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Technical Resources at Your Fingertips: Building America Solution Center and Standard Work Specifications for Existing Homes

Panelists

Chrissi Antonopoulos, Pacific Northwest National Laboratory

David LoVullo, National Renewable Energy Laboratory

Moderator

Linh Truong – National Renewable Energy Laboratory

June 26, 2018

Building AMERICA U.S. Department of Energy

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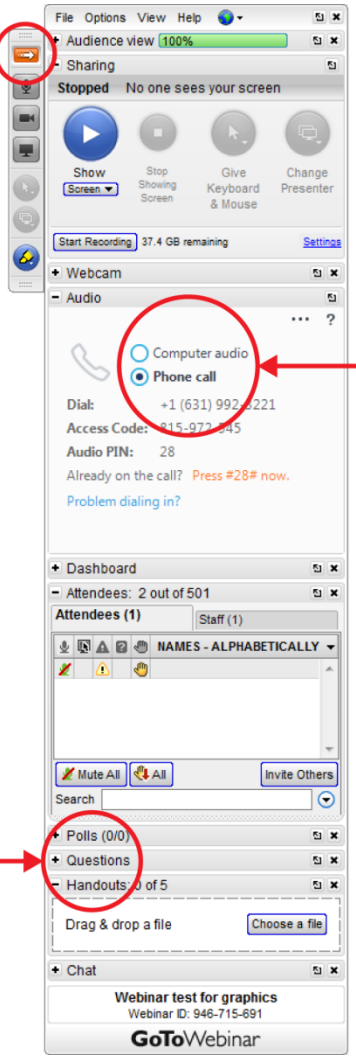

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http://energy.gov/eere/buildings/building-america-meetings#current

Agenda

✓**Welcome and Introductory Remarks**

✓**Overview of Building America (buildingamerica.gov)**

- Linh Truong – National Renewable Energy Laboratory

✓**Speaker**

- Chrissi Antonopoulos, Pacific Northwest National Laboratory
- David LoVullo, National Renewable Energy Laboratory

✓**Questions and Answers**

✓**Closing Remarks**

Building America Webinar: June 26, 2018

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Technical Resources at Your Fingertips: Building America Solution Center and Standard Work Specifications for Existing Homes

Chrissi Antonopoulos
Senior Energy Analyst,
Pacific Northwest National Laboratory

June 26, 2018

Webinar Overview

- Building America Solution Center (BASC) Intro:
  - Overview of stakeholders and users
  - Tour of core BASC content and user interface related to existing homes
  - Linkages between BASC and SWS
- Standard Work Specifications (SWS) Intro:
  - Overview of SWS tool and application
  - Linkages between SWS and BASC

World-Class Expert Guidance…

Building America Solution Center

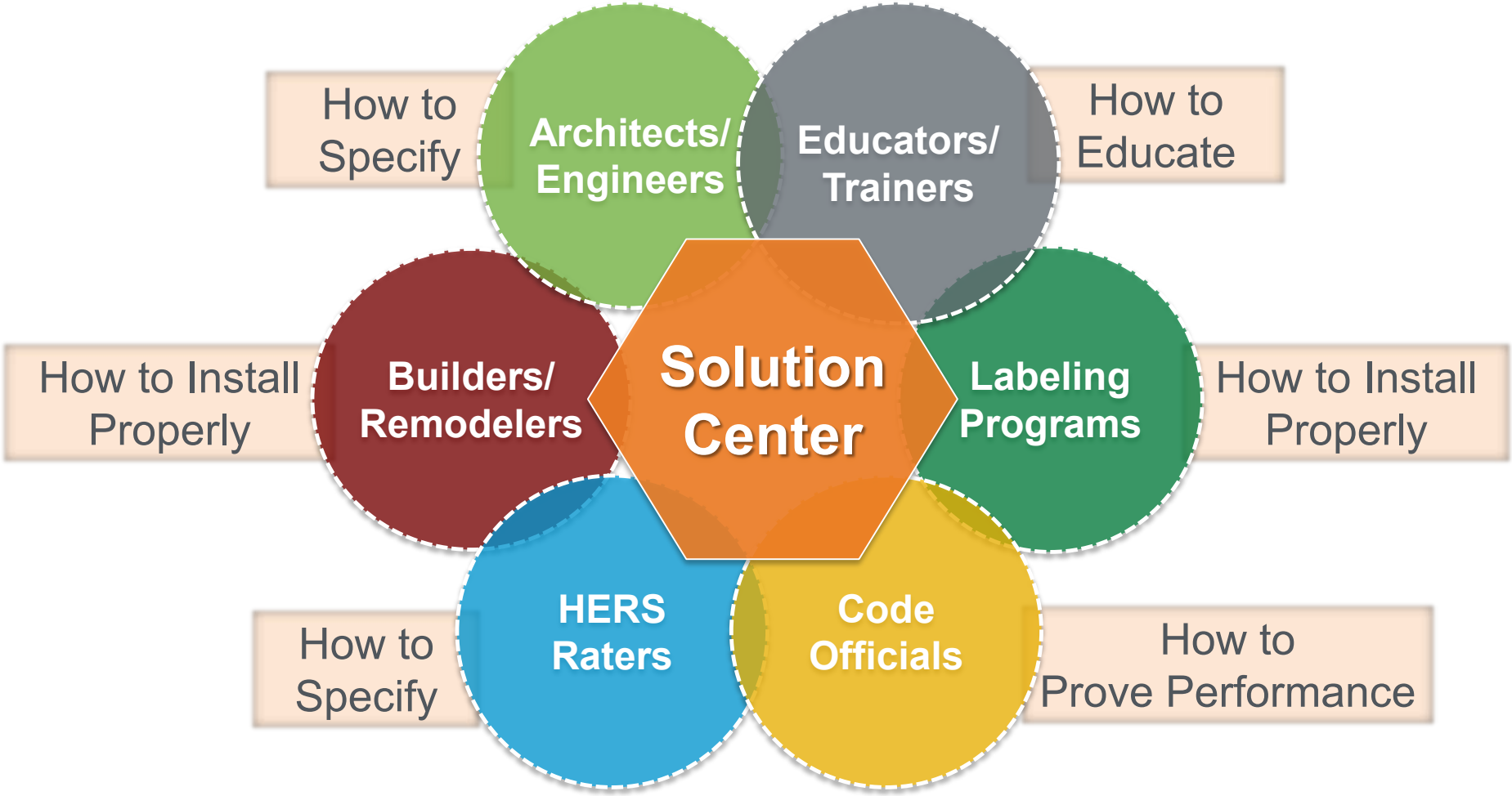
BASC.energy.gov

…At Your Fingertips

BASC Overview

- Continuously Improved vs. Fixed Content
- Fast, Free and Reliable Best Practices
- Focus on ‘Guides’ for Applying Best Practices
- Browsing Capability for Galleries of Content
- User Feedback
- Customizable Content

BASC Actionable Content



BASC Simple Interface

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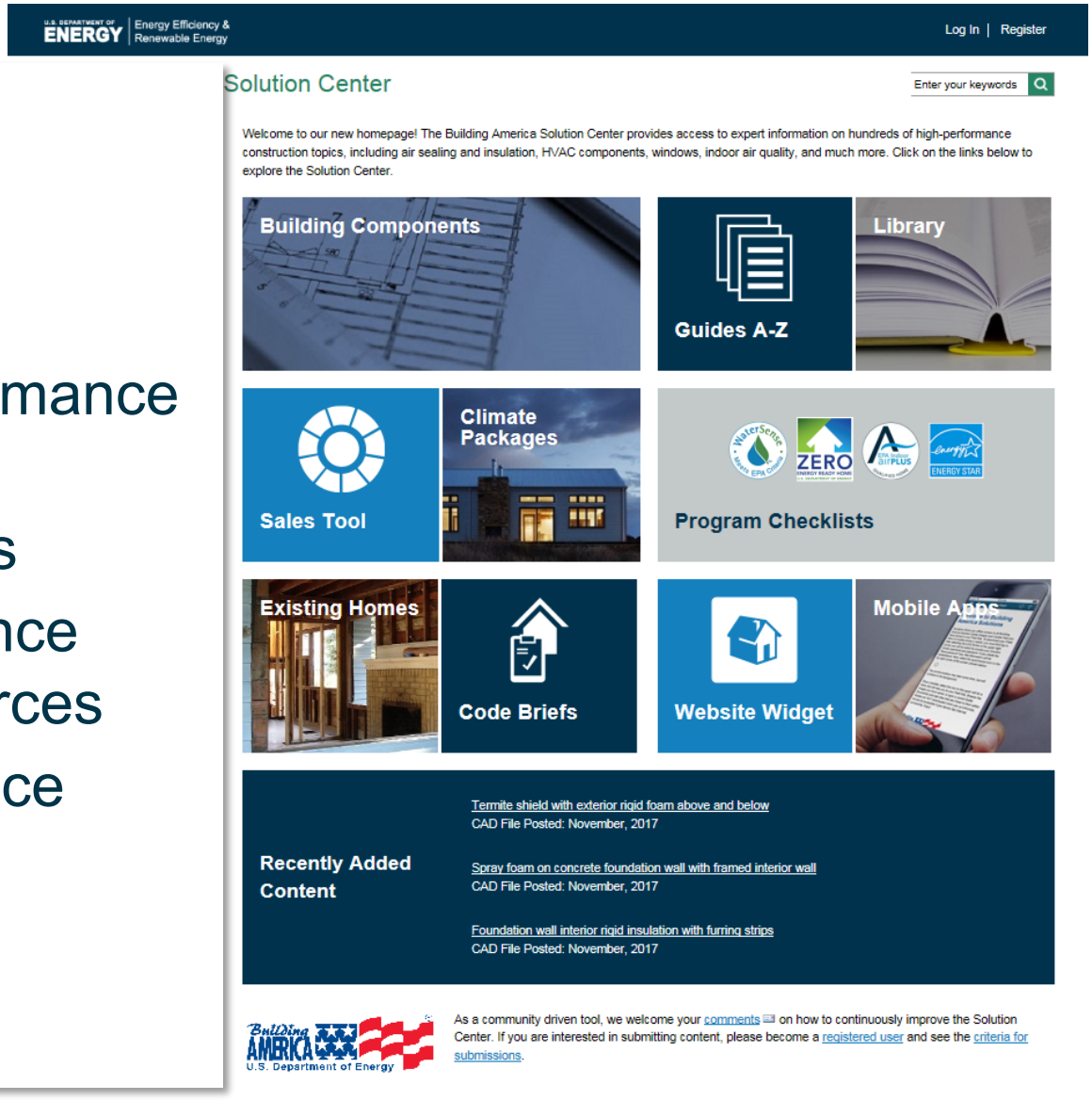

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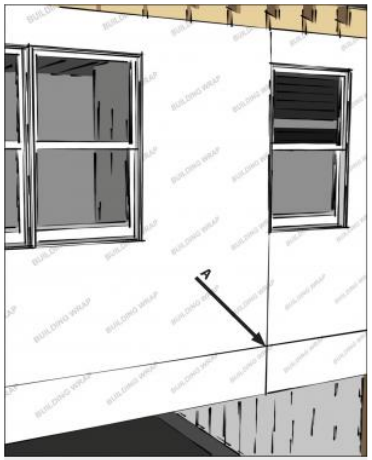
Building America Solution Center

Drainage Plane Behind Exterior Wall Cladding

Scope

Install a fully sealed continuous drainage plane behind the exterior cladding on the walls of the home to keep water out of the wall cavities.

- Make sure that this layer laps over flashing installed around doors, windows, and wall penetrations and any flashing installed at the top or base of walls.
- Provide an additional bond-break drainage plane layer behind all stucco and non-structural masonry wall cladding assemblies.
- Possible monolithic weather-resistant barrier materials include house wrap that is sealed or taped at all joints; rigid foam insulation or other sheathing materials with a weather-resistant coating if all joints are fully taped; building paper or building felt installed with shingle-style laps; liquid-applied coatings; or other water-resistive barrier materials recognized by the ICC-ES or another accredited agency.



House wrap is sealed at all seams and overlaps flashing to serve as a continuous drainage plane over the exterior walls.

See the Compliance Tab for related codes and standards requirements, and criteria to meet national programs such as DOE's Zero Energy Ready Home program, ENERGY STAR Certified Homes, and Indoor airPLUS.

