

WEATHERIZATION *PLUS*

Executive Summary

What is Weatherization *Plus*?

Weatherization *Plus* is a term that describes the evolution of the Weatherization Assistance Program from its traditional focus on heating and cooling energy conservation to an expanded focus on whole-house energy usage and whole-community efforts. The whole-house approach incorporates advanced technologies and addresses the comprehensive energy usage in low-income homes, as well as related health and safety improvements. The whole-community approach enables Weatherization providers to serve as a resource for community-based efforts to conserve energy, boost economic activity, and improve the environment.

Why was Weatherization *Plus* developed?

Weatherization services are delivered by an established network of local Weatherization providers. Through diverse partnerships with other federal, state, community, and private entities, many Weatherization agencies have demonstrated the capability to deliver expanded services in low-income homes. Weatherization *Plus* has been developed to foster this capability within the full network of providers and to magnify the benefits produced through weatherization.

What is the goal of Weatherization *Plus*?

The goal of Weatherization *Plus* is to achieve significantly greater energy cost savings for more low-income households and to increase the Program's contribution to the economic and environmental health and sustainability of the nation's communities.

Background

Discussions about strategic planning for the evolution of the Weatherization Assistance Program first began in the fall of 1998, at the Weatherization State Program Managers' Meeting in Brooklyn, New York. As an outcome of the Brooklyn discussions, a planning group, called the Weatherization Millennium Committee, was formed. The committee included state, local and federal staff, in addition to representatives from the National Association for State Community Services Programs (NASCSPP) and the National Community Action Foundation (NCAF).



Weatherization staff sprays foam insulation into the home of a low-income client.





Weatherization insulation truck equipped with a Krendl insulation machine.

The Millennium Committee developed a visionary report containing a strategy for strengthening and expanding the Weatherization Assistance Program for the future. Named “Weatherization *Plus*: Opportunities for the 21st Century,” this strategic plan urged the Department to support the network of state and local Weatherization agencies in flexibly adopting a whole-house approach and a whole-community approach to better serve low-income Americans.

The goal of Weatherization *Plus* is to enable the Weatherization Assistance Program to achieve significantly greater energy cost savings for more low-income households and to increase the Program’s contribution to the economic and environmental health and sustainability of our nation’s communities.

When the original Weatherization Millennium Committee’s work was completed, a follow-on group, called the Millennium Implementation Planning Committee (nicknamed the “MIC”) took the vision of the first Committee and transferred it into an implementation plan. The MIC expanded upon the membership of the original Committee to include representation of the interests of Native American tribes, training centers and other stakeholders. With input from the entire network, the MIC formulated a series of action steps to lay the groundwork for Weatherization *Plus*. Actions were defined in the context of the three main strategies that the original committee established. They are:

Increase the network’s flexibility through legislative/regulatory program improvements, and facilitating the role of Weatherization agencies in interactions with other community-based initiatives.

Advance the network’s technological capabilities through an integrated strategy of training and technical assistance to employ new and advanced technologies which have been determined to be cost-effective, but have not been readily available to the Weatherization network in the past.

Expand resources available to the network through exchange of information on successes and new opportunities, interagency partnerships, appropriations at state and federal levels, and other leveraged funds from multiple sources.

In May of 2000, an update on Weatherization *Plus* was provided via a report entitled: “Progress Report on Weatherization *Plus*: Steps to New Opportunities in the 21st Century.” It reported on the status of the 18 specific actions that the MIC defined to lay the groundwork for success assuming eventual broader network implementation when the necessary resources become available. Another update was issued in June 2001, entitled, “Weatherization *Plus* Progress Report: Poised to Move Forward.”

In 2005 the Weatherization *Plus* Committee met once again to discuss the future of the Program and where focused time and attention was needed to ensure the future health and success of the Program. The results of that meeting are contained in the report, “Weatherization *Plus* – Our Future, Our Vision – *Where we want to be in 2010.*” It contains clear, concise areas of focus and milestones for the Program over a five-year timeframe. Three strategies evolved from this process that are consistent with the Program’s Mission and Vision:

- Expanded Resources: Leveraging/Partnerships
- Consistent Delivery of Quality Services
- National Information Exchange Resource

Since the release of the latest report the Weatherization network has achieved great accomplishments in each of the outlined areas. A dedicated Web site, www.weatherizationplus.org, was developed to provide a gateway to information, analysis, and contacts available to Weatherization providers. The pages contain examples of lessons learned and material used when winning resources for affordable energy. In 2007, the Weatherization Trainers Consortium released the “Core Competencies” which outline a set of core competencies for the various staff positions that implement the Weatherization Program. This document is intended to:

Increase awareness of the specialized skills and knowledge that are required to run an effective weatherization program;

- Help state and local weatherization agencies hire staff with a strong potential to perform well and prosper in the program;
- Serve as a foundation in establishing standardized curricula to ensure the consistent delivery of high-quality weatherization services nationwide; and
- Put upward pressure on salaries to reduce staff turnover.

Additionally, in keeping with the three strategies outlined above, the Weatherization network will complete the first phase of the Weatherization Resource Library (WXRL). WXRL, developed specifically for the Weatherization Assistance Program, will serve as a source to archive all historical documents and ensure easy retrieval of governing documents by the Program network.

Weatherization *Plus* Credits

Since the inception of Weatherization *Plus*, the Program has experienced transformation at every level. The flexibility of the regulations and legislation has been addressed, allowing the program staff to leverage resources and re-shape their programs to better meet the needs of the low-income clients served. The technological capabilities have been raised across the country, allowing for better services to be rendered and training techniques to be replicated and replenished throughout the nation. And, the resources that have come into the program over the last several years have dramatically increased and affected the types of services and the number of individuals this program has been able to assist.

The following is a partial list of the initial activities and actions resulting from the first phase of Weatherization *Plus* movement guided by the MIC and the May 2000 progress report:

- Statutory changes restructured the method of computing the average cost per home, increasing the funds invested into each home served.
- Regulations were amended to add additional priority groups (high energy burden and high energy users) and to create separate categories for health and safety expenditures and vehicle purchases.
- The National Energy Audit Tool was revised, incorporating whole-house Weatherization components into the software for use by practitioners.
- Representatives from the network, led by our Association partner NASCSP, developed a Weatherization Public Information Campaign to spread the message about the work being accomplished across the nation for the low-income families served. This effort included the launching and annual celebration of Weatherization Day on October 30.

The following is a list of the activities and actions resulting from the second phase of Weatherization *Plus* following the 2005 meeting that reconvened the Weatherization *Plus* Committee:

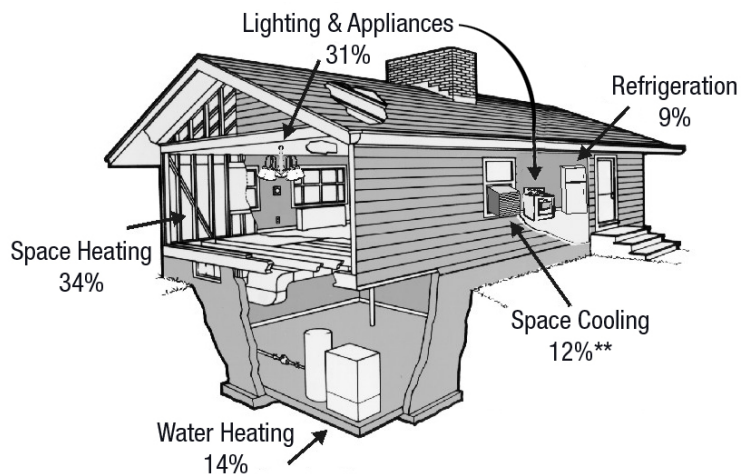
- Trainers and energy professionals were brought into the “Hot-Climate Initiative” to support the incorporation of more advanced techniques and technologies, including electric baseload measures, to help the hot-climate states achieve higher energy savings per household, and to leverage additional funds to reach more households.
- “Best Practices” studies were funded to establish baseline goals for zonal pressure diagnostics, testing cookstoves for carbon monoxide emissions, building tightness limits, duct testing, worst case draft testing, and train-the-trainer curriculum.
- Several states are establishing certification programs to ensure that their weatherization work force has command of certain technical knowledge and possesses a minimum set of technical skills. The “Core Competencies” developed by the Weatherization Trainers Consortium

are being used as the foundation of some of these new certification programs. Other states are basing their certification programs on Building Performance Institute requirements.

- The “Weatherization *Plus*” Leveraging Partnership Project was established and provides technical assistance to local and state organizations that are seeking to leverage low-income energy affordability resources through partnerships with utilities, housing developers, and other non-federal sources of investment.
- The Weatherization Resource Library (WXRL). WXRL, is being developed specifically for the Weatherization Assistance Program to serve as a source to archive all historical documents and ensure easy retrieval of governing documents by the Program network.

