Developing a Robust Workforce:

Tools and Resources to Enhance Training in the Residential Energy Retrofit Industry
The WAP National T&TA Plan

- ARRA increased T&TA funds from 10% to 20%
- $1 Billion/ $5 Billion T&TA
- The Weatherization Assistance Program National Weatherization Training and Technical Assistance Plan is the plan for $138.5 M
Quality Work = Sustainability

- The T&TA Plan is building tools and resources to ensure that the WAP is able to produce high quality work and demonstrate that quality to stakeholders.
- The Weatherization Assistance Program has 30 years of building science expertise and energy retrofit work behind it. It is the largest group of experts in home energy upgrades in the country.
- By utilizing the expertise of the WAP program, the DOE is seeking to lay the foundation for a robust private market for home energy upgrades.
Framework for Sustainability

Professional Workers/

Quality Work

Training and Certification of Workers

Defining Worker Tasks

Creating Work Specifications

Market Expansion

• Multifamily
  - Energy Audit Tool
  - Standard Work Specifications
  - Weatherization Innovation Pilot Program

• Private Market Integration
  - Better Buildings
  - Building America
  - Energy Star

• Healthy Homes
  - Wx Plus Health

• Regulatory Changes
  - Grant to Loan
  - Appendix A
Quality Work / Qualified Workers

- Guidelines for Home Energy Professionals
  - Standard Work Specifications
  - Job Task Analysis

- Training Program Accreditation

- Worker Certification

- Training Resources and Tools
  - WAP Standardized Curriculum
  - National Weatherization Training Platform
  - WAP Training Centers
  - National Audit Tools- Multi-Family/Healthy Homes
Voluntary national guidelines to support *quality work* and a *skilled workforce* in the Weatherization Assistance Program and private residential energy efficiency upgrade industry

- **Developed by industry**, facilitated by NREL and EERE
- **Second Round Public Comment Fall 2011**
# Four Components

<table>
<thead>
<tr>
<th>Workforce</th>
<th>Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job Task Analyses</td>
<td>Technical Standards Reference Guide</td>
</tr>
<tr>
<td><strong>Guidelines for Home Energy Professionals</strong></td>
<td>Standard Work Specifications</td>
</tr>
<tr>
<td>Essential Knowledge, Skills, and Abilities</td>
<td></td>
</tr>
</tbody>
</table>

**Description:**
- **Workforce** includes Job Task Analyses, Essential Knowledge, Skills, and Abilities.
Benefits of Guidelines

Help increase the quality of work performed and enhance the skills of the workforce involved in the home energy retrofit industry...
Retrofit Work Pyramid

Description

Techniques, methods, or processes believed to be the most efficient and effective way of meeting the Standard Work Specifications (SWS)

Sets of guidelines or rules that govern work procedures and often invoke SWS and technical standards

Define the minimum requirements for high-quality work and conditions needed to achieve desired outcomes

Define safety, materials, installation, and application standards relevant to residential retrofits

Developed by

Companies, retrofit crews, or individuals

Retrofit program administrators or individual companies

Technicians and retrofit industry representatives (including building trades, manufacturers, and building scientists)

Industry or third-party standards development organizations, such as ASHRAE, ASTM, and BPI
Standard Work Specifications

- Define the minimum requirements for high-quality work and the conditions necessary to achieve the desired outcomes of a given energy efficiency retrofit measure
- Standard Work Specifications are outcome driven, but not prescriptive
- When applicable, SWS are based on existing technical standards
- Fill a critical niche in the “standards landscape”
- Work specifications = setting the bar for quality work
Technical Standards

• Define the safety, materials, installation, and application standards, codes, and regulations applicable to residential energy efficiency retrofits

• Developed by government, industry, or third-party standards development organizations

• Examples
  - ASHRAE 62.2 (Ventilation for Acceptable Indoor Air Quality)
  - ASTM E1186 – 03 (Standard Practices for Air Leakage Site Detection)
  - OSHA 1926.28 (Safety and Health Regulations for Construction; Personal Protective Equipment)

• Workforce Guidelines for Home Energy Upgrades will contain a Technical Standards Reference Guide for industry
### Draft SWS: Attic Insulation