Last Updated: 06/13/2017

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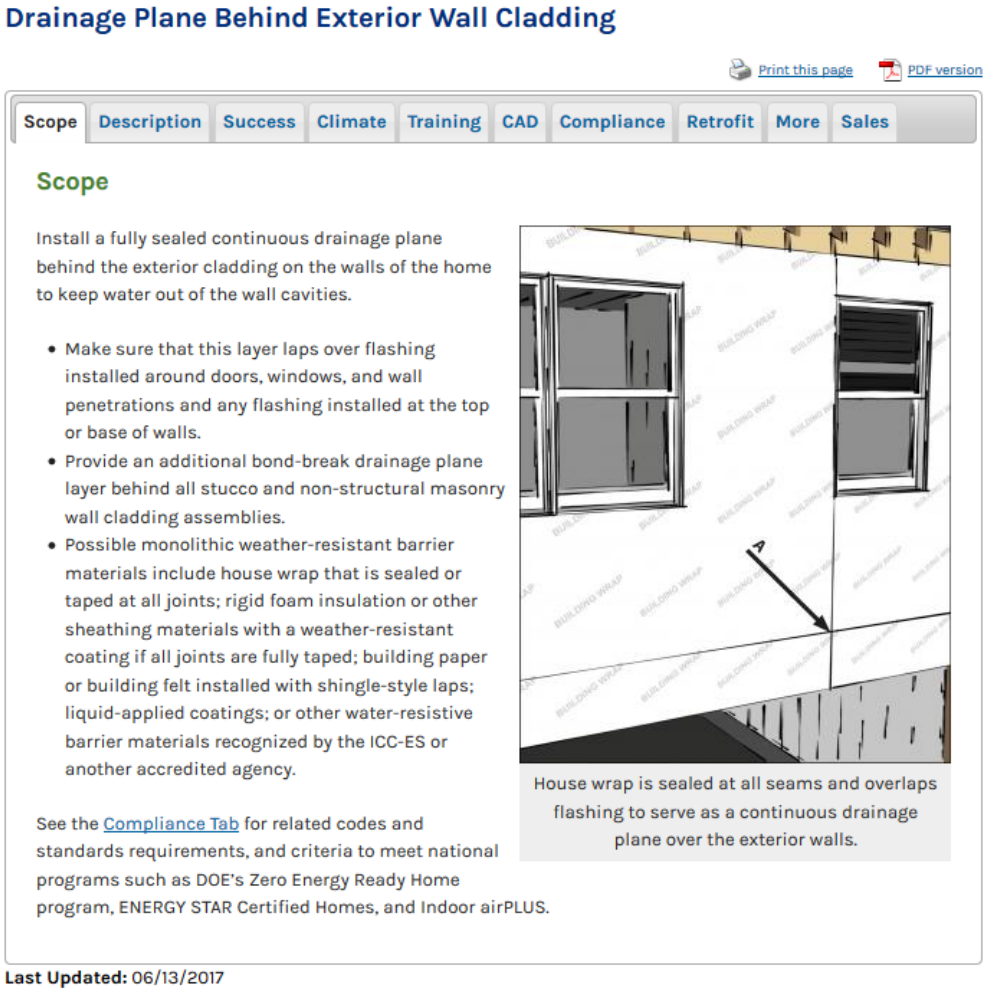

Drainage Plane Behind Exterior Wall Cladding

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Scope | Description | Success | Climate | Training | CAD | Compliance | Retrofit | More | Sales

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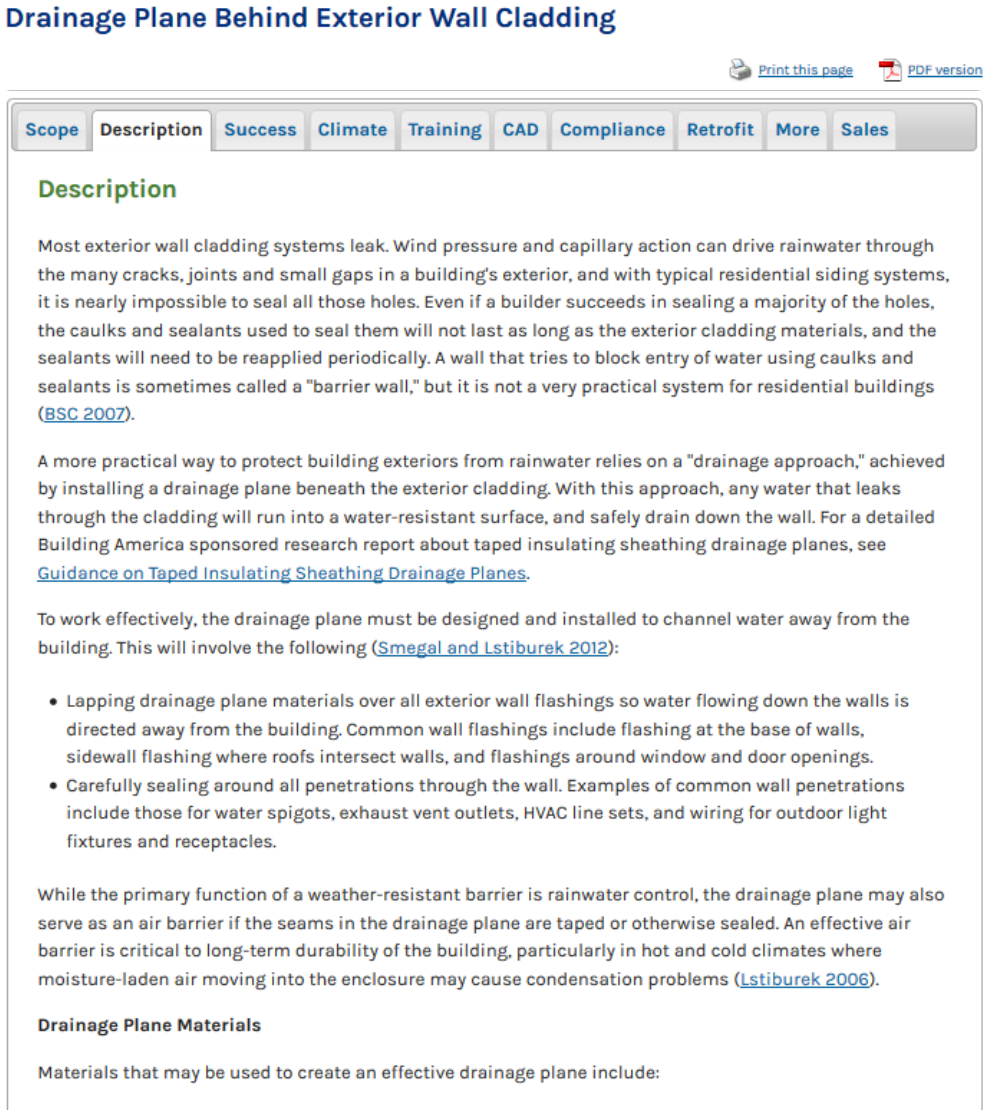

Drainage Plane Behind Exterior Wall Cladding

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Description

Most exterior wall cladding systems leak. Wind pressure and capillary action can drive rainwater through the many cracks, joints and small gaps in a building's exterior, and with typical residential siding systems, it is nearly impossible to seal all those holes. Even if a builder succeeds in sealing a majority of the holes, the caulks and sealants used to seal them will not last as long as the exterior cladding materials, and the sealants will need to be reapplied periodically. A wall that tries to block entry of water using caulks and sealants is sometimes called a "barrier wall," but it is not a very practical system for residential buildings (BSC 2007).

A more practical way to protect building exteriors from rainwater relies on a "drainage approach," achieved by installing a drainage plane beneath the exterior cladding. With this approach, any water that leaks through the cladding will run into a water-resistant surface, and safely drain down the wall. For a detailed Building America sponsored research report about taped insulating sheathing drainage planes, see Guidance on Taped Insulating Sheathing Drainage Planes.

To work effectively, the drainage plane must be designed and installed to channel water away from the building. This will involve the following (Smegal and Lstiburek 2012):

- Lapping drainage plane materials over all exterior wall flashings so water flowing down the walls is directed away from the building. Common wall flashings include flashing at the base of walls, sidewall flashing where roofs intersect walls, and flashings around window and door openings.
- Carefully sealing around all penetrations through the wall. Examples of common wall penetrations include those for water spigots, exhaust vent outlets, HVAC line sets, and wiring for outdoor light fixtures and receptacles.

While the primary function of a weather-resistant barrier is rainwater control, the drainage plane may also serve as an air barrier if the seams in the drainage plane are taped or otherwise sealed. An effective air barrier is critical to long-term durability of the building, particularly in hot and cold climates where moisture-laden air moving into the enclosure may cause condensation problems (Lstiburek 2006).

Drainage Plane Materials

Materials that may be used to create an effective drainage plane include:

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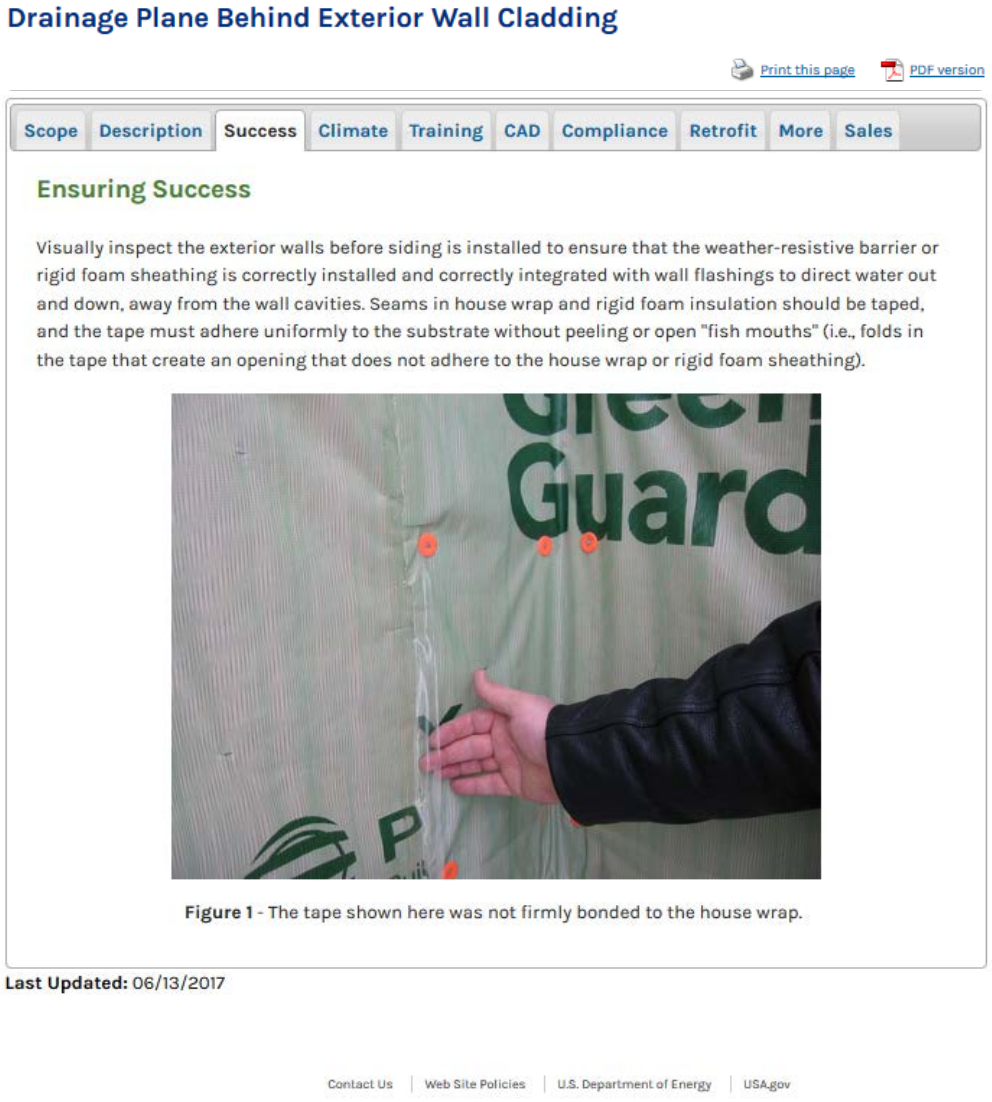

Drainage Plane Behind Exterior Wall Cladding

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Ensuring Success

Visually inspect the exterior walls before siding is installed to ensure that the weather-resistive barrier or rigid foam sheathing is correctly installed and correctly integrated with wall flashings to direct water out and down, away from the wall cavities. Seams in house wrap and rigid foam insulation should be taped, and the tape must adhere uniformly to the substrate without peeling or open "fish mouths" (i.e., folds in the tape that create an opening that does not adhere to the house wrap or rigid foam sheathing).

Figure 1 - The tape shown here was not firmly bonded to the house wrap.