Weatherization *Plus* – The Next Generation

With all successful ventures, there must be continual evolution. The Weatherization Program, for almost three decades, has demonstrated its inherent ability to transform and evolve to meet the continual changing needs of the nation’s poor. Challenged by today’s housing stock, the Weatherization Program continues to seek out technological advancements and ingenious approaches to address the issues facing the Program. However, while a great deal of emphasis is placed on the activities underway today; the Program prepares to meet the challenges of tomorrow.



Percent of Total Energy Costs by End-Use in Households up to 150% Poverty*

**Source: 2006 Residential Energy Consumption Survey

Weatherization: The Best Kept Secret in America

Weatherization is often a catalyst for other projects. It is a small part of many programs and projects, but without Weatherization the larger effort would not exist.

Weatherization: Setting the Standard for Residential Energy Efficiency

by Allison Spector with special thanks to Bill Lazar of the St. Johns Housing Partnership (*NASCSP Newsletter, Volume 23, June 2008*)

Beyond a doubt, the Weatherization Assistance Program has set the national standard for residential energy efficiency. From our state-of-the-art diagnostic measures, to our comprehensive energy-savings improvements, WAP provides a model from which other like-minded programs can develop and flourish. As issues of climate change and conservation move to the forefront of the public consciousness, many excellent opportunities have arisen to make energy and housing more affordable to those in need. Such projects are possible through the hard work and dedication of those who seek to improve the environment for those living today, as well as future generations. As a pioneer of the green movement, the Weatherization Assistance Program often provides a foundation from which new residential conservation programs may thrive.

An excellent example of the synergy between WAP and likeminded programs can be found in St. Johns County, Florida at Hancock Place, an affordable housing development comprised of 36 quality built, low-maintenance, Energy Star Homes. Long experienced with the Weatherization Assistance Program, the St. Johns Housing Partnership's goal was to develop financially accessible fuel efficient housing for first time homebuyers. Following Energy Star standards, SJHP soon found itself looking to WAP for strategies to optimize home energy use in these 1280 sq ft, 3 bedroom, 2 bath units.

It was an easy transition to the Energy Star Standard. Through their experience with the WAP, SJHP has developed a strong proficiency in the use of NEAT audit software, blower door diagnostics, and duct blasting technology allowing building crews to "work smart" and focus their efforts

to create a home with 14 SEER HVAC and a high Energy Star score at an affordable price to the customer. In addition, drought tolerant plants and low volume irrigation were installed in the yard to keep water bills low. Inside, dual flush toilets lead the way in reducing water usage, with low flow faucets and a water frugal dishwasher.

Bill Lazar of the St. Johns Housing Partnership recalls the lessons applied from WAP to his green housing. “It all started for me with the first weatherization program here in Florida- Florida Fix, 20 years ago, where I was offered training on how to make cost effective improvements to sub-standard housing, to keep those homes running more efficiently for the occupants. It was easy to make the transition to new construction. [I thank WAP] for all the training that introduced us to energy conservation long before it started to become hip.”

The Partnership’s efforts have been met with great success. Recent electric bills for SJHP’s new homeowners were less than \$80. SJHP has received high scores for both energy and water conservation. One of these houses has received recognition by the Florida Green BuildingCoalition for being the first “Certified Green Built Home” in St. Johns County. In a recent Parade of Homes, the Hancock Place was seen as one of the “best buys for the money” in the under 1500 sq foot division. The project has also received the 2007 Florida Friendly Yards and Neighborhood Award for Community Wide Landscaping, and 2007 Builder of the Year for St. Johns County.

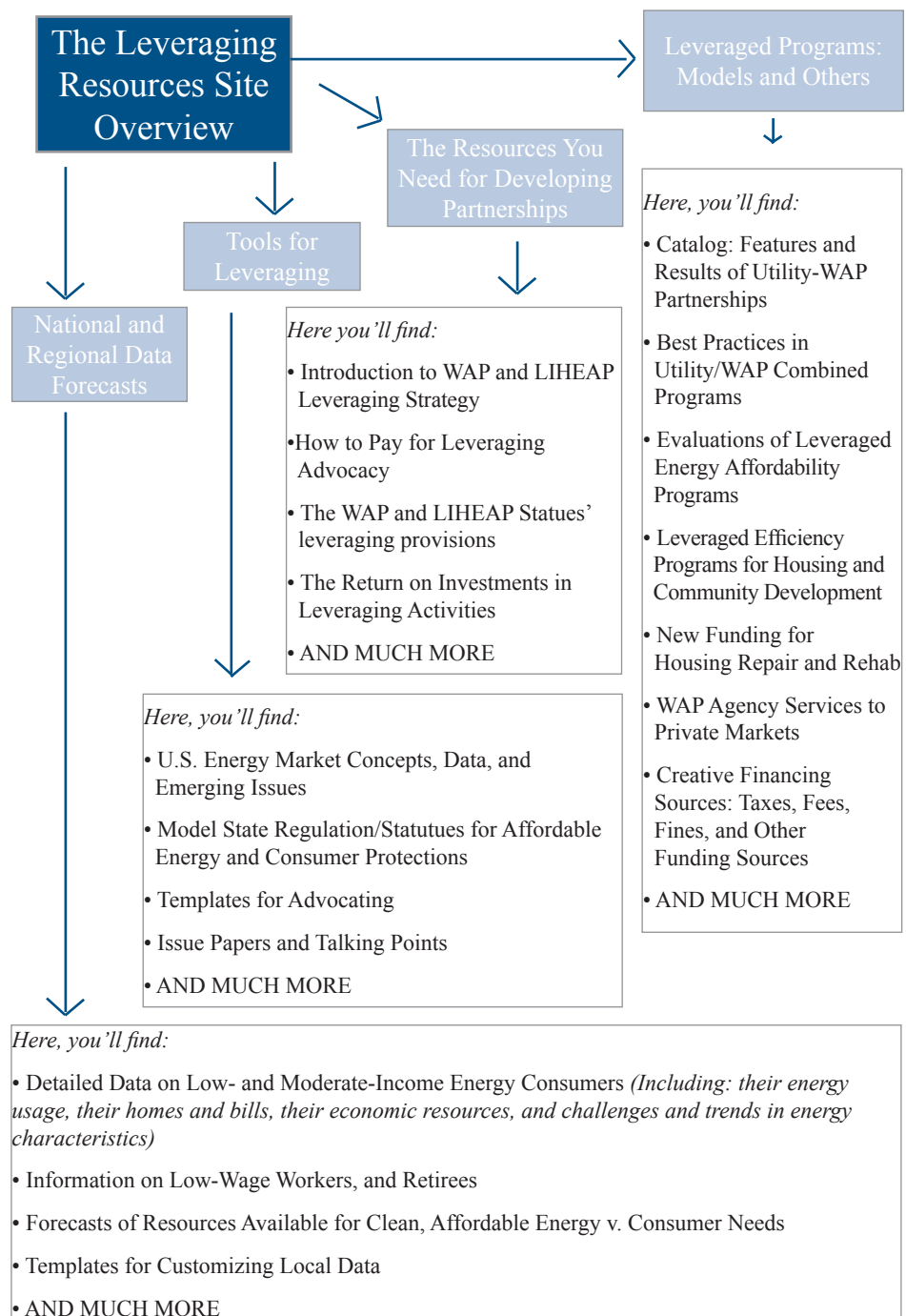
Purchasers have been employees of the National Guard, the School Board, local construction companies, auto dealerships and small business.

The recognition of this program is well deserved and demonstrates a best practice model for developing future green initiatives.

Leveraging Partnership Project

www.weatherizationplus.org

The “Weatherization *Plus*” Leveraging Partnership Project at Economic Opportunity Studies (EOS) is carried out with support from the U.S. Department of Energy through the National Energy Technology Laboratory. The project provides technical assistance to local and state organizations that are seeking to leverage low-income energy affordability resources through partnerships with utilities, housing developers, and other non-federal sources of investment. Its Leveraging Resources Web site offers some of the resources advocates and program managers need for successful initiatives.