#### Prep Detail-Knee Wall

<table>
<thead>
<tr>
<th>Row</th>
<th>Title</th>
<th>Specification(s)</th>
<th>Objective(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Knee wall prep for batts</td>
<td>All knee walls will have a top and bottom plate or blockers installed using a rigid material.</td>
<td>Eliminate bending, sagging or movement that may result in air leakage.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All joints, cracks and penetrations will be sealed in finished material including interior surface to framing connections.</td>
<td>Prevent air leakage through the top or bottom of the knee wall.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insulation will be installed using one of the following methods:</td>
<td>Create an air barrier.</td>
</tr>
<tr>
<td>2</td>
<td>Installation</td>
<td>New batts will be installed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>All existing batted insulation will be adjusted to ensure it is in full contact with the interior cladding and top and bottom plates.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Eliminate misalignment of existing insulation.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Backing knee wall</td>
<td>If rigid material is used, material will be installed to cover 100% of the surface of the Knee Wall.</td>
<td>Prevent insulation settling or movement.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If foam sheathing is used, sheathing will be listed for uncovered use in an attic, or covered with a fire barrier.</td>
<td></td>
</tr>
</tbody>
</table>

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*NREL*

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Note: [ASTM E1186 - 09(2009)]
Job Task Analysis

- Identifies and inventories a job’s critical tasks.

- A formal process for determining and cataloguing what a worker does.

- Tasks are classified as either cognitive (mental) or psychomotor (physical) skills, and as critical, very important, and important for job performance.

- **Examples**: set up blower door, run test in accordance with ASTM E779, record results of blower door test in diagnostic software, etc.
Four Home Energy Retrofit Job Classifications

- Energy Auditor
- Installer/Technician
- Crew Leader
- Quality Control Inspector
Essential KSAs

• Identify the minimum knowledge, skills, and abilities that workers should possess to perform high-quality work

• Each Job Task has a corresponding set of essential KSAs

• Examples:
  - Demonstrate ability to blow insulation at appropriate air pressure and material quantity…
  - Demonstrate ability to prioritize air sealing measures to inhibit moisture migration…
  - Demonstrate knowledge of basic building science, including aligning barriers, stack effect, moisture transfer…
# Attic Air Sealing: Penetrations

## Technical Standard

<table>
<thead>
<tr>
<th>International Residential Code</th>
<th>Backing and Infill</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Ch. 3, 6, 7, 8, 11, 31)</td>
<td>Provide backing or infill as needed to meet specified characteristics of the selected material and the hole</td>
</tr>
<tr>
<td></td>
<td>Infill will not bend, sag, or move once installed</td>
</tr>
<tr>
<td></td>
<td><strong>Objective:</strong> Hole size small enough to use sealant, closure is permanent and supports any load</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>International Energy Conservation Code</th>
<th>Sealant Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Ch. 4)</td>
<td>Materials adhere and are continuous with intended surfaces, and meet ignition barrier requirements</td>
</tr>
<tr>
<td></td>
<td><strong>Objective:</strong> Permanent; meet/exceed performance characteristics of surrounding materials</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ASHRAE</th>
<th>Insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>(62.2, 119, 136)</td>
<td>Use only non-combustible materials in contact with chimneys, vents, and flues</td>
</tr>
<tr>
<td></td>
<td><strong>Objective:</strong> Do not create a fire hazard</td>
</tr>
</tbody>
</table>

| ASTM | |
|------| |
| (C509, C920, C1363, C1642, C330M, E84, E779, E814, E2178) | |

## Standard Work Specifications

- **Backin and Infill:**
  - Provide backing or infill as needed to meet specified characteristics of the selected material and the hole
  - Infill will not bend, sag, or move once installed
  - **Objective:** Hole size small enough to use sealant, closure is permanent and supports any load

- **Sealant Selection:**
  - Materials adhere and are continuous with intended surfaces, and meet ignition barrier requirements
  - **Objective:** Permanent; meet/exceed performance characteristics of surrounding materials

- **Insulation:**
  - Use only non-combustible materials in contact with chimneys, vents, and flues
  - **Objective:** Do not create a fire hazard