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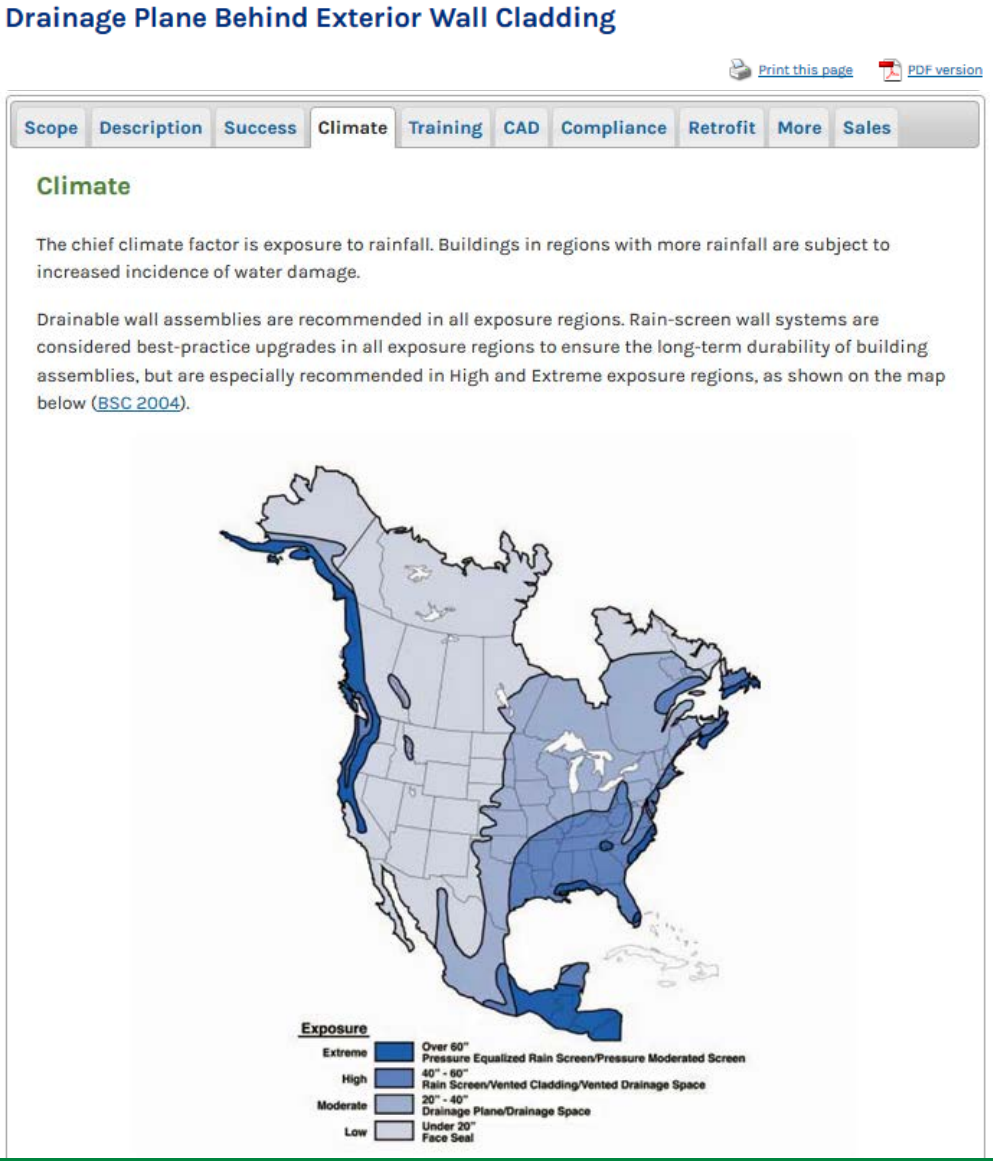

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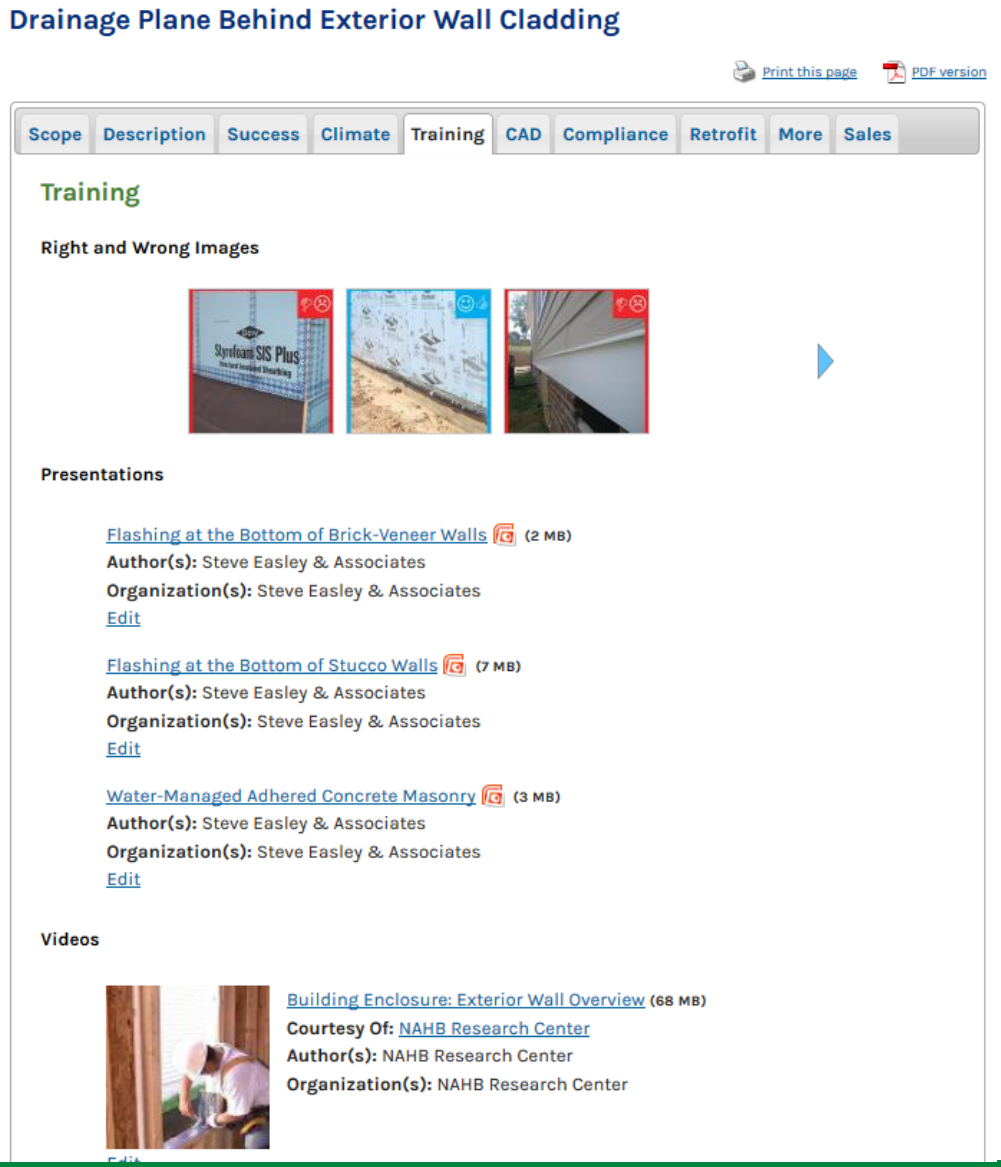

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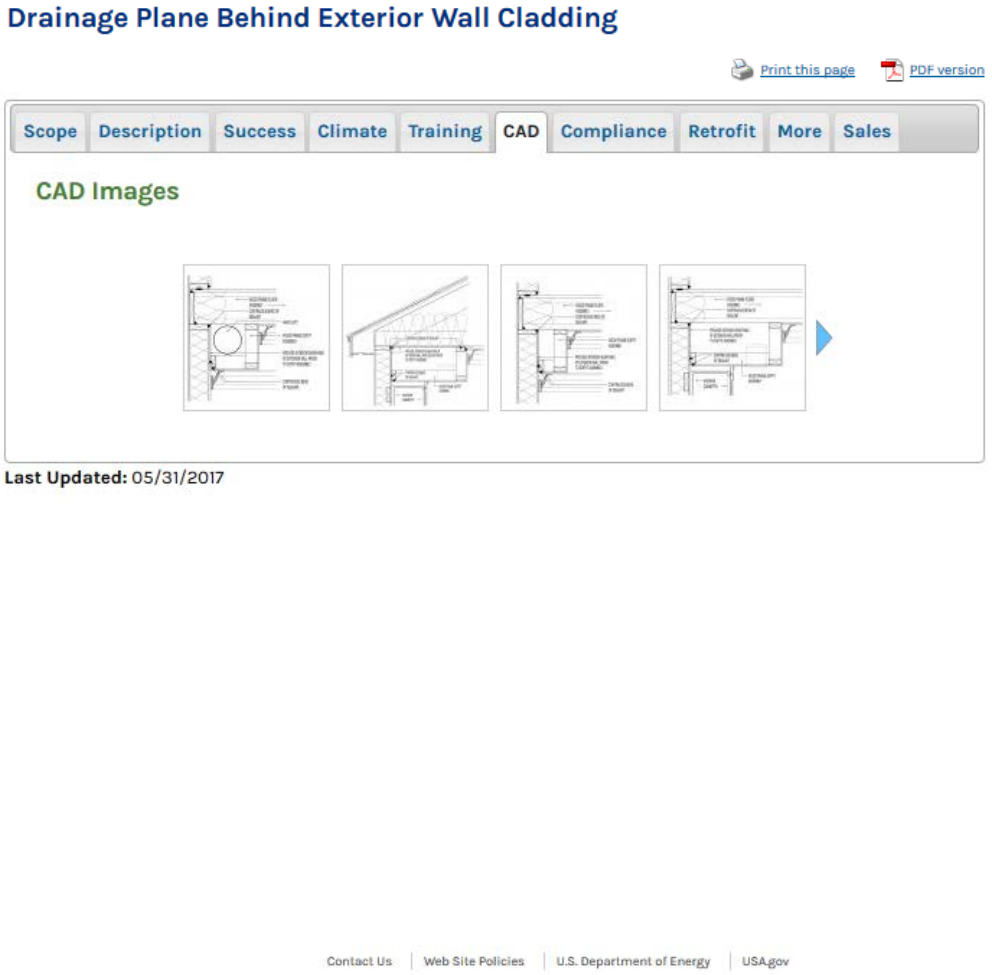

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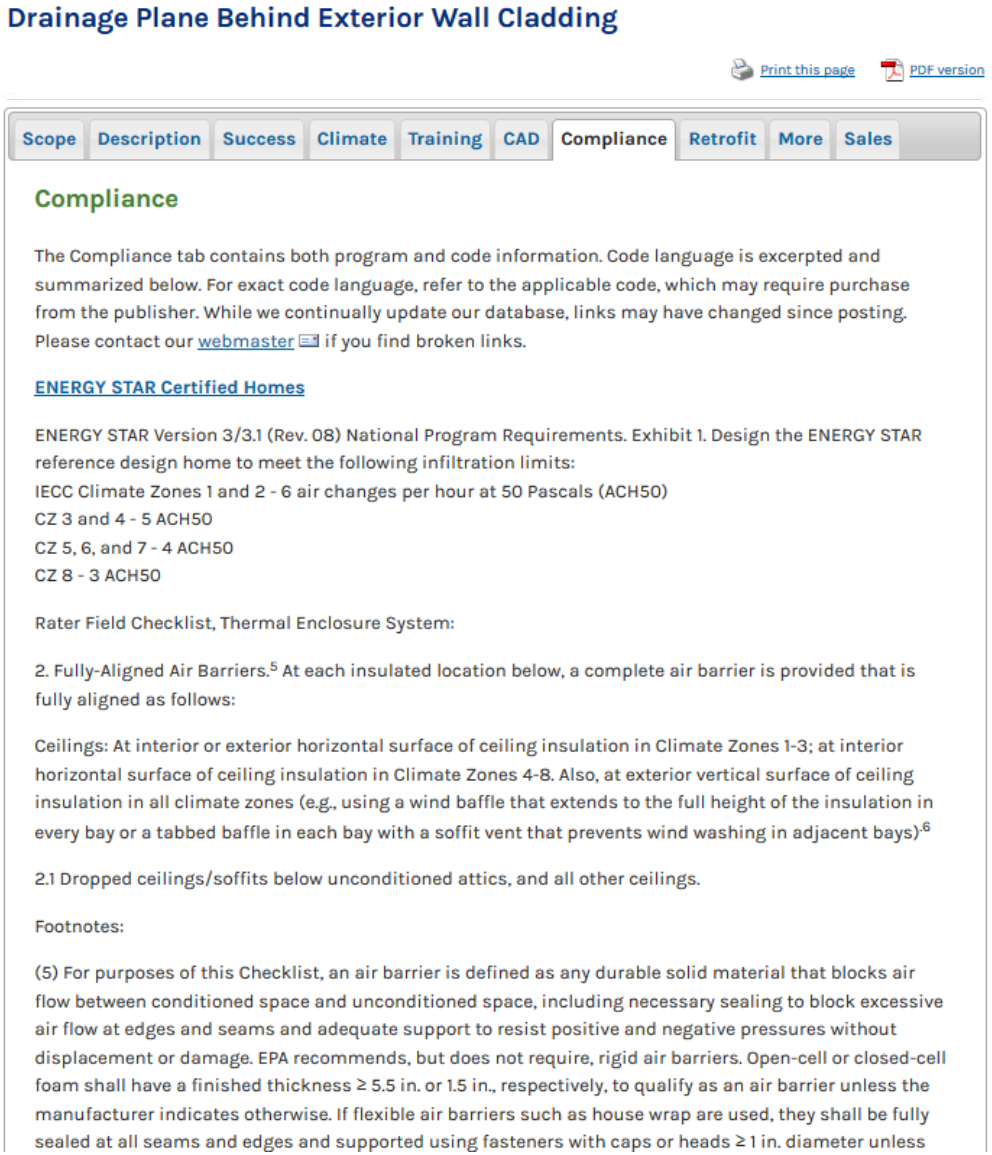

Drainage Plane Behind Exterior Wall Cladding

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Compliance

The Compliance tab contains both program and code information. Code language is excerpted and summarized below. For exact code language, refer to the applicable code, which may require purchase from the publisher. While we continually update our database, links may have changed since posting. Please contact our webmaster if you find broken links.