WEATHERIZATION PLUS | ACKNOWLEDGEMENTS

- Robert Adams**
National Association for State
Community Services Programs
- John Atcheson**
U.S. Department of Energy - OWIP
- Bill Beachy**
Community Housing Partners
Corporation/Energy Services
- Eric Bell**
U.S. Department of Energy - NETL
- Mimi Burbage**
Alaska Housing Finance Corporation
- Leslie Campanella**
California Department of Community Services
and Development
- Dale Canning**
Salt Lake Community Action Program
- Richard Cherry**
Community Environmental Center
- James Childs**
U.S. Department of Energy - OWIP
- Patrick Costello**
New York State Division of
Housing and Community Renewal
- Marco Cruz**
Texas Department of Housing
and Community Affairs
- Greg Davoren**
U.S. Department of Energy - NETL
- Rob DeSoto**
U.S. Department of Energy - GO
- Jean M. Diggs**
U.S. Department of Energy - OWIP
- Alfanzo Dorsey**
Kansas Housing Resource Corporation
- Joel Eisenberg**
Oak Ridge National Laboratory
- Dan Elliott**
Oregon Housing and Community Services
- Marcia Ferris**
Michigan Department of Human Services
- Dave Finet**
Opportunity Council, Inc.
- Carole Gates**
U.S. Department of Energy - GO
- Ed Gerardot**
Indiana Community Action Association
- David Hepinstall**
Association for Energy Affordability, Inc.
- Tawanna Holloway**
U.S. Department of Energy - OWIP
- Cherry Ivey**
Georgia Environmental Facilities Authority,
Division of Energy Resources
- Keith Jackson**
Kentucky Cabinet for Families and Children
- Robert T. Jackson**
Kansas City Neighborhood and
Community Services Department
- Elliott Jacobson**
ACTION, Inc.
- Jules Junker**
Vermont Office of Economic Opportunity
- Lisa Kesecker**
West Virginia Office of Economic Opportunity
- Tim Lenahan**
Ohio Department of Development
- Val Martinez**
Redwood Community Action Agency
- Kathy McLaughlin**
Oklahoma Department of Commerce
- Alex Moore**
SMS
- Dennis Osmer**
Central Coast Energy Services, Inc.
- Julie Palakovich**
Washington Department of Community, Trade,
and Economic Development
- Michael Peterson**
U.S. Department of Energy - GO
- Meg Power**
National Community Action Foundation
- Ken Rauseo**
Massachusetts Department of
Housing and Community Development
- Madga Rivera**
U.S. Department of Energy - NETL
- Ken Robinette**
South Central Community Action Partnership
- Bob Scott**
West Virginia Governor's Office of
Economic Opportunity
- Ronald Shaw**
U.S. Department of Energy - OWIP
- Cynthia Simonson**
SMS
- Cal Steiner**
North Dakota Division of
Community Service
- Greg Thomas**
Performance Systems Development
- Bill Van der Meer**
Pennsylvania College of Technology
- Kerry Varley**
SMS
- Tim Warfield**
National Association for State
Community Services Programs
- William Warren**
Detroit Department of Human Services
- Susan White**
Inter-Tribal Council of Arizona, Inc.
- Doris Wright**
Arkansas Department of Human Services

Core Competencies for the Weatherization Assistance Program

March 26, 2007

CORE COMPETENCIES FOR THE WEATHERIZATION ASSISTANCE PROGRAM

INTRODUCTION

Specialized knowledge and skills are required at the local, state, and federal level to run an effective Weatherization Program. While there is a general understanding of the competencies required, these have not been articulated on a national scale.

As part of the Weatherization *Plus* effort to plan the continued evolution of the Weatherization Program, a subcommittee was formed to increase the consistency of quality weatherization services delivered to low-income homes across the country. The goal is that every house that is weatherized receives all appropriate, cost-effective measures installed properly to provide long-term savings.

As a first step, this means recognizing the varying approaches states use to train staff.

- Some states require technical staff at local agencies to obtain certification from an organization such as the Building Performance Institute, while other states have developed their own certification criteria.
- Many states do not have formal certification requirements, but instead require local weatherization staff to attend standardized training courses offered on a regular basis.
- Others have no standardized certification or training requirements, but offer training periodically as the need is perceived and funds allow.

Technical weatherization training for auditors, technicians, and monitors is available from many training centers and independent trainers across the country. Only a few states have developed administrative training for weatherization program managers at the local level. In-depth administrative training for state weatherization staff is even harder to find outside National Association for State Community Services Programs (NASCSPP) conference “newcomer” sessions.

The Weatherization *Plus* subcommittee and the Weatherization Trainers Consortium believe that publishing a set of core competencies will increase awareness and raise expectations. Not all the competencies will be appropriate for every state. Workers repairing or replacing heating and cooling systems often require certification or licensing from the state. Therefore, this work may be subcontracted to licensed contractors outside the Weatherization Program. However, just because a heating, ventilation, and air conditioning (HVAC) contractor is licensed by the state does not mean they possess the HVAC competencies required by the Weatherization Program. Someone at the local agency must be competent to specify what work the contractor is to do and to verify that the completed work complies with state and local codes as well as the technical standards of the Weatherization Program.

The competencies that a weatherization worker should possess depend on their position. For example, an auditor needs to conduct diagnostic testing that may not be required of an installer. The point of entry also dictates which core competencies are required. An

entry-level installer requires a minimum set of competencies. This installer must acquire additional skills to become a crew chief, and still more to become an auditor. A new auditor hired off the street must already possess auditor-level competencies as a condition of hire. These increasing levels of competency also provide a career or development path for agency and contractor personnel.

The following core competencies were compiled from course offerings of several weatherization training centers and from the technical program standards of a handful of states. Core competencies for the following topical areas are listed:

- Basic competencies,
- Safe work practices,
- Building evaluation,
- Measure installation,
- Final inspection,
- Consumer education,
- Monitoring,
- Program management, and
- Training.

Definitions

- **Competency** means the possession of a minimum level of knowledge and proficiency required to collect appropriate information, make informed decisions, and physically take the needed actions to deliver the high-quality weatherization service in question.
- **Possess a working knowledge of** means to:
 - ♦ Know how a particular topic impacts the weatherization process;
 - ♦ Have the relevant information committed to memory or be able to locate it in readily available sources; and
 - ♦ Use the knowledge to make informed decisions and guide weatherization work.
- **Demonstrate the ability to** means to:
 - ♦ Physically conduct a test, procedure, or technique on an actual house, a prop, or in a training lab in the presence of someone qualified to assess the particular competency.

BASIC COMPETENCIES

All weatherization workers must possess the following Basic Competencies:

- Ability to read and write legibly;
- Basic verbal and written communication skills;
- Basic construction knowledge;
- Basic math skills; and
- Basic computer skills.

Depending on the position of the weatherization worker, the following Core Competencies help ensure the delivery of effective weatherization services.

SAFE WORK PRACTICES

All field workers must exhibit safe work practices by possess the following competencies.

- Possess a working knowledge of:
 - ♦ U.S. Department of Energy (DOE) program regulations/policy and Environmental Protection Agency (EPA) guidelines for asbestos, lead, mold, and other health hazards;
 - ♦ Material Safety Data Sheets; and
 - ♦ Occupational Safety and Health Act (OSHA) standards:
 - Ladder safety;
 - Fall protection;
 - Personal protective equipment;
 - Respiratory protection;
 - Motor vehicles;
 - Power-operated hand tools;
 - Fire prevention;
 - Permit-required confined spaces;
 - Other worker-related OSHA standards.
- Demonstrate the ability to:
 - ♦ Select, fit, and use the appropriate Personal Protection Equipment for a particular task;
 - ♦ Safely use basic hand and power tools;
 - ♦ Use a basic first aid kit to treat common job-site injuries; and
 - ♦ Work Lead Safe
 - ♦ Identify serious mold conditions
 - ♦ Assess work area safety hazards

INSTALLER

The following competencies are required by workers that install weatherization measures.

- ***Prerequisites***
 - ♦ Possess *Safe Work Practices* competencies
- ***Air Sealing***
 - ♦ Possess a working knowledge of:
 - Proper materials selection based on location of leakage areas
 - Minimum ventilation rates.
 - ♦ Demonstrate the ability to:
 - Use the blower door to locate leakage sites within the building
 - Seal attic and floor bypasses at penetrations for plumbing, electrical wiring, flue vents, ducts; dropped soffits, and balloon-framed walls;
 - Seal typical bypasses in kneewalls and finished attic spaces;
 - Seal basement band joists;
 - Properly apply caulk and spray foam insulation;

- Identify, select, and install weatherstripping on doors, windows, and attic hatches;
- Cut glass, replace broken window panes, and apply glazing compound;
- Repair plaster and sheetrock (drywall); and
- Modify or install mechanical ventilation to ensure acceptable indoor air quality for post-air-sealing conditions.
- **Duct Sealing**
 - ◆ Demonstrate the ability to:
 - Properly seal duct connections with mastic and fiberglass mesh tape or other approved material; and
 - Repair or modify duct systems as specified in a work order.
- **Insulation**
 - ◆ Possess a working knowledge of:
 - Properties and appropriate application of different insulation materials; and
 - Potential hazards of insulating around knob-and-tube wiring.
 - ◆ Demonstrate the ability to:
 - Install blown and batt attic insulation;
 - Access closed wall cavities and properly install dense-packed cellulose wall insulation including removing and replacing siding;
 - Install blown insulation and batt insulation in a floor;
 - Install water heater installation blankets;
 - Install insulation on ducts, hydronic distribution pipes, and domestic hot water pipes; and
 - Safely operate and properly maintain insulation blowing machines and generators.
- **Base-Load Measures**
 - ◆ Demonstrate the ability to:
 - Replace incandescent light bulbs with compact fluorescent lamps while maintaining or improving lighting levels; and
 - Install low-flow showerheads and faucet aerators;
 - Assess the existing condition of plumbing pipes and faucets that may prohibit these measures.