## Knowledge, Skills, Abilities

- Ability to read and follow directions
- Physical ability to climb ladders and work in enclosed spaces
- Tolerance to heat and cold extremes
- Knowledge and ability to identify and differentiate building elements including framing, plumbing, electrical, insulation, sheathing, HVAC, fasteners
- Understanding of basic building science, including aligning barriers, stack effect, moisture transfer
- Knowledge of and ability to install sealants, including methods and requirements
- Ability to use tools including a tape measure, utility knife, hand and power saws, caulk and foam guns
- Ability to recognize hazardous conditions requiring special treatment
Building Markets on Quality

- Markets are driven by consumer confidence
- WAP’s long history and extensive expertise support the development of consumer confidence
- Market rate programs can rely on the technical expertise within the WAP program to set standards for work quality and quality assurance
- WAP has a skilled workforce ready and able to transition into the middle-income market
- Common standards and certifications across markets and programs will ensure that the workforce is able to deliver a consistent product that consumers can trust
- WAP has spent 30+ years developing quality standards - a resource that can be utilized by all energy efficiency programs
- Standard Work Specifications (SWS) are outcome driven, but not prescriptive (*not protocols or best practices*)

**Standard Work Specifications = setting the bar for quality work**
National Workforce Certification
Training Program Accreditation
Accreditation
• Is given to the **Training Program**
  • (Weatherization Training Center or other qualified program)
• Verifies that the Training Program meets a standard in both its operations as well as facilities

Certification
• Is given to individuals (**worker**)  
• Certifies that an individual has the knowledge, skills, and abilities to perform a certain job.
• Is issued by an independent third party

Credential (**generic term**)  
• Careful! - Can be a “Certificate for Completion” or License, or degree, or full Certificate
Training: Key Challenges

Proliferation of training and certificate programs for WAP and the Home Performance workforce

– industry, labor, government, educational institutions, NGOs

1. Major infusion of Federal and State training dollars with no standards

2. No objective measure (3\textsuperscript{rd} party assessment) of training program effectiveness

3. No uniform way for workers seeking training to assess the quality of the program or provider
Solution: Training Program Accreditation

• Voluntary, third-party assessment of training provider quality

• Interstate Renewable Energy Council (IREC)
  ▪ Currently accredits solar training programs

• ISPQ International Standard 01022

• IREC will use the *DOE Job Task Analysis and Knowledge, Skills, and Abilities* as the foundational document for accreditation
What is Accreditation Based On?

Job Task Analysis

• Identifies and inventories a job’s critical tasks.

• A formal process for determining and cataloguing what a worker does.

• Tasks are classified as either cognitive (mental) or psychomotor (physical) skills, and as critical, very important, and important for job performance.

• Example: An Auditor needs to be able to:
  • set up blower door
  • run test in accordance with ASTM E779,
  • record results of blower door test in diagnostic software, etc.
Four Home Energy Upgrade Job Classifications

- Energy Auditor
- Installer/Technician
- Crew Leader
- Quality Assurance Inspector
Credentialing Single Family: Key Challenges

1. Lots of different credentials
   - Certifications and certificates galore
   - Credentials are not always transferable across programs and geographies (impedes mobility)
   - What’s a worker or a consumer to do?

2. Competencies (Job Tasks and KSAs) upon which certifications are built are all different and in need of strengthening

3. Certification exams need to better assess field capabilities

4. Many credentials are too expensive and are not always available in all locations
Developing the Standard Work Specifications: Multifamily

- Collaboration between industry, labor and the building trades, and the DOE, HUD, USDA, and EPA
  - Continue collaboration with EPA on Protocols
- National Renewable Energy Lab, Advanced Energy, Association for Energy Affordability, Weatherization Assistance Program, Industry
- Will follow a process similar to the Single Family SWS development
- Multifamily is unique in that individual trade workers often play a larger role
- Overall Goal: Industry acceptance and market transformation!
Overall Goals

- Build on the work and experience of the Guidelines for Home Energy Upgrade Professionals: Single Family
- Define Multi-Family building types
- Assess existing standard and resources for inclusion and reference in the SWS
- Fill gaps in existing materials through collaboration of market players
- Define professional job positions that will utilize the SWS
Weatherization Training Centers
Weatherization Training Centers

At a Glance:

• 39 Centers Nationwide in 29 States

• Hands-on, skills based training to workers, auditors, inspectors and program administrators

• Coursework built on the Weatherization Assistance Program’s Standardized Training Curriculum and Core Competencies

• Supported by a network of over 1000 local agencies

• Backed by Training and Technical Assistance support from the national Weatherization Assistance Program

• Third-party accreditation and worker certification coming-soon.
Legacy WTC receiving grant funding.