ENERGY STAR Certified Homes

ENERGY STAR Version 3/3.1 (Rev. 08) National Program Requirements. Exhibit 1. Design the ENERGY STAR reference design home to meet the following infiltration limits:
IECC Climate Zones 1 and 2 - 6 air changes per hour at 50 Pascals (ACH50)
CZ 3 and 4 - 5 ACH50
CZ 5, 6, and 7 - 4 ACH50
CZ 8 - 3 ACH50

Rater Field Checklist, Thermal Enclosure System:

2. Fully-Aligned Air Barriers.[5] At each insulated location below, a complete air barrier is provided that is fully aligned as follows:

Ceilings: At interior or exterior horizontal surface of ceiling insulation in Climate Zones 1-3; at interior horizontal surface of ceiling insulation in Climate Zones 4-8. Also, at exterior vertical surface of ceiling insulation in all climate zones (e.g., using a wind baffle that extends to the full height of the insulation in every bay or a tabbed baffle in each bay with a soffit vent that prevents wind washing in adjacent bays).[6]

2.1 Dropped ceilings/soffits below unconditioned attics, and all other ceilings.

Footnotes:

(5) For purposes of this Checklist, an air barrier is defined as any durable solid material that blocks air flow between conditioned space and unconditioned space, including necessary sealing to block excessive air flow at edges and seams and adequate support to resist positive and negative pressures without displacement or damage. EPA recommends, but does not require, rigid air barriers. Open-cell or closed-cell foam shall have a finished thickness ≥ 5.5 in. or 1.5 in., respectively, to qualify as an air barrier unless the manufacturer indicates otherwise. If flexible air barriers such as house wrap are used, they shall be fully sealed at all seams and edges and supported using fasteners with caps or heads ≥ 1 in. diameter unless

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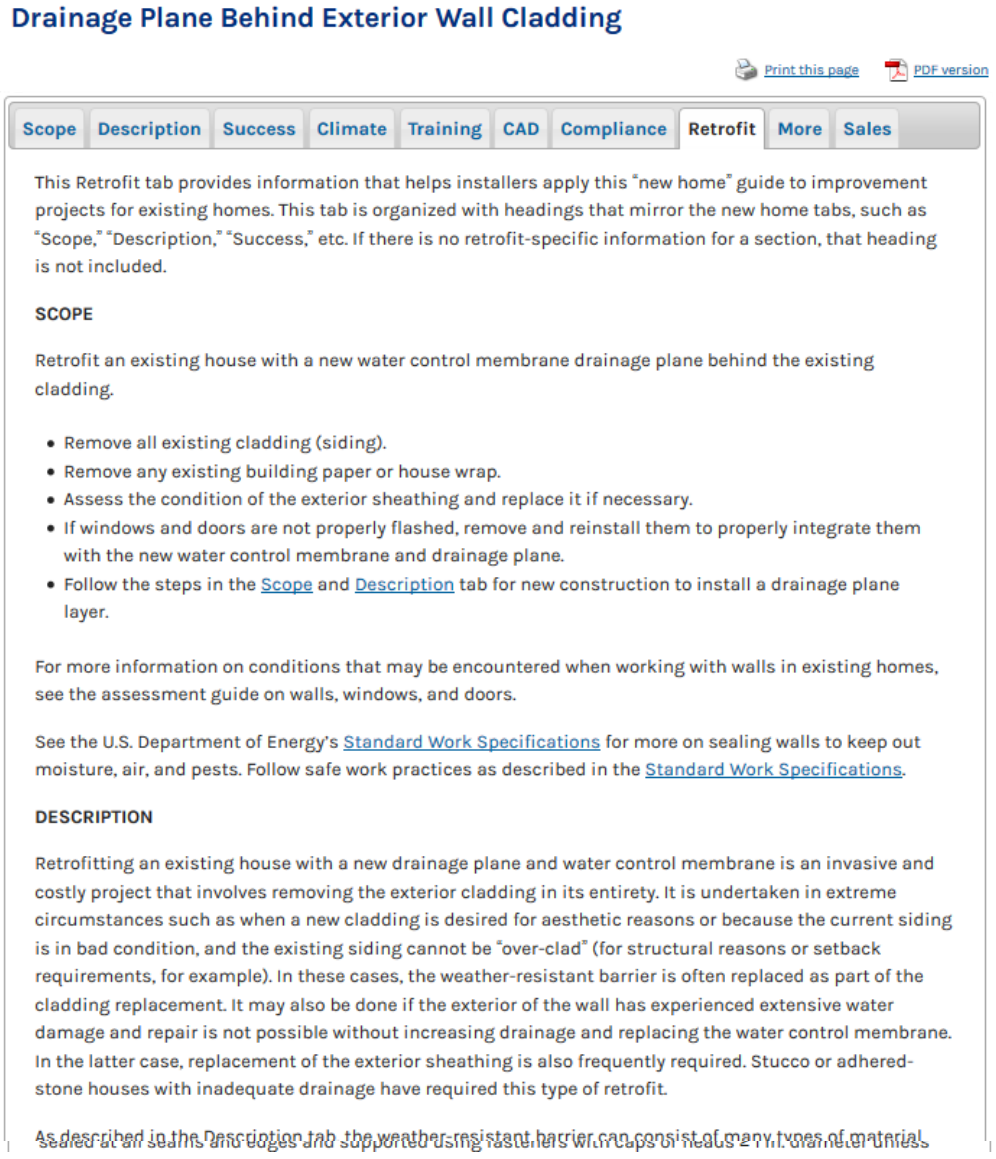

Drainage Plane Behind Exterior Wall Cladding

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Scope | Description | Success | Climate | Training | CAD | Compliance | **Retrofit** | More | Sales

This Retrofit tab provides information that helps installers apply this "new home" guide to improvement projects for existing homes. This tab is organized with headings that mirror the new home tabs, such as "Scope," "Description," "Success," etc. If there is no retrofit-specific information for a section, that heading is not included.

SCOPE

Retrofit an existing house with a new water control membrane drainage plane behind the existing cladding.

- Remove all existing cladding (siding).
- Remove any existing building paper or house wrap.
- Assess the condition of the exterior sheathing and replace it if necessary.
- If windows and doors are not properly flashed, remove and reinstall them to properly integrate them with the new water control membrane and drainage plane.
- Follow the steps in the Scope and Description tab for new construction to install a drainage plane layer.

For more information on conditions that may be encountered when working with walls in existing homes, see the assessment guide on walls, windows, and doors.

See the U.S. Department of Energy's Standard Work Specifications for more on sealing walls to keep out moisture, air, and pests. Follow safe work practices as described in the Standard Work Specifications.

DESCRIPTION

Retrofitting an existing house with a new drainage plane and water control membrane is an invasive and costly project that involves removing the exterior cladding in its entirety. It is undertaken in extreme circumstances such as when a new cladding is desired for aesthetic reasons or because the current siding is in bad condition, and the existing siding cannot be "over-clad" (for structural reasons or setback requirements, for example). In these cases, the weather-resistant barrier is often replaced as part of the cladding replacement. It may also be done if the exterior of the wall has experienced extensive water damage and repair is not possible without increasing drainage and replacing the water control membrane. In the latter case, replacement of the exterior sheathing is also frequently required. Stucco or adhered-stone houses with inadequate drainage have required this type of retrofit.

As described in the Description tab, the weather-resistant barrier can consist of many types of material

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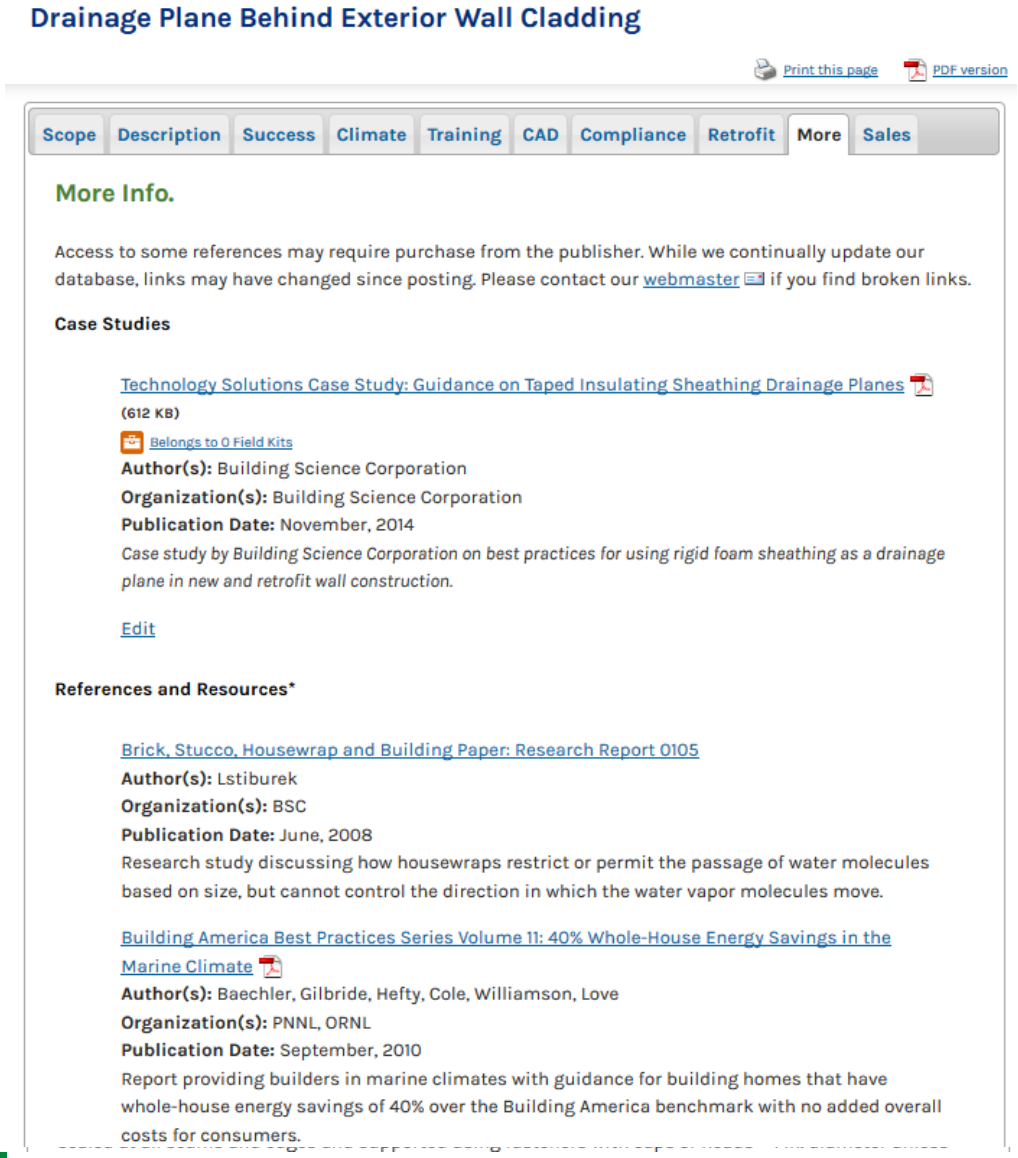

Drainage Plane Behind Exterior Wall Cladding

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Scope | Description | Success | Climate | Training | CAD | Compliance | Retrofit | More | Sales

More Info.