CREW CHIEF

Personnel that supervise field workers such as *Installers* must possess the following competencies.

- **Prerequisites**
 - ◆ Possess *Safe Work Practices* and *Installer* competencies.
 - ◆ Possess a working knowledge of building science principles.
- **Project Management**
 - ◆ Demonstrate the ability to:
 - Manage a crew of *Installers* so weatherization work is conducted safely, effectively, and efficiently;
 - Ensure that the job site and *Installers* comply with the *Safe Work Practices* described previously;

- Maintain quality control of weatherization work and ensure it meets program stands;
- Understand a work order;
- Order and obtain materials, supplies, and equipment in time to avoid delays and wasted time on the job site; and
- Warehouse materials as necessary to avoid delays in completing weatherization work.
- ***Inspection and Measurement***
 - ◆ Possess a working knowledge of:
 - Air and heat flow in buildings;
 - Factors that affect building heat loss;
 - Construction features and critical junction points of common housing types;
 - Insulation R-values;
 - Different insulation materials and installation techniques;
 - Various air-sealing techniques and appropriate materials;
 - Causes of and remedies for existing and potential moisture problems;
 - Causes of and remedies for other existing and potential indoor air quality problems;
 - Residential mechanical ventilation systems;
 - Minimum ventilation rates/building tightness limits based on the appropriate ASHRAE 62 standard; and
 - Electric base-load usage.
 - ◆ Demonstrate the ability to:
 - Measure the dimensions of floors, walls, ceilings, windows, and doors, and compute surface areas;
 - Compute the volume of conditioned space of a building;
 - Define the thermal envelope of a building; and
 - Assess the effectiveness of existing insulation and the effective R-values.
- ***Diagnostic Testing***
 - ◆ Blower door
 - Possess a working knowledge of:
 - Principles of air movement and how they relate to building heat loss;
 - Typical air leakage problems in common housing types; and
 - Minimum ventilation rates.
 - Demonstrate the ability to:
 - Set up a blower door;
 - Prepare a building for a blower door test; and
 - Take blower door reading and interpret results.
 - ◆ Zone pressure diagnostics
 - Possess a working knowledge of:
 - The air barrier of a building and the importance of aligning it with the thermal barrier; and
 - Primary and intermediate zones of a house.
 - Demonstrate the ability to:
 - Conduct zone pressure diagnostics and interpret results; and
 - Determine the location and effectiveness of the air barrier of a house.

- ◆ Duct testing
 - Possess a working knowledge of:
 - Problems associated with different types of duct leakage.
 - Demonstrate the ability to:
 - Determine dominant duct leakage;
 - Determine the amount of duct leakage or least the existence of significant duct leakage by conducting pressure pan, duct blaster, or delta Q tests.
 - Measure room pressure imbalances in houses with forced-air systems.
 - Resolve room pressure imbalances.
- **Combustion Appliance Safety**
 - ◆ Possess a working knowledge of:
 - CO action levels;
 - Common code requirements related to:
 - Vent system sizing, materials, clearances, and installation;
 - Safety shut-off devices;
 - Gas line sizing; and
 - Combustion air;
 - Causes of and remedies to common vent system problems.
 - ◆ Demonstrate the ability to:
 - Measure the CO level in ambient air;
 - Measure the CO level of vented and unvented combustion appliances;
 - Measure the CO levels of gas- or propane-fired cook stoves (oven and burners) and remedy high CO levels through basic cleaning and adjustments;
 - Understand the difference between as-measured and air-free CO readings;
 - Detect gas, propane, and fuel oil leaks; and
 - Conduct a worst-case draft test of a combustion appliance zone; and
 - Measure the steady-state efficiency of a vented combustion appliance.
- **Insulation**
 - ◆ In addition to the insulation-related *Installer* competencies, possess a working knowledge of:
 - Local codes relating to attic ventilation.
- **Training**
 - ◆ Possess a working knowledge of:
 - Adult learning concepts; and
 - Benefits of cross training on-site personnel.
 - ◆ Demonstrate the ability to:
 - Provide on-site training to *Installers* in a positive environment to strengthen competency in existing skills and increase the number of skill areas.

AUDITOR

- **Prerequisites**
 - ◆ Possess *Safe Work Practices, Installer, and Crew Chief* competencies.
 - ◆ Possess a working knowledge of building science principles.
- **Inspection and Measurement**
 - ◆ Possess a working knowledge of:
 - Air and heat flow in buildings;
 - Factors that affect building heat loss;
 - Construction features and critical junction points of common housing types;
 - Insulation R-values;
 - Different insulation materials and installation techniques;
 - Various air-sealing techniques and appropriate materials;
 - Causes of and remedies for existing and potential moisture problems;
 - Causes of and remedies for other existing and potential indoor air quality problems;
 - Residential mechanical ventilation systems;
 - Minimum ventilation rates/building tightness limits based on the appropriate ASHRAE 62 standard; and
 - Electric base-load usage.
 - ◆ Demonstrate the ability to:
 - Measure the dimensions of floors, walls, ceilings, windows, and doors, and compute surface areas;
 - Compute the volume of conditioned space of a building;
 - Define the thermal envelope of a building;
 - Assess the effectiveness of existing insulation and the effective R-values; and
 - Analyze utility bills including breaking out base-load usage from heating and cooling usage.
- **Diagnostic Testing**
 - ◆ Blower door
 - Possess a working knowledge of:
 - Principles of air movement and how they relate to building heat loss;
 - Typical air leakage problems in common housing types; and
 - Minimum ventilation rates.
 - Demonstrate the ability to:
 - Set up a blower door;
 - Prepare a building for a blower door test; and
 - Take blower door reading and interpret results.
 - ◆ Zone pressure diagnostics
 - Possess a working knowledge of:
 - The air barrier of a building and the importance of aligning it with the thermal barrier; and
 - Primary and intermediate zones of a house.
 - Demonstrate the ability to:
 - Conduct zone pressure diagnostics and interpret results;
 - Determine the location and effectiveness of the air barrier of a house; and
 - ◆ Duct testing

- Possess a working knowledge of:
 - Problems associated with different types of duct leakage.
- Demonstrate the ability to:
 - Determine dominant duct leakage; and
 - Conduct pressure tests. Potential tests include:
 - Pressure pan
 - Duct Blaster
 - Delta-Q
 - Seal duct leaks with appropriate materials and good workmanship.
 - Measure room pressure imbalances in houses with forced-air systems.
- ◆ Steam and hot water distribution system testing
 - Possess a working knowledge of:
 - The components of typical steam and hot water distribution systems and the characteristics of their proper operation.
 - Demonstrate the ability to:
 - Test air vents, steam traps, thermostatic radiator valves, and hot water zone valves; and
 - Estimate the energy impacts of existing overheating problems.
- ◆ Base-load systems
 - Demonstrate the ability to:
 - Meter electrical devices to determine their annual energy consumption.
- ***Combustion Appliance Safety***
 - ◆ Possess a working knowledge of:
 - CO action levels;
 - Common code requirements related to:
 - Vent system sizing, materials, clearances, and installation;
 - Safety shut-off devices;
 - Gas line sizing; and
 - Combustion air;
 - Causes of and remedies to common vent system problems.
 - ◆ Demonstrate the ability to:
 - Measure the CO level in ambient air;
 - Measure the CO level of vented and unvented combustion appliances;
 - Measure the CO levels of gas- or propane-fired cook stoves (oven and burners);
 - Understand the difference between as-measured and air-free CO readings;
 - Detect and natural gas, propane, and fuel oil leaks;
 - Conduct a worst-case draft test of a combustion appliance zone;
 - Measure the CAZ to assure sufficient volume for combustion air;
 - Clock a gas meter to determine the actual input of a gas-fired combustion appliance;
 - Conduct basic temperature-rise and static-pressure-drop tests on forced-air furnaces;
 - Measure the steady-state efficiency of a vented combustion appliance; and
 - Assess the potential inadequacy of supply and return plenum and duct sizes for forced-air systems.

- **Measure Selection**
 - ◆ Possess a working knowledge of:
 - What materials are allowed to be installed based on 10 CFR 440 Appendix A;
 - The regulatory and policy requirements for selecting weatherization measures using DOE-approved energy audit software or priority lists; and
 - The interaction between typical weatherization measures (e.g., the impact of air-sealing and insulation measures on the potential savings of heating efficiency improvements).
 - ◆ Demonstrate the ability to:
 - Use a DOE-approved energy audit to input accurate building data and recommend appropriate, cost-effective weatherization measures;
 - If required, use a DOE-approved priority list to select appropriate, cost-effective weatherization measures;
 - Prioritize air-sealing efforts;
 - Estimate the heating and/or cooling load of a dwelling to ensure proper equipment sizing if the heating or cooling system is to be replaced;
 - Select the proper CFL to replace an incandescent lamp while maintaining or improving lighting levels; and
 - Meter an existing refrigerator or locate its DOE tested usage in a database to estimate annual energy consumption.
- **Work Scope Development**
 - ◆ Demonstrate the ability to:
 - Accurately estimate the type and quantity of materials required to cost-effectively weatherize an eligible dwelling unit; and
 - Prepare clearly written work orders for work crews or contractors.

