantees had to deal with increased media and political attention focused on their weatherization programs.
- Subgrantees were faced with rapidly increasing and training the new workforce.
- In part, because of these challenges and increased costs, the estimated cost effectiveness of the program during the ARRA period was lower than estimated for the retrospective period.

In many ways, WAP during the Recovery Act resembled WAP as implemented just before the Recovery Act in PY 2008. For example, WAP did not change appreciably during the Recovery Act period with respect to these characteristics:

- Frequency of use of various diagnostic procedures (e.g., blower door tests were used with the same frequency).
- Approaches to and topics covered for client education purposes (e.g., most client education was again delivered during the in-home audit and the most popular topics were thermostat usage, insulation and lighting).
- Approaches for weatherization measure selection (e.g., frequency of Subgrantees using priority lists versus computerized audits was about the same).
- Measures installed (e.g. air sealing was again the most frequently installed measure).
- Use of various training venues (e.g., National Weatherization Program Conference was again a preferred training option).
- Weatherization program marketing efforts were at the local level (e.g., mailings to clients, radio ads were most popular again).
- Leveraged funding was approximately the same (\$700 million in PY 2010 versus \$600 million in PY 2008) though available leveraged funding per unit was substantially lower.

In some ways, though, WAP as implemented during the Recovery Act was different. For example, the income eligibility requirements were adjusted from being 150% of the federal poverty level to 200% and the average amount of DOE funds that could be invested in a home was increased from \$2500 to \$6500. In part because of these changes, households that received weatherization services had higher incomes and fewer vulnerable individuals in residence. The formula used to distribute federal weatherization funds to the Grantees was different during the ARRA period in that it allocated a higher percentage of DOE funds to hot climate states. In turn, homes that were weatherized were smaller, newer, less likely to use bulk fuels (e.g., fuel oil), and were more likely to use supplemental fuels (e.g., electric space heaters).

Overall, despite the ramp-up and ramp-down challenges, increased oversight and media attention, and organizational shake-ups experienced within state governments in reaction to ARRA funding increases for low-income weatherization, 44% of Grantees thought that the added attention to weatherization during the Recovery Act was beneficial, only 12% disagreed. Amongst Subgrantees, 51% thought the attention was beneficial, and only 7% disagreed. Almost half of the Subgrantees thought the public's support for weatherization increased during ARRA; only 3% thought that support decreased.