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Case Studies

Technology Solutions Case Study: Guidance on Taped Insulating Sheathing Drainage Planes (612 KB)

Belongs to 0 Field Kits

Author(s): Building Science Corporation
Organization(s): Building Science Corporation
Publication Date: November, 2014
Case study by Building Science Corporation on best practices for using rigid foam sheathing as a drainage plane in new and retrofit wall construction.

Edit

References and Resources*

Brick, Stucco, Housewrap and Building Paper: Research Report 0105
Author(s): Lstiburek
Organization(s): BSC
Publication Date: June, 2008
Research study discussing how housewraps restrict or permit the passage of water molecules based on size, but cannot control the direction in which the water vapor molecules move.

Building America Best Practices Series Volume 11: 40% Whole-House Energy Savings in the Marine Climate
Author(s): Baechler, Gilbride, Hefty, Cole, Williamson, Love
Organization(s): PNNL, ORNL
Publication Date: September, 2010
Report providing builders in marine climates with guidance for building homes that have whole-house energy savings of 40% over the Building America benchmark with no added overall costs for consumers.

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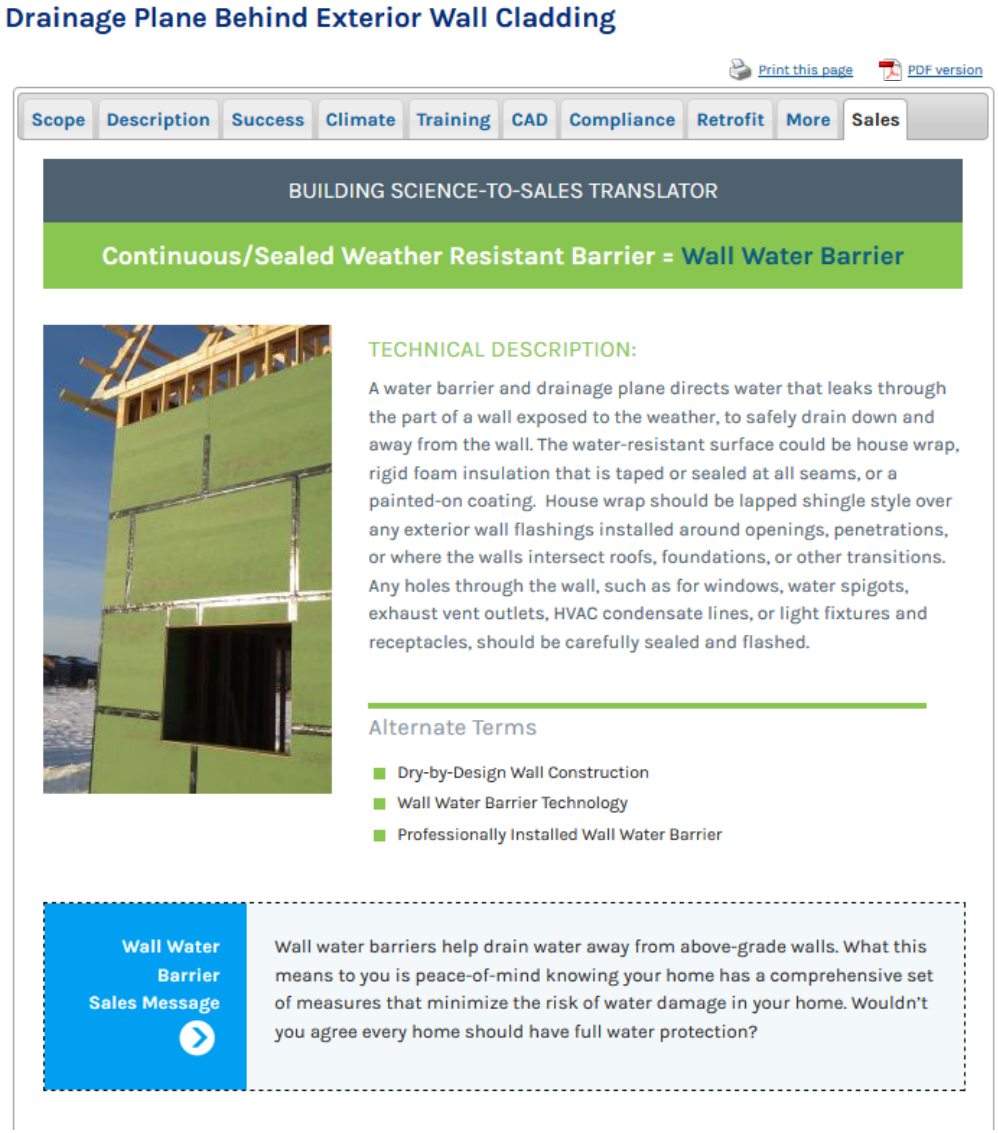

BASC Existing Homes Tool

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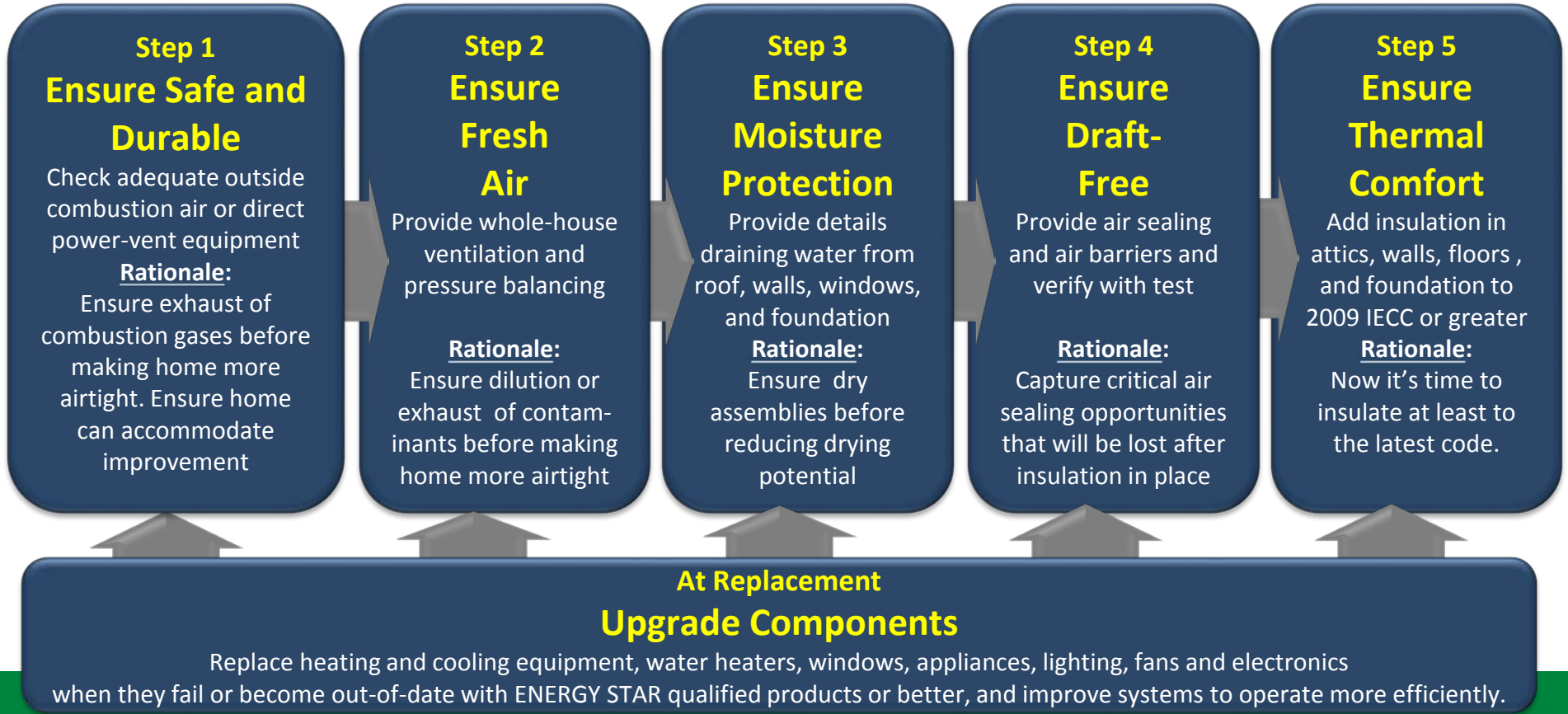
- Launched in October, 2017
- 90% populated
- Navigation based on the "Steps" to home performance:



BASC Existing Homes

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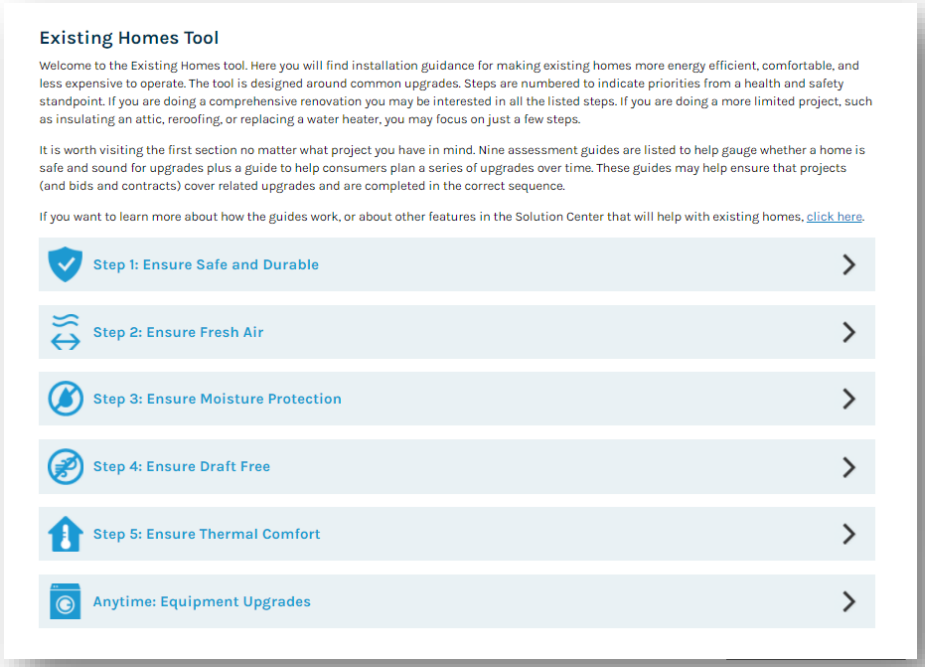