CONTRACTOR

Contractors hired by local weatherization agencies to perform weatherization work must possess the following competencies. See *HVAC Installer/Contractor* for the competencies required of these specialty contractors.

- **Prerequisites**
 - ◆ Possess *Safe Work Practices, Installer, and Crew Chief* competencies.
 - ◆ Possess a working knowledge of building science principles.
- **Business Management**
 - ◆ Demonstrate the ability to:
 - Maintain the licenses required by the state and local jurisdiction for the type of work the *Contractor* is hired to perform;
 - Possess adequate insurance;
 - Employ U.S. citizens or properly documented aliens; and
 - Bid, negotiate, and sign contracts, as necessary.

- ***Project Management***

- ◆ Demonstrate the ability to:
 - Manage a crew of *Contractor*-employed *Installers* so weatherization work is conducted safely, effectively, and efficiently;
 - Ensure that the job site and *Contractor*-employed *Installers* comply with the *Safe Work Practices* described previously;
 - Understand a work order;
 - Maintain quality control of weatherization work and ensure it meets program standards;
 - Order and obtain materials, supplies, and equipment in time to avoid delays and wasted time on the job site; and
 - Warehouse materials as necessary to avoid delays in completing weatherization work.

Depending on the type of work the *Contractor* is hired to perform, the following inspection, diagnostic testing, combustion appliance safety, and/or insulation competencies may be required.

- ***Inspection and Measurement***

- ◆ Possess a working knowledge of:
 - Air and heat flow in buildings;
 - Factors that affect building heat loss;
 - Construction features and critical junction points of common housing types;
 - Insulation R-values;
 - Different insulation materials and installation techniques;
 - Various air-sealing techniques and appropriate materials;
 - Causes of and remedies for existing and potential moisture problems;
 - Causes of and remedies for other existing and potential indoor air quality problems;
 - Residential mechanical ventilation systems;
 - Minimum ventilation rates/building tightness limits based on the appropriate ASHRAE 62 standard; and
 - Electric base-load usage.
- ◆ Demonstrate the ability to:
 - Measure the dimensions of floors, walls, ceilings, windows, and doors, and compute surface areas;
 - Compute the volume of conditioned space of a building;
 - Define the thermal envelope of a building; and
 - Assess the effectiveness of existing insulation and the effective R-values.

- ***Diagnostic Testing***

- ◆ Blower door
 - Possess a working knowledge of:
 - Principles of air movement and how they relate to building heat loss;
 - Typical air leakage problems in common housing types; and
 - Minimum ventilation rates.
 - Demonstrate the ability to:
 - Set up a blower door;
 - Prepare a building for a blower door test; and

- Take blower door reading and interpret results.
 - ◆ Zone pressure diagnostics
 - Possess a working knowledge of:
 - The air barrier of a building and the importance of aligning it with the thermal barrier; and
 - Primary and intermediate zones of a house.
 - Demonstrate the ability to:
 - Conduct zone pressure diagnostics and interpret results; and
 - Determine the location and effectiveness of the air barrier of a house.
 - ◆ Duct testing
 - Possess a working knowledge of:
 - Problems associated with different types of duct leakage.
 - Demonstrate the ability to:
 - Determine dominant duct leakage;
 - Determine the amount of duct leakage or least the existence of significant duct leakage by conducting pressure pan, duct blaster, or delta Q tests;
 - Measure room pressure imbalances in houses with forced-air systems; and
 - Resolve room pressure imbalances.
- **Combustion Appliance Safety**
 - ◆ Possess a working knowledge of:
 - CO action levels;
 - Common code requirements related to:
 - Vent system sizing, materials, clearances, and installation;
 - Safety shut-off devices;
 - Gas line sizing; and
 - Combustion air;
 - Causes of and remedies to common vent system problems.
 - ◆ Demonstrate the ability to:
 - Measure the CO level in ambient air;
 - Measure the CO level of vented and unvented combustion appliances;
 - Measure the CO levels of gas- or propane-fired cook stoves (oven and burners) and remedy high CO levels through basic cleaning and adjustments;
 - Understand the difference between as-measured and air-free CO readings;
 - Detect gas, propane, and fuel oil leaks; and
 - Conduct a worst-case draft test of a combustion appliance zone; and
 - Measure the steady-state efficiency of a vented combustion appliance.
- **Insulation**
 - ◆ In addition to the insulation-related *Installer* competencies, possess a working knowledge of:
 - Local codes relating to attic ventilation.

HEATING, VENTILATION, AND AIR CONDITIONING (HVAC) INSTALLER/CONTRACTOR

- **Heating and Cooling Equipment**
 - ♦ Prerequisites:
 - Possess *Auditor/Combustion Appliance Safety* and *Safe Work Practices* competencies; and
 - Possess the HVAC certifications and licenses required by the state and local jurisdiction.
 - ♦ Possess a working knowledge of:
 - The components of typical steam and hot water distribution systems and the characteristics of their proper operation.
 - ♦ Demonstrate the ability to:
 - Maintain quality control of weatherization work and ensure it meets program standards;
 - Repair or replace heating and cooling equipment in a code-compliant manner;
 - Estimate the heating and/or cooling load of a dwelling per Manual J to ensure proper sizing of replacement heating or cooling systems;
 - Repair or replace vent systems of combustion appliances in a code-compliant manner;
 - Repair or replace a water heater in a code-compliant manner (some states may require a licensed plumber to replace a water heater);
 - Ensure proper sizing of gas lines;
 - Assess the adequacy of supply and return plenum and duct sizes for forced-air systems;
 - Add return and supply plenums and ducts as required;
 - Determine dominate duct leakage;
 - Conduct duct pressure tests, which could include:
 - Pressure pan;
 - Duct Blaster; and
 - Delta-Q;
 - Measure and solve room pressure imbalances in houses with forced-air systems;
 - Test air vents, steam traps, thermostatic radiator valves, and hot water zone valves;
 - Bleed unwanted air from a hot water distribution system;
 - Estimate the energy impacts of existing overheating problems in steam and hot water heating systems;
 - Warehouse materials as necessary to avoid delays in completing weatherization work; and
 - Test out to assure system is operating properly and safely.

INSPECTOR

- Prerequisites:
 - ♦ Inspectors should possess *Safe Work Practices, Installer, and Auditor* competencies.
- Possess a working knowledge of:
 - ♦ Relevant DOE Weatherization Program regulations and policy;
 - ♦ Building science principles; and
 - ♦ Relevant local codes.
- Demonstrate the ability to:
 - ♦ Verify that the weatherized house is safe by conducting all appropriate combustion appliance safety tests;
 - ♦ Evaluate the allowability and appropriateness of the installed weatherization measures taking into consideration program regulations, policy, energy audit results, and/or priority lists;
 - ♦ Assess whether the measures were installed with good workmanship, proper materials, and in such a manner to comply with local code and ensure long-term energy savings over the life of the measures;
 - ♦ Ensure that all measures charged to the job were actually installed; and
 - ♦ Verify the effectiveness of air-sealing efforts by conducting a blower door test and zone pressure diagnostics.

CONSUMER EDUCATION

- Competency
 - ♦ Principles of adult education
- Possess a working knowledge of:
 - ♦ What actions can be taken to reduce energy use in the home;
 - ♦ The basic steps in the Weatherization process from auditing, testing, installation, inspection, and monitoring;
 - ♦ The purpose of the basic equipment involved in weatherizing a house, including a blower door, pressure pan, combustion analyzer, gas leak detector, insulation blowing machine, and generator; and
 - ♦ What actions need to be taken to maintain a healthful indoor environment.
- Demonstrate the ability to:
 - ♦ Estimate the economic impacts of suggested actions to bolster customer commitment to change.

MONITOR (TECHNICAL)

- Prerequisites:
 - ♦ Monitors should possess all *Safe Work Practices, Auditor, and Inspector* competencies.
 - ♦ Monitors should be knowledgeable of *Installer* competencies.
- Possess a working knowledge of:
 - ♦ Principles of building science; and
 - ♦ Principles of adult education.
- Demonstrate the ability to:
 - ♦ Produce written reports that clearly identify weaknesses and provide sound solutions;
 - ♦ Provide on-site training and technical assistance; and
 - ♦ Solve complex technical problems.

