



## Evaluation of the U.S. department of energy's weatherization assistance program: Impact results

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### ARTICLE INFO

#### Keywords:

Low-income weatherization  
Energy savings  
Emissions reductions  
Health benefits  
Cost-effectiveness

### ABSTRACT

This paper presents the results of two impact evaluations of the U.S. Department of Energy's Weatherization Assistance Program (WAP). This comprehensive weatherization program provides grants to U.S. states, which then provide grants to local weatherization agencies to weatherize income-eligible low-income homes. The program treats single family and mobile homes, and multifamily buildings in all climate zones. The impact evaluations focused on Program Years (PYs) 2008 and 2010. The latter fell during the American Recovery and Reinvestment Act (ARRA) period. The program supported the weatherization of 98,000 units in PY 2008 and 332,000 units in PY 2010. It is estimated that the program saved 2.3 trillion Btus in PY 2008 and 7.6 trillion Btus in PY 2010. These savings achieve \$420 million in energy cost savings with respect to PY 2008 and \$1.2 billion in savings in PY 2010. Environmental and health and household related benefits add \$267 million and \$1.2 billion and \$694 million and \$3.8 billion of co-benefits to the energy cost savings benefits. The average total benefit per unit weatherized in PY 2008 is \$22,000 versus an average total cost of \$4,700. These results for PY 2010 are \$20,000 and \$6,800, respectively.

### 1. Introduction

This paper presents impact results from two evaluations of the U.S. Department of Energy's Weatherization Assistance Program (WAP). One is known as the retrospective evaluation and focused on WAP Program Year 2008. The other is known as the ARRA Period evaluation and focuses on one Program Year, 2010, that falls within the American Recovery and Reinvestment Act of 2009 (ARRA) time frame. Reported below are estimated energy savings, non-energy benefits, and cost effectiveness for those two program years.<sup>1</sup>

Briefly, 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) 10 CFR 440.1 is "to increase the energy efficiency of dwellings owned or occupied by low-income persons, reduce their total residential energy 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, 2011)<sup>2</sup>

WAP provides grants, guidance, and other support to Grantees: weatherization programs administered by each of the 50 states, the District of Columbia, territories and several Native American tribes. The Grantees, in turn, oversee a network of 900+ local weatherization agencies (Subgrantees): community action agencies, nonprofit organizations, and local government agencies that are eligible to receive weatherization funding from DOE. These weatherization agencies qualify eligible households, assess their homes' energy efficiency opportunities, install energy-saving measures, and inspect the work. The work performed includes air sealing, insulation upgrades, furnace repair/replacements, and other dwelling-specific measures found to be cost-effective, as well as home improvements needed to ensure the health and safety of household occupants. The work is done at no cost to the eligible participants. WAP weatherizes single-family homes (SF), mobile homes (MH) and multifamily buildings, both small (2–4 units) (SMF) and large (5+ units) (LMF) buildings, regardless of home heating fuel (e.g., natural gas (NG), electricity, fuel oil). WAP procedures are adaptable to all climate zones.<sup>3</sup>

In February 2009, the U.S. Congress passed and the President signed ARRA (also referred to as the Recovery Act) into law. Included in the

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<sup>1</sup> Tonn et al. (2014c) and Tonn et al. (2015a) are reports that summarize all aspects of the retrospective and ARRA period evaluations, respectively. All reports from the evaluations can be found at: <http://weatherization.ornl.gov>

<sup>2</sup> For a comprehensive treatment of the population eligible for WAP, please see Carroll et al. (2014b).

<sup>3</sup> To learn more about WAP through a series of case studies, please see Tonn et al. (2014a).

hundreds of billions of dollars of programs, initiatives, and investments was \$5 billion for WAP. Annually, this funding represents about six times more per year than Congress had been typically appropriating for WAP. The huge increase in funding was based on the assumption that weatherization was a ‘shovel ready’ program, capable of quickly ramping up production and, most importantly given a major goal of ARRA, employing significant numbers of individuals to weatherize low-income homes. The national weatherization network was given approximately three years to spend these funds.

Preparations for what came to be known as the retrospective evaluation were well underway by the time ARRA was passed. It was decided to also evaluate WAP as administered during the Recovery Act for several reasons. One was to meet the accountability and transparency goals for efforts funded by ARRA. Also, the Recovery Act also included several provisions specifically related to WAP and it was decided that an evaluation could provide insights into the impacts and effects of those provisions on the program. The most important provisions in the Recovery Act pertaining to WAP are these:

- The income eligibility threshold for the program was raised from 150% of the Federal Poverty Level to 200%, though the 60% or less of the state medium income threshold remained the same;
- The average DOE funding that could be spent per weatherized unit was raised from \$2,500 to \$6,500; and
- WAP Grantees and Subgrantees had to adhere to the provisions of the Davis-Bacon Act with respect to prevailing wages and paperwork reporting.