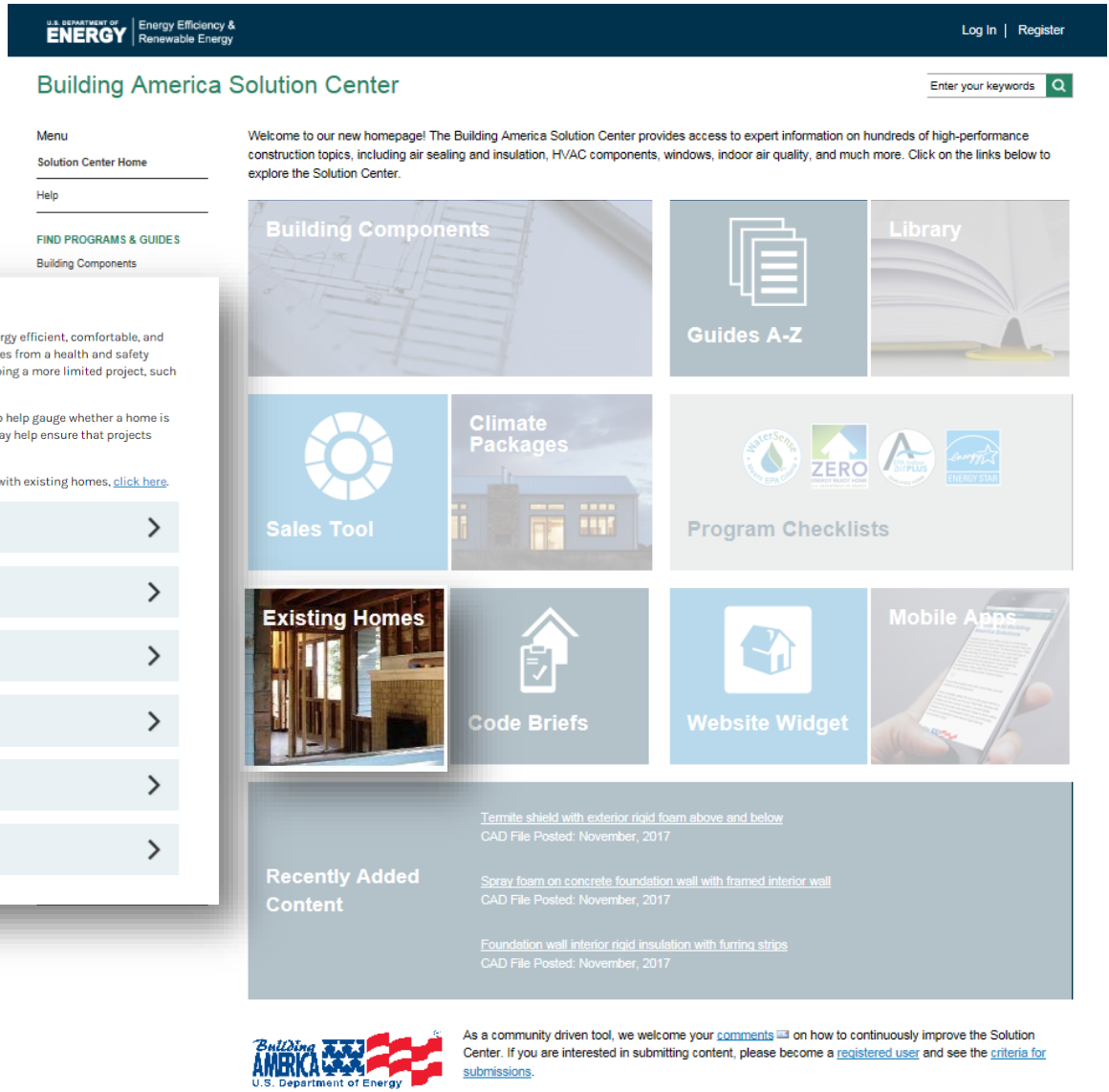

Pre-Retrofit Assessments

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Solution Center Home

Help

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Guides A-Z

Existing Homes

DOE Zero Energy Ready Home

ENERGY STAR Certified Homes

EPA Indoor airPLUS

EPA WaterSense®

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Pre-Retrofit Assessment of Hazardous Materials

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Remove or remediate hazardous materials that will be affected by the retrofit work or that may impact indoor air quality. The U.S. Environmental Protection Agency (EPA) document, Healthy Indoor Environment Protocols for Home Energy Upgrades, provides guidance on a number of hazardous materials including asbestos, lead, polychlorinated biphenals, and radon (along with other soil gases). It also talks about the role that tobacco smoke and home furnishings play as potential sources of indoor pollutants. The protocols provide additional information on all of the materials described here. Other references are included with each topic.

Asbestos

Vermiculite insulation between attic joists (image courtesy of EPA).

Asbestos is a naturally occurring silicate mineral that has historically been used in building materials. Cutting, tearing or abrasion of asbestos materials can release asbestos fibers into the air. If inhaled, the asbestos particles can cause lung cancer and other forms of lung disease. Examples of materials that might contain asbestos include vermiculite insulation in attics and walls, tape used to seal old ducts, insulation on steam pipes and ducts, door gaskets in furnaces, plaster in old houses, vinyl flooring, and wall cladding. To find out more about asbestos, see the EPA's asbestos website.

Volatile Organic Compounds

Volatile organic compounds (VOCs) include formaldehyde and a variety of other chemicals, some of which may have short- or long-term adverse health effects. VOCs can be found in insulation, cabinetry, carpets, paints, and stains. The U.S. Environmental Protection Agency's Indoor airPLUS Program recommends choosing no- and low-VOC versions of these types of products for installation in the home. The Building America Solution Center includes guides to help contractors meet the requirements of the EPA's Indoor airPLUS checklist. VOC-containing products such as solvents, cleansers, coatings, and fuels are often stored in the garage. Attached garages should be well sealed from living spaces and possibly ventilated with an exhaust fan as described in these guides. Furnace and air conditioner ducts and air handlers should not be located in garages, which could enable the spread of pollutants throughout the house as described in the guide No ducts or equipment in garages. Flammable solvents and fuels should not be stored in any part of a residential structure. To find out more about VOCs, visit the EPA's website on indoor air quality and volatile organic compounds.

Soil Gases including Radon

Air sealing to reduce heat loss may also reduce natural air changes in the home that dilute soil gases or indoor air pollutants, leading to increased concentrations of soil gases in the home. Air sealing steps should include air sealing of any cracks in and around the

CURRENT PROJECT:

Home Improvement Guides

Step 1: Ensure Safe and Durable

Pre-Retrofit Assessment of Hazardous Materials

BASC Existing Homes

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Existing Homes Tool

Welcome to the Existing Homes tool. Here you will find installation guidance for making existing homes more energy efficient, comfortable, and less expensive to operate. The tool is designed around common upgrades. Steps are numbered to indicate priorities from a health and safety standpoint. If you are doing a comprehensive renovation you may be interested in all the listed steps. If you are doing a more limited project, such as insulating an attic, reroofing, or replacing a water heater, you may focus on just a few steps.

It is worth visiting the first section no matter what project you have in mind. Nine assessment guides are listed to help gauge whether a home is safe and sound for upgrades plus a guide to help consumers plan a series of upgrades over time. These guides may help ensure that projects (and bids and contracts) cover related upgrades and are completed in the correct sequence.

If you want to learn more about how the guides work, or about other features in the Solution Center that will help with existing homes, click here.

BASC Existing Homes

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Step 5: Ensure Thermal Comfort

The following categories provide information about adding insulation in attics, walls, floors, and foundation to 2009 IECC or greater levels. Consult Step 1, Step 2, Step 3 and Step 4 before completing items here.

Click on the links below for detailed information about each topic in this step:

- Insulate Existing Attic or Roof
- Insulate Existing Exterior Walls
- Insulate Existing Foundations
- Insulate Existing Floors over Unconditioned Space
- Upgrade Windows
- Place HVAC Equipment and Ducts in Conditioned Space
- Dehumidification in Hot-Humid Climates

CURRENT PROJECT:

Home Improvement Guides

Step 5: Ensure Thermal Comfort

BASC Existing Homes

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

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- Insulate Existing Floors over Unconditioned Space
- Upgrade Windows
- Place HVAC Equipment and Duc… …ned Space
  - Air Sealed, Insulated Basements
  - Ducts in Dropped Ceilings
  - Ducts in Interstitial Floor Framing
  - Ducts in Raised Ceiling Sections
  - No Ducts or Air Handlers Located in Garage
  - Unvented, Insulated Crawlspaces
- Dehumidification in Hot-Humid Climates

Click

CURRENT PROJECT:

Home Improvement Guides

Step 5: Ensure Thermal Comfort

BASC Existing Homes

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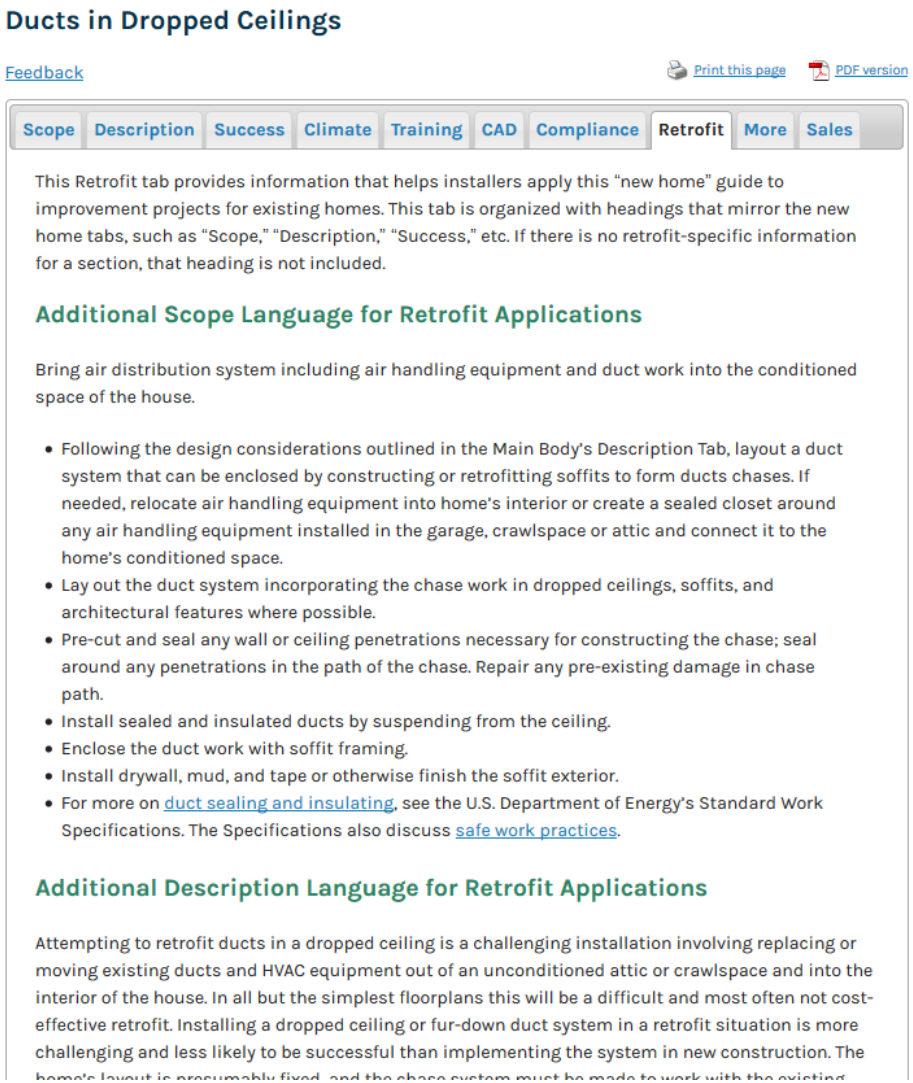


Ducts in Dropped Ceilings

Feedback

Print this page PDF version

Scope | Description | Success | Climate | Training | CAD | Compliance | **Retrofit** | More | Sales

This Retrofit tab provides information that helps installers apply this "new home" guide to improvement projects for existing homes. This tab is organized with headings that mirror the new home tabs, such as "Scope," "Description," "Success," etc. If there is no retrofit-specific information for a section, that heading is not included.

Additional Scope Language for Retrofit Applications

Bring air distribution system including air handling equipment and duct work into the conditioned space of the house.

- Following the design considerations outlined in the Main Body's Description Tab, layout a duct system that can be enclosed by constructing or retrofitting soffits to form ducts chases. If needed, relocate air handling equipment into home's interior or create a sealed closet around any air handling equipment installed in the garage, crawlspace or attic and connect it to the home's conditioned space.
- Lay out the duct system incorporating the chase work in dropped ceilings, soffits, and architectural features where possible.
- Pre-cut and seal any wall or ceiling penetrations necessary for constructing the chase; seal around any penetrations in the path of the chase. Repair any pre-existing damage in chase path.
- Install sealed and insulated ducts by suspending from the ceiling.
- Enclose the duct work with soffit framing.
- Install drywall, mud, and tape or otherwise finish the soffit exterior.
- For more on duct sealing and insulating, see the U.S. Department of Energy's Standard Work Specifications. The Specifications also discuss safe work practices.

Additional Description Language for Retrofit Applications

Attempting to retrofit ducts in a dropped ceiling is a challenging installation involving replacing or moving existing ducts and HVAC equipment out of an unconditioned attic or crawlspace and into the interior of the house. In all but the simplest floorplans this will be a difficult and most often not cost-effective retrofit. Installing a dropped ceiling or fur-down duct system in a retrofit situation is more challenging and less likely to be successful than implementing the system in new construction. The home's layout is presumably fixed, and the chase system must be made to work with the existing

CURRENT PROJECT:

- Home Improvement Guides
- Step 5: Ensure Thermal Comfort
- Place HVAC Equipment and Ducts in Conditioned Space
- **Ducts in Dropped Ceilings**

- Project map tracks existing homes tool clicks.
- User lands either on the scope tab or retrofit tab.

BASC/SWS Links

- Links to SWS available on all BASC retrofit guides, embedded in scoping statements
- Take user directly to the associated SWS content
- BASC image gallery integrates photos from SWS Flicker account
- SWS links user to BASC

BASC/SWS linkages

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Whole House Ventilation Strategies for Existing Homes

Feedback

Scope | Description | Success | Climate | Training | CAD | Compliance | More

Scope

To assess and upgrade the ventilation system in an existing home, do the following:

- Preliminary Planning
  - Determine project goals with respect to ventilation.
  - Determine what code or program requirements must be met.
  - Assess existing ventilation systems (including local ventilation for kitchen and bathrooms).
  - Assess existing heating and cooling systems – especially if new ventilation may be integrated with existing HVAC systems.
- Determine the most appropriate type of ventilation.
- Install and commission ventilation system.