MONITOR (ADMINISTRATIVE)

- Possess a working knowledge of:
 - ♦ Principles of adult education;
 - ♦ Enabling legislation governing the U.S. Department of Energy's (DOE's) Weatherization Assistance Program;
 - ♦ DOE program regulations 10 C.F.R. 440;
 - ♦ DOE program guidance and policy issued via Weatherization Program Notice or memoranda;
 - ♦ Federal, state, and local budget processes;
 - ♦ Federal financial assistance regulations 10 C.F.R. 600 and relevant OMB circulars;
 - ♦ Applicable state procurement regulations; and
 - ♦ State and local approaches to monitoring, training, and technical assistance.
- Demonstrate the ability to:
 - ♦ Produce written reports that can clearly identify weaknesses and provide sound solutions; and
 - ♦ Provide on-site training and technical assistance;

PROGRAM MANAGER

- Possess a working knowledge of:
 - ♦ Enabling legislation governing the U.S. Department of Energy's (DOE's) Weatherization Assistance Program;
 - ♦ DOE program regulations 10 C.F.R. 440;
 - ♦ DOE program guidance and policy issued via Weatherization Program Notice or memoranda;
 - ♦ Federal, state, and local budget process;
 - ♦ Federal financial assistance regulations 10 C.F.R. 600 and relevant OMB circulars;
 - ♦ Applicable state procurement regulations;
 - ♦ State and local approaches to monitoring, training, and technical assistance;

- ◆ Applicable computer databases and tracking systems and the importance that they remain up-to-date, are secured and backed-up, and are used effectively to manage the program; and
- ◆ Building science principles.
- For state staff:
 - ◆ Demonstrate the ability to:
 - Prepare an annual state plan;
 - Prepare an annual weatherization grant application;
 - Submit accurate financial and production reports in a timely manner;
 - Develop, maintain, and enforce state technical program standards;
 - Provide adequate technical and administrative training for coordinators, auditors, technicians, and inspectors directly employed by local agencies, and ensure that subcontractors receive appropriate technical training;
 - Develop and manage an effective monitoring program;
 - Coordinate resources;
 - Develop and implement innovative leveraging strategies; and
 - Process reimbursement requests in a timely manner.
- For local agency weatherization coordinators:
 - ◆ Demonstrate the ability to:
 - Effectively communicate and manage weatherization staff and subcontractors;
 - Prepare and track a budget for implementing a local weatherization program;
 - Maintain a purchase order system to track contracted services and materials and tool requisitions;
 - Maintain a coding system to assure expenditures are charged to the correct budget category;
 - Maintain inventory tracking system for materials, tools, and equipment;
 - Submit accurate financial and production reports in a timely manner;
 - Comply with federal limits on administrative expenses;
 - Manage a small construction/production-focused operation;
 - Ensure rigorous, unbiased, and accurate final inspection of all completed units;
 - Provide adequate technical training for auditors, technicians, and inspectors directly employed by the local agency, and ensure that subcontractors receive appropriate technical training;
 - Ensure that weatherization work complies with state technical program standards;
 - Coordinate resources; and
 - Develop and implement innovative leveraging strategies.

TRAINER

- Prerequisites:
 - ♦ Trainers should possess *Safe Work Practices, Auditor, and Inspector* competencies;
 - ♦ Trainers should be knowledgeable of *Installer* competencies;
 - ♦ Completion of adult education training program; and
 - ♦ Certification in subject areas of presented training.
- Possess a working knowledge of:
 - ♦ Principles of building science;
 - ♦ Principles of adult education;
 - ♦ Benefits of cross-training;
 - ♦ Building codes, especially energy and health/safety-related codes;
 - ♦ Allowable activities at the location of training (e.g., knob-and-tube wiring requirements); and
 - ♦ Available resources to aid students in future understanding and application.
- Demonstrate the ability to:
 - ♦ Develop curriculum based on student needs;
 - ♦ Tailor each class to the experience and needs of the students;
 - ♦ Motivate students through inspirational presentations;
 - ♦ Provide hands-on training;
 - ♦ Use technology to enhance the learning experience, especially as related to adult education principles; and
 - ♦ Direct students to other resources to get answers beyond the capacity of the trainer to provide.

Appendix A: Math Pre-Test (omitted)

Appendix B: Computer Skills Pre-Test (omitted)

Appendix C: Glossary

Air Barrier – The air barrier of a dwelling, also known as the pressure boundary, is the building shell surface that limits airflow between inside and outside. For maximum energy efficiency and comfort, the air barrier and thermal barrier should be continuous and in contact with each other.

ASHRAE – American Society of Heating, Refrigeration, and Air Conditioning Engineers

ASHRAE 62 – ASHRAE 62 is a group of ASHRAE standards for minimum building ventilation requirements. ASHRAE 62.1-2004, entitled Ventilation for Acceptable Indoor Air Quality, cover general topics and requirements for commercial and high-rise residential buildings. ASHRAE 62.2-2004, Ventilation for Acceptable Indoor Air Quality in Low-Rise Residential Buildings, has a self-explanatory title.

Attic Ventilation – Building codes require attic openings to outside to induce airflow that cools the attic in summer and exhausts moisture. There is a growing consensus that unvented attics have energy benefits and that in hot, humid climates attic ventilation brings in more moisture from outside than it purges.

Auditor – An auditor is a weatherization worker that assesses an eligible dwelling for potential weatherization services. Auditors visually inspect the building shell and mechanical systems; conduct diagnostic, health, and safety tests; record the location, condition, and dimensions of walls, ceilings, floors, windows, doors, and mechanical systems; enter data into computerized energy audit or use a priority list to select cost-effective measures; and prepare clear and accurate work orders to ensure the most appropriate measures are installed properly.

Balloon-Framed Walls – Balloon-framed walls are built without top or bottom plates. This type of framing often provides an air channel from the basement or crawlspace to the attic that allows outside air to flow through the walls resulting in excessive heat loss/gain.

Band Joist – Band joists are the floor joists that run around the perimeter of the house. There are two types of band joists - header joists that run perpendicular to the floor joists and rim joists that run parallel. A typical weatherization measure involves insulating the header joist spaces between floor joists and along the rim joists.

Base Load – Base loads are energy loads from appliances that are on most of the time and do not vary with changing climate. Base loads include refrigerators, water heaters, and lights. Base loads are often thought to be primarily electric loads, but can be fueled by other energy sources.

Batt Insulation – Batts are fiberglass insulation manufactured in rolls precut to standard widths to fit snugly between framing (joists, rafters, or studs) on 16-inch or 24-inch centers in ceilings, floor, and walls. While often made with a “Kraft” paper facing

designed to retard vapor transmission, batt insulation is also available without the paper facing (unfaced batts).

Blower Door – A blower door is a device for testing the airtightness of a building. A blower door consists of a calibrated fan for measuring an air flow rate and a pressure sensing device to measure the pressure created by the fan flow. The combination of pressure and flow can be used to estimate the airtightness.

Building Performance Institute (BPI) – BPI is an organization that supports the development of a professional building performance industry through individual and organizational credentialing and a quality assurance program. BPI offers certification of individuals in evaluation, mechanical, envelope, mobile home, and multi-family designations, as well as accreditation of organizations committed to using a quality management system.

Building Science – Building science is the collection of scientific knowledge that focuses on the analysis and control of the physical phenomena affecting buildings. This includes the detailed analysis of building materials and building envelope systems.

Building Tightness Limit – Also known as the minimum ventilation rate, the building tightness limit is the least amount of fresh air that must be drawn through a house (by either natural or mechanical means) to ensure acceptable indoor air quality.

Bypass – A bypass is a hole between conditioned and unconditioned space that allows air leakage through the pressure boundary, or air barrier, of a dwelling.

CAZ – A combustion appliance zone, or CAZ, is any zone containing a combustion appliance.

CO – Carbon monoxide

Combustion Air – Complete combustion of fossil fuels such as natural gas, propane, and fuel oil requires an adequate supply of air. Inadequate combustion air causes incomplete combustion, which generates carbon monoxide.

Combustion Appliance – A combustion appliance is a furnace, boiler, space heater, wood stove, water heater, cook stove, or other device that burns wood or fossil fuel such as natural gas, propane, or fuel oil.

Compact Fluorescent Lamp – A compact fluorescent lamp (CFL) is a type of fluorescent lamp that screws into a regular light bulb socket or plugs into a small lighting fixture. In comparison to incandescent light bulbs, CFLs have a longer rated life and use less electricity.

Competency – Competency means the possession of a minimum level of knowledge and proficiency required to collect appropriate information, make informed decisions, and

physically takes the needed actions to deliver the high-quality weatherization service in question.

Consumer/Client Education – Consumer or client education includes discussion, instruction, brochures, and pamphlets that explain the weatherization process, the measures installed in the client’s house, how to use certain measures (such as programmable thermostats), and low-cost/no-cost ways to save energy and reduce energy costs.

Crew Chief – A crew chief is a weatherization worker that supervises a crew of installers and directs their efforts to weatherize eligible dwellings.

Critical Junction Point – Critical junction points are areas in building construction that typically exhibit air leaks or are inadequately insulated. Critical junction points include the intersection of ceilings and walls, cantilevers, and finished-attic kneewalls.