Section 2.0 presents descriptive statistics about the number, types and locations of units weatherized using WAP funds during the program years of interest and presents a summary of DOE and leveraged funds expended (Section 2.1). Also described in this section is how WAP was similar and dissimilar in PYs 2008 and 2010 and how these factors may have influenced program outcomes. Section 3.0 presents the impact results, beginning with a summary of the research design (Section 3.1), then the energy savings impacts (Section 3.2), with summaries of the non-energy impacts (Section 3.3), and cost-effectiveness estimates (Section 3.4). The paper concludes in Section 4.0 with observations about program operation and effectiveness.

## 2. WAP during the recovery act

### 2.1. Production and funding<sup>4</sup>

During the ARRA period, WAP's funding and production levels were unprecedented. Fig. 1 presents the number of units weatherized by quarter the national weatherization network using DOE funds from 2008 through 2014. One can see that the production supported by ARRA funds spiked in the fourth quarter of 2011 at 90,000 units. In entire PY 2008, WAP only supported the weatherization of 98,000 units. The figure also shows that units weatherized with formula funds (i.e., normal Congressional appropriations) declined to fall below pre-ARRA levels. Ramp up and ramp down of employment in low-income weatherization matches these curves.

Table 1 documents the number and types of units weatherized in PY's 2008 and 2010. Most of the units weatherized by WAP are owner occupied, single family site built homes. The program has been increasing its efforts to weatherize units in large multi-family buildings and the buildings themselves. Some progress along those lines is seen in PY 2010. Table 2 indicates in which climate zones homes were weatherized in PYs 2008 and 2010 (see Fig. 2 for the map of climate zones used in this research). There is a much bigger difference in where

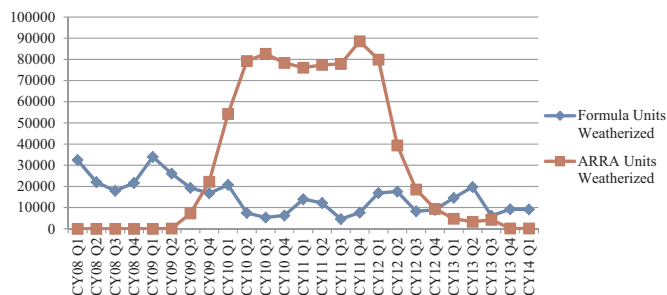


Fig. 1. Units Weatherized With WAP Funds During the Recovery Act Period.

Table 1

Weatherized units in program years 2008 and 2010 by housing type.

Housing type	2008 units	2008 by %	2010 units	2010 by %
Site Built Homes (1–4 units)	62,835	64%	215,445	65%
Mobile Homes	17,754	18%	48,267	14.5%
Large Multi-family Units (5+)	17,376	18%	68,153 <sup>a</sup>	20.5%
<b>Total</b>	<b>97,965</b>	<b>100%</b>	<b>331,865</b>	<b>100%</b>

<sup>a</sup> Excluded in this number are multifamily units that were reported weatherized about which the evaluation team had no information and it also excludes weatherized shelters

Table 2

Weatherized units in program years 2008 and 2010 by climate zone.

Climate zone	2008 units	2008 by %	2010 units	2010 by %
Very Cold	24,749	25%	58,584	18%
Cold	42,233	43%	127,386	38%
Moderate	18,794	19%	56,006	17%
Hot/Humid	6,390	7%	55,157	17%
Hot/Dry	5,799	6%	34,732	10%
<b>Total</b>	<b>97,965</b>	<b>100%</b>	<b>331,865</b>	<b>100%</b>

homes were weatherized during the Recovery Act than what types of homes were weatherized. This is because according to the WAP authorizing legislation, the funding formula used to distribute WAP funding to the Grantees changes when the annual appropriation exceeds \$275 million to allocate a higher percentage of funding to hot climate states. The hot humid states of the U.S. Southeast were particular beneficiaries of this formula change. Weatherizing more homes in the hot climates also increases the percentage of home heating with electricity and decreased the number heated with fuel oil PY 2008 to PY 2010. (Table 3)

Table 4 summarizes funding received by the Grantees and Subgrantees in PY 2010 and PY 2008 for low-income weatherization. The Congressional appropriation for WAP in PY 2008 was \$236 million. This funding was used to leverage another \$486 million in non-DOE funding. Most of the leveraged funding came from states deciding to allocate some of their Low Income Home Energy Assistance Program (LIHEAP) funding to low-income weatherization.<sup>5</sup> State public benefit funds and utility companies were other important sources of leveraged funding. \$224 million of the leveraged funding was braided with DOE/WAP funding to weatherize homes. Generally, the leveraged funding invested in DOE homes followed DOE/WAP guidelines, but this is not always the case. The remaining leveraged funding was spent in whatever ways dictated by the source of the leveraged funding. The two evaluations reported on herein only included homes that had DOE

<sup>4</sup> A more complete characterization of WAP during the Recovery Act can be found in Tonn et al. (2015c).

<sup>5</sup> LIHEAP is also a federal program, though administered by the U.S. Department of Health and Human Services.

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