This HRV, installed in a con… provides balanced ventilati… home

For an overview of whole-building ventilation systems, see the Building America Solution Center guide Whole-Building Delivered Ventilation. For information on assessing the performance of existing ventilation systems, see the Pre-Retrofit Assessment of Ventilation Systems.

The U.S. Department of Energy's Standard Work Specifications have additional information on ventilation systems.

Last Updated: 03/06/2018

NREL NATIONAL RENEWABLE ENERGY LABORATORY

Standard Work Specifications Tool

Home | About | Help | Contact Us | My Account | Sign In

Search All Topics | Go

Health & Safety | Air Sealing | Insulation | Heating & Cooling | Ventilation | Baseload

Keyword

ventilation

Housing Type

- Single-Family Homes (34)
- Manufactured Housing (28)
- Multifamily Homes (55)

Section

- 2 Health & Safety (12)
- 3 Air Sealing (8)
- 4 Insulation (18)
- 5 Heating & Cooling (17)
- 6 Ventilation (39)
- 7 Baseload (5)

Search Results

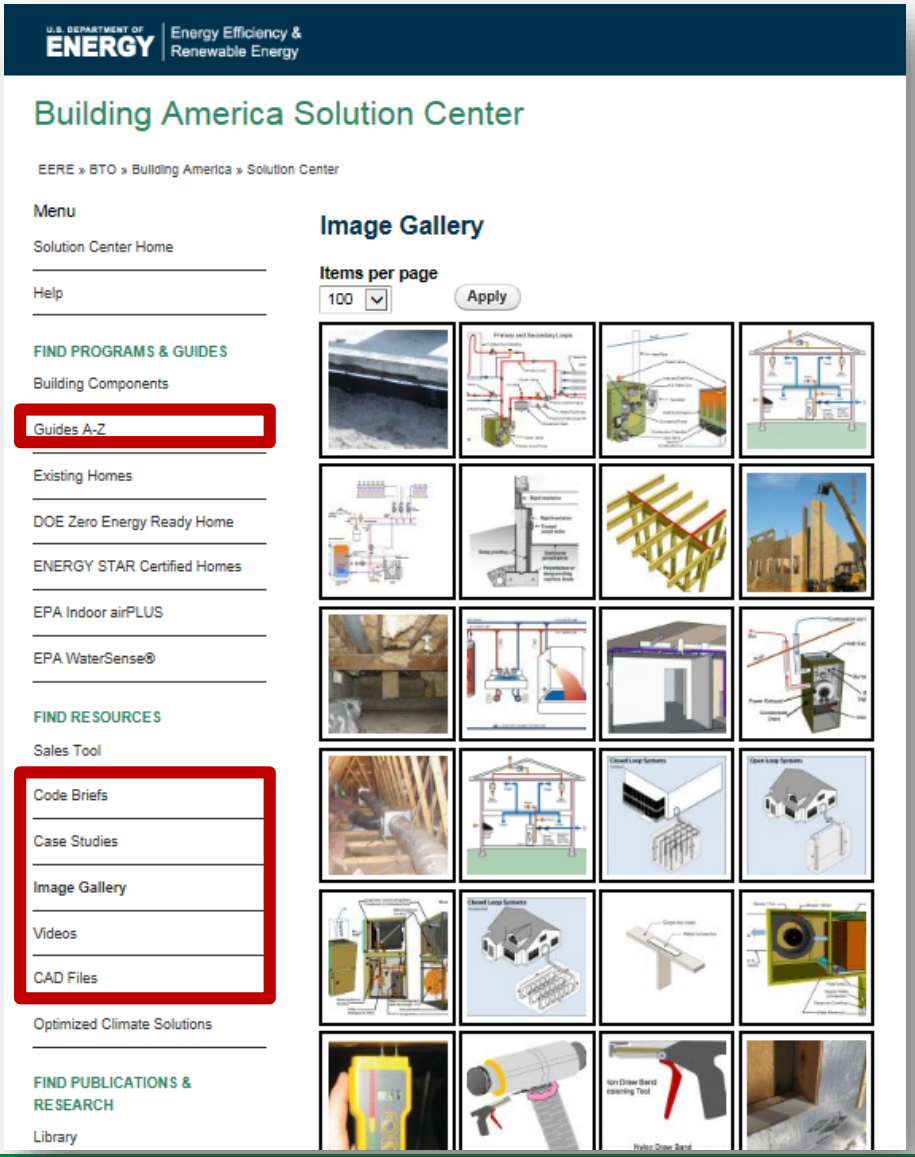
Results 1 - 10 of 99

6.6204.1 **Commissioning Ventilation Systems**
Topic: Whole Building Ventilation
Subtopic: System Evaluation
Desired Outcome: Verify proper operation of existing system,installed system air flow meets required standard and provides continuous ventilation for background pollutant sources
Available In: Single-Family Homes, Manufactured Housing

6.6102.1 **Outside Air Ventilation Supply Ducts**
Topic: Supply
Subtopic: Components
Desired Outcome: Ventilation supply ducts effectively move the required amount of air and prevent condensation
Available In: Single-Family Homes

3.1602.15 **Ventilation Existing Duct Sealing (All Building Types)**
Topic: Ducts
Subtopic: Duct Sealing
Desired Outcome: Improved effectiveness and efficiency of ventilation distribution

BASC Content Browsers



Build presentations, training materials and construction documentation using BASC Content Browsers:

- Code Briefs
- Case Studies
- Image Gallery
- CAD Files
- Videos
- Guides A-Z

BASC Content Browsers

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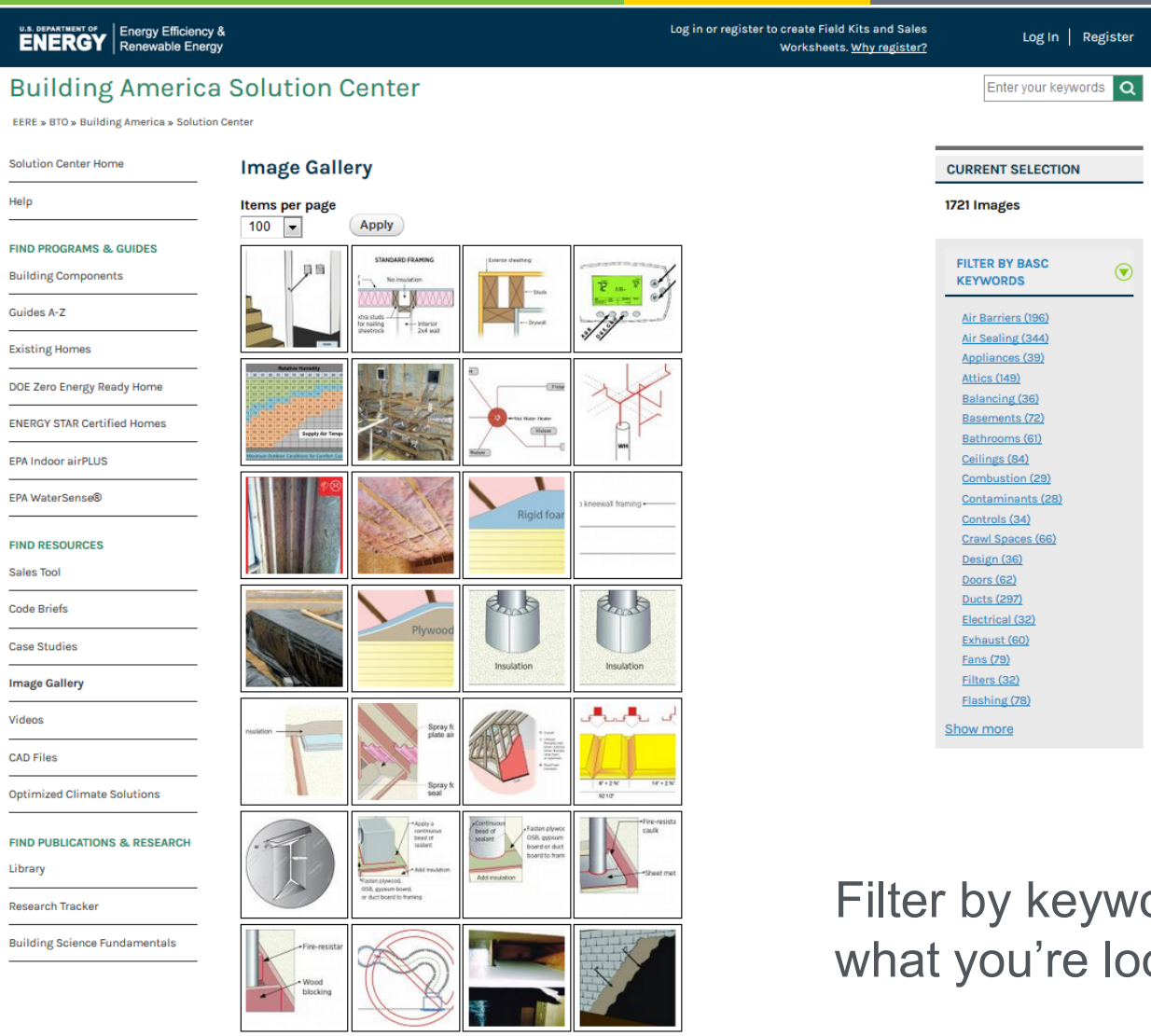
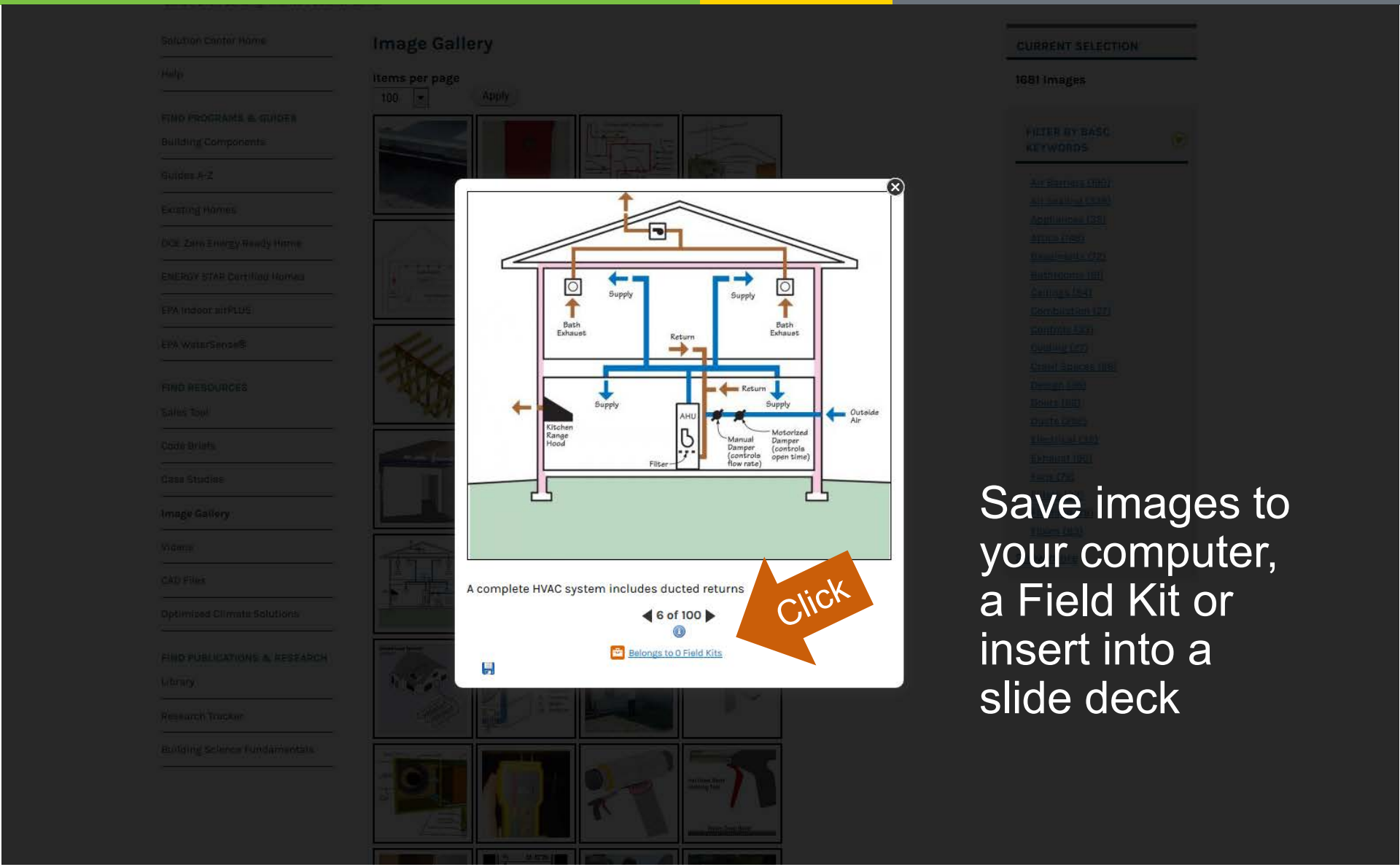