Cross Training – Training every member of a crew to be able to do every job is known as cross training. While certain crew members may specialize in specific tasks, a cross-trained crew understands how their specialty impacts all others and can adjust to staff turnover.

Delta Q – Delta Q is a testing protocol to measure duct leaks to the outside under actual operating conditions.

Demonstrated Ability – A demonstrated ability is the physical performance of a test, procedure, or technique on an actual house, a prop, or in a training lab in the presence of someone qualified to assess the particular competency.

Dense-Packed Cellulose Insulation – Loose cellulose insulation is blown into closed building cavities (usually walls, but also roof/ceiling cavities) to a density of 3½ pounds per cubic inch to air seal as well as insulate.

DOE – U.S. Department of Energy

Dropped Soffit – A dropped soffit (or simply drop soffit) is built from framing and drywall over kitchen cabinets to give a more finished appearance than just hanging wall cabinets with a foot or so gap between the top of the cabinet and the ceiling. From the attic, a dropped soffit looks like a big hole in the floor and often causes breaks in the attic thermal and air barriers.

Duct Blaster – A Duct Blaster is a calibrated airflow measurement system designed to test and document the air tightness of forced-air duct systems. Duct Blaster is the trade name of the device manufactured by the Energy Conservatory of Minneapolis, Minnesota. Other competing companies such as Infiltec and Retrotec manufacture similar systems.

EPA – U.S. Environmental Protection Agency

HVAC – Heating, ventilation, and air conditioning

HVAC Installer/Contractor – A HVAC installer/contractor is a crew member or contractor trained and licensed to repair and replace furnaces, boilers, air conditioners, and related equipment.

Hydronic Distribution Pipes – Hydronic distribution pipes deliver hot water or steam from a water heater or boiler to baseboard convectors or radiators located throughout a house.

Inspector – An inspector verifies the proper selection, installation, and effectiveness of weatherization measures installed in eligible dwellings through review of documentation, visual inspection, and performance of diagnostic, health, and safety testing.

Installer – An installer is a crew member or contractor that installs weatherization measures in eligible dwellings.

Knob-and-Tube Wiring – Older homes may have “knob-and-tube” electrical wiring, where two separate wires run through ceramic posts (knobs) attached to the top of ceiling joists or through ceramic tubes inserted into holes drilled in the wall or roof framing. Since this type of wiring was designed to dissipate heat to the attic air, insulating over knob-and-tube wiring can cause dangerous overheating.

Lead-Safe Work Practices – Lead-safe work practices are the use of specific precautions in the conduct of weatherization activities designed to avoid contaminating homes with lead-based paint dust and debris, and to avoid exposing the clients, weatherization workers, and their families to this hazard.

Mastic – Mastic is a material used to seal duct leaks. It is the consistency of drywall joint compound when applied, but dries to a hard, durable finish. To seal duct leaks larger than ¼ inch, mastic is applied over a specially made fiberglass mesh tape.

Material Safety Data Sheet (MSDS) – A material safety data sheet or MSDS describes the properties of a particular substance (e.g., caulk, mastic, sealant). An important component of workplace safety, it is intended to provide workers and emergency personnel with procedures for handling or working with that substance in a safe manner.

Mechanical Ventilation – Mechanical ventilation is the controlled exhaust of indoor air, intake of fresh outdoor air, or a combination of both through the use of fans, controls, passive air intakes, and sometimes ducts, registers, and air-to-air heat exchangers.

Minimum Ventilation Rate – Also known as the building tightness limit, the minimum ventilation rate is the least amount of fresh air that must be drawn through a house (by either natural or mechanical means) to ensure acceptable indoor air quality.

Monitor (Administrative) – An administrative monitor is someone employed or contracted by a state to review the administrative and programmatic activities of local weatherization agencies (subgrantees) to ensure compliance with applicable laws and programmatic and financial regulations.

Monitor (Technical) – A technical monitor is someone employed or contracted by a state to review the technical and field activities of local weatherization agencies (subgrantees) to ensure compliance with the enacting federal legislation, federal program regulations, and state technical program standards.

NASCSP – National Association for State Community Services Programs is a national association charged with advocating and enhancing the leadership role of states in preventing and reducing poverty. NASCSP's members are state administrators of the U.S. Department of Health and Human Services' Community Services Block Grant (CSBG) and the U.S. Department of Energy's Weatherization Assistance Program. NASCSP keeps its members, the federal government, and other interested parties informed about issues related to CSBG and the Weatherization Program through its publications and training.

OSHA – The Occupational Safety and Health Administration's mission is to assure the safety and health of America's workers by setting and enforcing standards; providing training, outreach, and education; establishing partnerships; and encouraging continual improvement in workplace safety and health.

Personal Protective Equipment – Equipment such as respirators, safety goggles, disposable coveralls, and hard hats worn by weatherization workers to protect them from jobsite hazards.

Plenum – A plenum is the initial duct on the supply and return side of an air handler.

Pressure Pan – A pressure pan resembles a cake pan and is used to locate duct leakage with a digital manometer while a blower door is running.

Priority List – A priority list is a list of weatherization measures appropriate for typical housing stock ordered by descending cost effectiveness. DOE-approved energy audit software is used to verify the cost effectiveness of the measures and account for the interaction between measures.

R-Value – R-value is a measure of resistance to heat flow. Insulation with an R-value of R-38 resists heat loss better than R-19 insulation.

Room Pressure Imbalances – Pressure imbalances happen when the conditioned air supplied to a room does not equal the airflow returned to the furnace or air conditioner. In dwellings with forced-air distribution and a central return system, closing bedroom doors can cause the bedrooms to experience a positive pressure and rooms that are open

to the return grille see a negative pressure. Atmospherically vented combustion appliances can backdraft if they are located in a zone with negative pressure.

Steam Trap – Steam traps are automatic valves used in steam heating systems to remove condensed steam (hot water) from the steam pipes and return it to the boiler.

Temperature-Rise Test – A temperature-rise test is conducted on a furnace by measuring the temperature of air entering the furnace and of the air exiting the furnace. The difference between these two temperatures is known as the temperature rise and is compared to the normal range indicated on the nameplate to verify proper operation of the furnace.

Thermal Barrier – The thermal barrier of a dwelling is the building shell surface that limits heat flow. For maximum energy efficiency and comfort, the air barrier and thermal barrier should be continuous and in contact with each other.

Unvented Combustion Appliance – An unvented combustion appliance vents combustion gases to the living space instead of outside as does a vented appliance.

Weatherization *Plus* – The U.S. Department of Energy’s effort to plan the continued evolution of the Weatherization Program for the next five years through activities designed to expand resources (leveraging and partnerships), share relevant information with the weatherization network, and increase the consistent delivery of high-quality weatherization services nationwide.

Work Order – A work order describes what weatherization measures are to be installed in an eligible dwelling and includes a list of the type and quantity of materials that are required to complete the job.

Working Knowledge – Working knowledge of means to:

- Knowing how a particular topic impacts the weatherization process;
- Having the relevant information committed to memory or being able to locate it in readily available sources; and
- Using the knowledge to make informed decisions and guide weatherization work.

Worst-Case Draft Test – A worst-case draft test is procedure used to verify the ability of a combustion appliance to safely exhaust combustion gases outside even when exhaust fans, pressure imbalances, and the stack effect are fighting its ability to properly draft.

Zone Pressure Diagnostics – Test procedures used with the blower door to locate air leakage are known as zone pressure diagnostics.

**Core Competencies for the
Weatherization Assistance Program**

Companion Matrix to the
March 26, 2007, Narrative Draft

	Installer	Crew Chief	Auditor	Contractor	HVAC Installer/ Contractor	Inspector	Client Ed.	Monitor (Tech.)	Monitor (Admin.)	Program Manager	Trainer
Basic Competencies	X	X	X	X	X	X	X	X	X	X	X
Safe Work Practices	X	X	X	X	X	X	X	X	X	X	X
Understand building science principles		X	X	X		X	X	X		X	X
Air Sealing											
Select proper materials	X	X	X	X	X	X		X			X
Know minimum ventilation rates	X	X	X	X	X	X		X			X
Use blower door	X	X	X	X	X	X		X			X
Seal leaks in attics, floors, etc.	X	X	X	X	X	X		X			X
Properly apply caulk & foam	X	X	X	X	X	X		X			X
Weatherstrip doors, windows, etc.	X	X	X	X	X	X		X			X
Repair broken glass	X	X	X	X	X	X		X			X
Repair plaster & sheetrock	X	X	X	X	X	X		X			X
Install or modify mechanical ventilation	X	X	X	X	X	X		X			X
Duct Sealing											
Seal ducts	X	X	X	X	X	X		X			X
Repair/modify ducts per work order	X	X	X	X	X	X		X			X
Insulation											
Know insulation materials	X	X	X	X	X	X	X	X		X	X
Know hazards of knob-&-tube wiring	X	X	X	X	X	X	X	X		X	X
Know local attic ventilation codes		X	X	X	X	X		X			X
Install blown & batt insulation	X	X	X	X	X	X		X			X
Access & dense-pack sidewalls	X	X	X	X	X	X		X			X
Install water heater blankets	X	X	X	X	X	X		X			X
Insulate ducts & pipes	X	X	X	X	X	X		X			X
Operate & maintain blowing machine	X	X	X	X	X	X		X			X
Base-Load Measures											
Convert incand. lamps to CFLs, maintain light level	X	X	X	X	X	X		X			X
Install low-flow showerheads/aerators	X	X	X	X	X	X		X			X
Meter energy usage of electrical appliances			X			X		X			X
Determine refrigerant energy usage w/ meter of database			X			X		X			X
Project Management											
Manage a crew of installers		X		X	X						
Ensure Safe Work Practices are used		X	X	X	X	X		X		X	X
Understand a work order		X	X	X	X	X		X	X	X	X
Know building codes, esp. energy & H&S codes		X	X	X	X	X		X		X	X
Order materials to avoid delays		X		X	X						
Maintain QC of wx work & ensure it meets pgm stads		X		X	X	X		X		X	