Legacy WTC

2010 WTC Grant Recipient
Weatherization Assistance Program: Standardized Training Curriculum

- Weatherization Installer/Technician Fundamentals
- Weatherization Installer/Technician Intermediate
- Weatherization Installer – Mobile Homes
- Crew Chief
- Energy Auditor – Single Family
- Energy Auditor – Multifamily
- Technical Monitor/ Inspector
- Heating Systems for Energy Auditors – Single Family
- Multifamily – HVAC
- Train the Trainer
- Weatherization Program Manager
National Weatherization Training Platform

Use a Blower Door as a Controlled Driving Force

Using the blower door depressurizes the house drawing air through all the holes between inside and outside.
What is NWTP?

The NWTP learning management system, being developed by the U.S. Department of Energy, provides the following:

- Web-based system that is easy to use for both students and trainers
- Adaptive learning system that tracks and tailors courses based on user progress
- Easy-to-access, online system that creates, stores, and maintains training curriculum
- Immersive, online training that is cost effective and allows content to be reused and repurposed by developers and trainers.
Online Training System

- Continually improve content and keep it up-to-date
- Meaningful assessments through performance-based testing
- Continuous, unobtrusive evaluation of students
- Game like environments and simulations
- Open Source (free)
- Saves paper, gas & money!
- The NWTP is a *supplement* to a quality trainer and a well-equipped training center. It replaces neither.
Sample Content

By reviewing this lesson, participants will:

- Know the proper location of thermal and air barriers
- Recognize the driving forces of air leakage
- Understand the connection between air leakage, energy waste, and moisture problems
- Understand how air ducts affect pressure balance within the home
- Understand the principle behind the blower door as a tool for measuring air leakage
Authoring tool for 3D content creation

- Build 3D simulations without programming
- Runs in browser; no heavy downloads
Correctly install the proper type of wall joint to complete the structure.
Audit Tools
Healthy Homes Electronic Assessment Tool

- Designed by ORNL in collaboration with HUD & DOE
- Performs whole-house health and safety audits including:
  - Site built single family
  - Mobile homes
  - Individual multifamily units
- Comprehensive checklist to identify potential H&S issues and recommend preventative and corrective measures
- Attempts to ensure health and safety of occupant and workers during and after weatherization
- Includes all the WAP health and safety and more
- Stand-alone module with potential for future efficiency audit integration
- Demo at http://hyperion.ornl.gov/hud
Multi-Family Audit Tool: ORNL and LBL Collaboration

Develop Small Multi-Family and Large Multi-Family Audit Tool and Programmatic Elements for the WAP

Add Multifamily HES Consumer (Home Owners) & HES Pro
The Multifamily Audit Tool will:

- Provide energy auditors with an improved energy simulation and weatherization measure selection tool for multifamily buildings
- Expand and enhance the energy auditing capabilities of auditors in multifamily buildings
- Provide a DOE-sponsored multifamily energy audit instrument to complement the single-family (NEAT) and mobile home (MHEA) energy audits already supported by DOE under the Weatherization Assistance
- Help improve retrofit work quality and provide a foundation for quality assurance
- Assist training providers in developing better training materials
- Increase workforce mobility up career ladders and across career lattices
- Build confidence among consumers, building owners, and the energy efficiency finance community
Weatherization Assistant — today

- NEAT and MHEA only — no multifamily-specific
- Locally run on PCs at agency level
- Aggregation to state level by agency
Weatherization Assistant — planned

- NEAT, MHEA, H&S, NEBs, new multifamily tool
- All run as Internet web service, secure servers
- Central data base
Some Primary Needs for New Tool

- Multiple zones and heating systems
- Improved methods of handling distribution systems
- Improved methods of handling impact of sensor location and controls
- Better handling of ventilation systems
- Rules-based savings estimation
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