**Core Competencies for the
Weatherization Assistance Program**

Companion Matrix to the

March 26, 2007, Narrative Draft

	Installer	Crew Chief	Auditor	Contractor	HVAC Installer/ Contractor	Inspector	Client Ed.	Monitor (Tech.)	Monitor (Admin.)	Program Manager	Trainer
Warehouse materials as necessary		X		X	X						
Training											
Know adult learning concepts		X		X			X	X		X	X
Complete adult education training program											X
Know benefits of cross training		X		X				X		X	X
Provide ongoing training		X		X				X			X
Certification in training topic								X			X
Know allowable activities at training location								X		X	X
Know training resources							X	X		X	X
Develop curriculum based on student needs								X			X
Tailor each class based on student needs								X			X
Motivate students								X			X
Provide hands-on training								X			X
Use technology to enhance learning								X			X
Diagnostic Testing											
Blower door/zone pressure diagnostics											
Know air & heat movement principles		X	X	X			X	X		X	X
Know typical air leakage problems		X	X	X			X	X		X	X
Compute minimum ventilation rates		X	X	X			X	X			X
Take blower door readings & interpret results		X	X	X			X	X			X
Know air barrier & its proper alignment		X	X	X			X	X		X	X
Know primary & intermediate zones		X	X	X			X	X		X	X
Conduct zone pressure diagnostics		X	X	X			X	X			X
Locate air barrier & determine its effectiveness		X	X	X			X	X			X
Duct testing											
Know problems w/ different kinds of leakage		X	X	X			X	X		X	X
Conduct pressure pan, duct blaster, or Delta Q		X	X	X			X	X			X
Determine dominant duct leakage		X	X	X			X	X			X
Measure & resolve room pressure imbalances		X	X	X			X	X			X
Steam & hot water pipe testing											
Know components & oper of steam & HW sys			X				X	X			X
Test air vents, steam traps, t'stat rad valves, etc.			X				X	X			X
Bleed air from HW distribution system							X				
Estimate energy impact of overheating problems			X				X	X			X
Combustion Appliance Safety											
Know CO action levels		X	X	X	X	X	X	X	X	X	X
Know code requirements of:											
				X	X	X	X	X	X	X	X

**Core Competencies for the
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Companion Matrix to the

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	Installer	Crew Chief	Auditor	Contractor	HVAC Installer/ Contractor	Inspector	Client Ed.	Monitor (Tech.)	Monitor (Admin.)	Program Manager	Trainer
Vent sizing, materials, clearances, installation		X	X	X	X	X		X			X
Safety shut-off devices		X	X	X	X	X		X			X
Gas line sizing		X	X	X	X	X		X			X
Combustion air		X	X	X	X	X		X			X
Know causes & remedies of common vent problems		X	X	X	X	X	X	X		X	X
Measure CO in ambient air		X	X	X	X	X		X			X
Measure CO in vented & unvented appliances		X	X	X	X	X		X			X
Measure CO of gas & propane stoves & ranges		X	X	X	X	X		X			X
Clean & adjust ovens/ranges to remedy high CO		X	X	X	X	X		X			X
Understand as-measured & air-free CO readings		X	X	X	X	X		X			X
Detect gas, propane, and fuel oil leaks		X	X	X	X	X		X			X
Conduct worst-case draft test of CAZ		X	X	X	X	X		X			X
Measure CAZ & ensure adequate combustion air			X		X	X		X			X
Clock a gas meter to determine appliance input			X		X	X		X			X
Measure temp rise/drop & static press drop on FA sys			X		X	X		X			X
Measure steady-state efficiency of vented units		X	X	X	X	X		X			X
Assess adequacy of plenum & duct sizes			X		X	X		X			X
Inspection and Measurement											
Know factors that affect heat loss in buildings		X	X	X	X	X	X	X		X	X
Know critical junction points		X	X	X	X	X	X	X		X	X
Know R-values of different insulation materials		X	X	X	X	X		X			X
Know different insulation mtrls & installation techniques		X	X	X	X	X	X	X		X	X
Know air-sealing techniques & appropriate materials		X	X	X	X	X	X	X		X	X
Know causes & remedies of moisture problems		X	X	X	X	X	X	X		X	X
Know causes & remedies of IAQ problems		X	X	X	X	X	X	X		X	X
Know residential mechanical ventilation systems		X	X	X	X	X		X		X	X
Know min ventilation rates per appropriate ASHRAE 62		X	X	X	X	X		X		X	X
Know electric base-load usage		X	X	X	X	X		X		X	X
Measure building dimensions & compute areas		X	X	X	X	X		X		X	X
Compute volume of conditioned space		X	X	X	X	X		X		X	X
Define thermal envelope of a building		X	X	X	X	X		X		X	X
Assess existing insulation & its R-value		X	X	X	X	X		X		X	X
Analyze utility bills			X			X		X			X
Measure Selection											
Know materials allowed by 10 CFR 440 Appendix A			X			X	X	X		X	X
Know regs & policy affecting measure selection			X			X	X	X		X	X
Understand the interaction between measures			X			X	X	X		X	X

**Core Competencies for the
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	Installer	Crew Chief	Auditor	Contractor	HVAC Installer/ Contractor	Inspector	Client Ed.	Monitor (Tech.)	Monitor (Admin.)	Program Manager	Trainer
Properly use DOE-approved energy audit/priority list			X			X		X			X
Prioritize air-sealing measures			X			X		X			X
Estimate heating & cooling load of a building			X		X	X		X			X
Work Scope Development											
Estimate type & quantity of wx materials needed			X			X		X			X
Prepare easy-to-understand work order			X			X		X			X
Business Management											
Maintain required licenses				X	X						
Possess adequate insurance				X	X						
Employ U.S. citizens or properly documented aliens		X		X	X						
Bid, negotiate, & sign contracts as necessary				X	X						
Heating & Cooling Equipment											
Repair/place heating & cooling eqmt per code					X						
Repair/place combustion appliance vent systems					X						X
Repair/place water heater					X						X
Add supply & return plenums & ducts as necessary					X						X
Client Education											
Know actions by occupant that reduce energy use							X			X	X
Estimate savings that can result from occupant actions							X				X
Know actions by occupant that ensure health & safety							X			X	X
Know basic steps involved in weatherization process							X			X	X
Know basic equipment used to weatherize a house							X			X	X
Monitoring											
Technical Monitoring											
Produce reports, identify weaknesses & solutions						X		X			X
Solve complex technical problems						X		X			X
Administrative Monitoring											
Know enabling legislation of Weatherization Pgm									X		X
Know DOE program regulations (10 CFR 440)									X		X
Know DOE program guidance & policy									X		X
Know budget federal, state, & local processes									X		X
Know 10 CFR 600 & OMB Circulars									X		X
Know applicable state procurement regulations									X		X
Know state approached to monitoring & T&TA									X		X
Program Management											
Know applicable databases & tracking systems										X	X
Submit accurate financial and production reports										X	X

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Weatherization Assistance Program**

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Provide T&TA for staff & contractors										X	X
Coordinate resources										X	
Develop & implement leveraging strategies										X	

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	Installer	Crew Chief	Auditor	Contractor	HVAC Installer/ Contractor	Inspector	Client Ed.	Monitor (Tech.)	Monitor (Admin.)	Program Manager	Trainer
State Program Management											
Prepare an annual state plan										X	
Prepare an annual weatherization grant application										X	
Develop, maintain, and enforce tec pgm stds										X	
Develop & manage an effective monitoring program										X	
Process reimbursement requests										X	
Local Agency Program Coordination											
Prepare and track a budget										X	
Maintain a purchase order system										X	
Maintain inventory tracking system										X	
Comply with federal limits on admin expenses										X	
Manage a small construction-focused operation										X	
Ensure rigorous final inspection of all units										X	X