Filter by keyword to find what you're looking for

Construction Documents: Image Gallery

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy



Save images to your computer, a Field Kit or insert into a slide deck

Construction Documents: CAD Files

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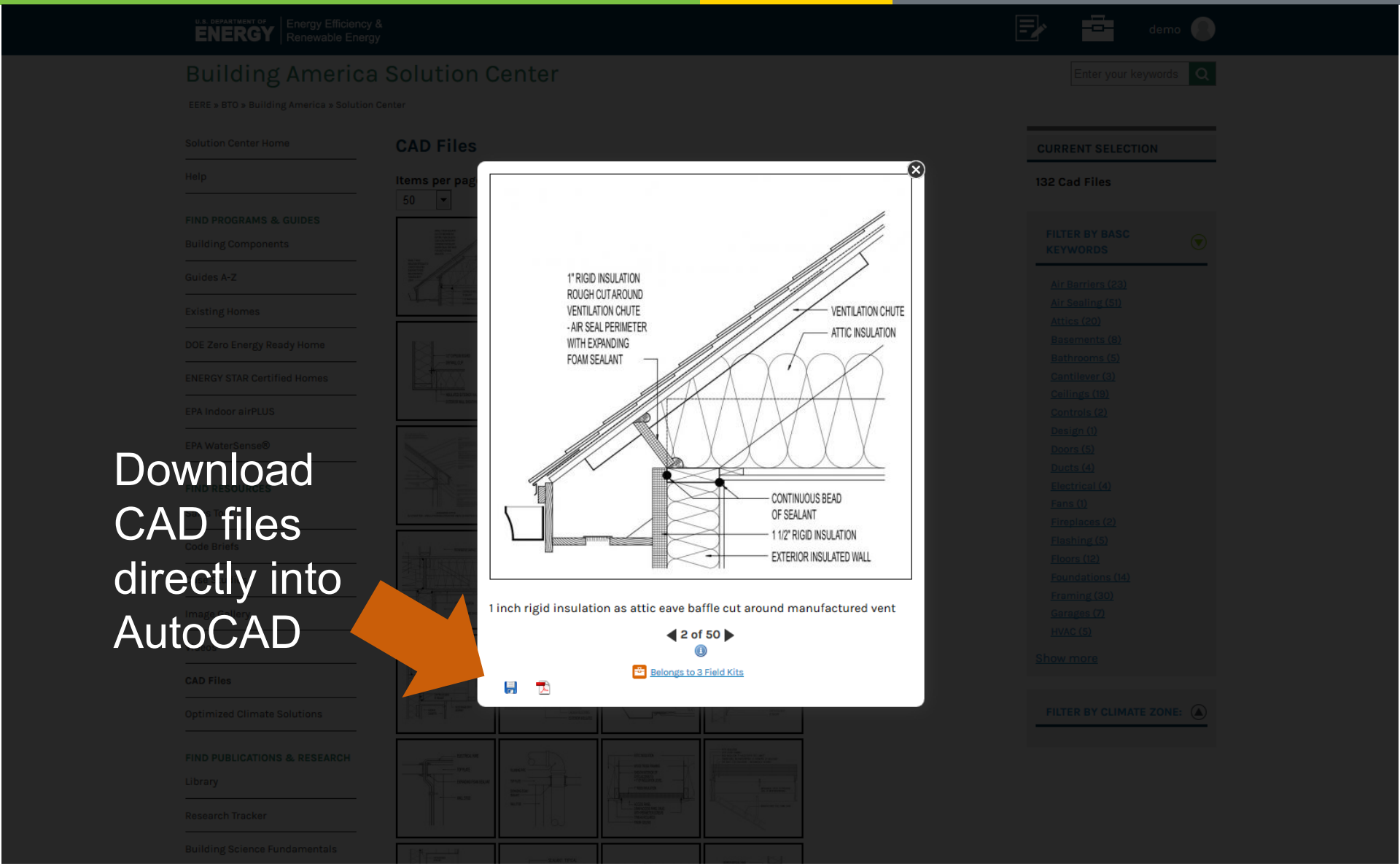
Download CAD files directly into AutoCAD



BASC Program Checklists

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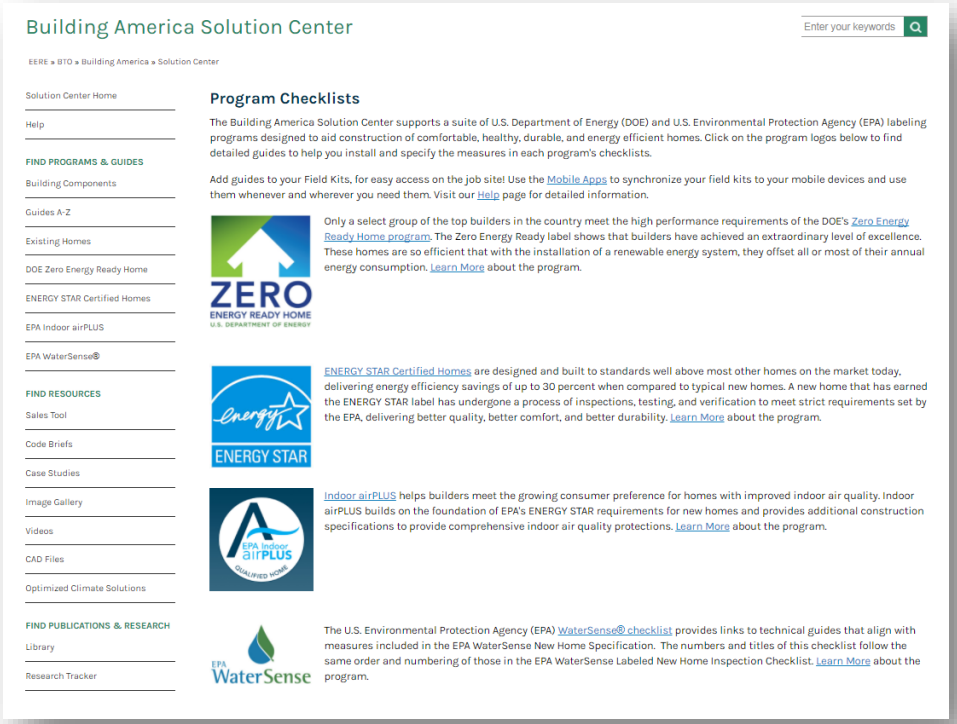
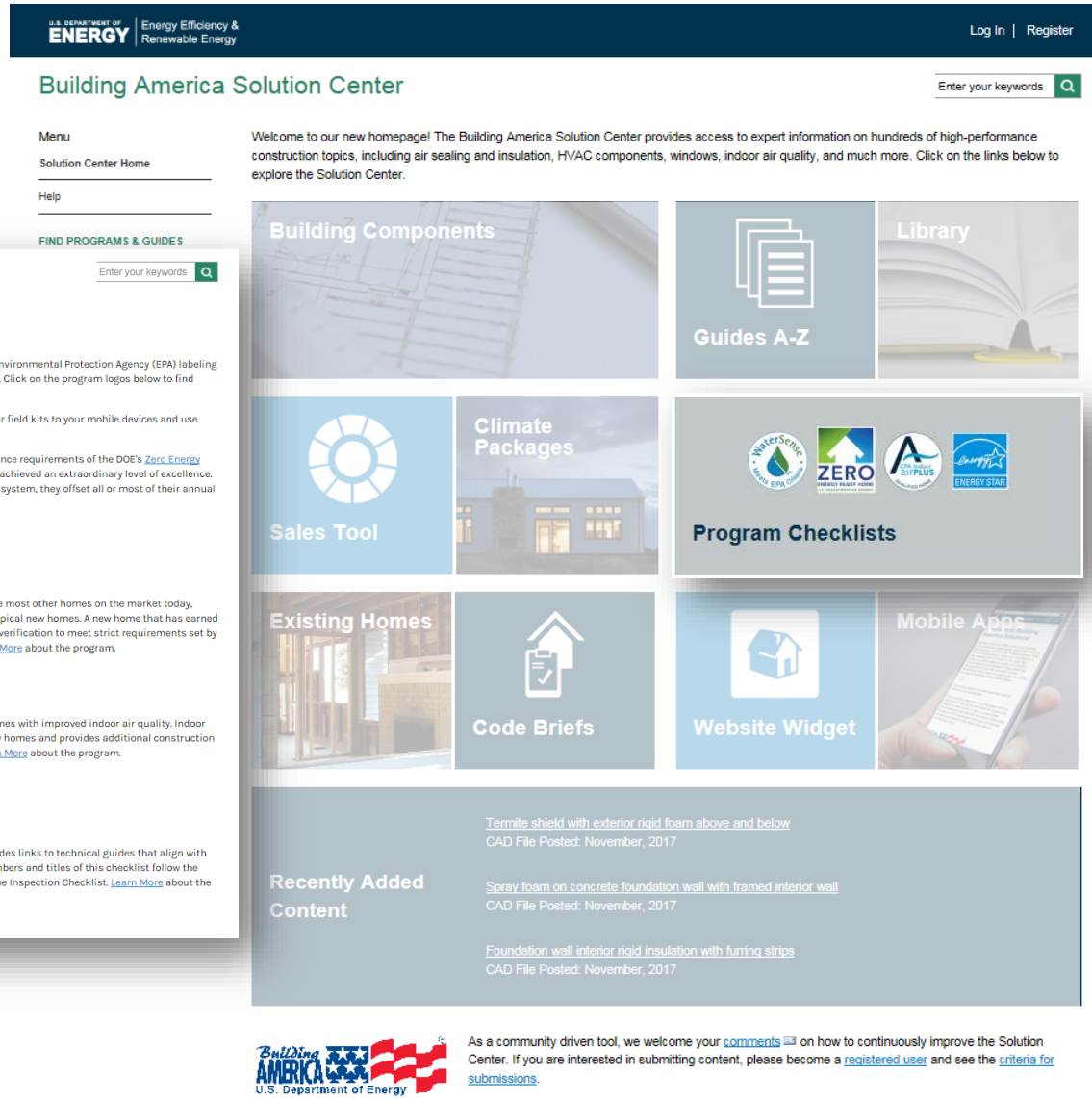
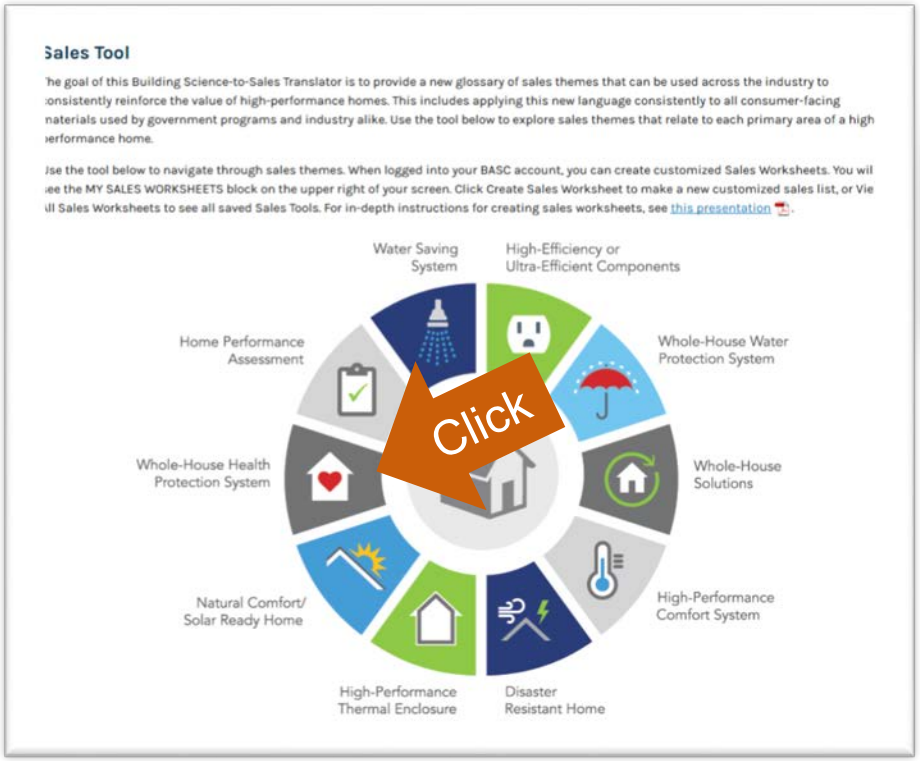
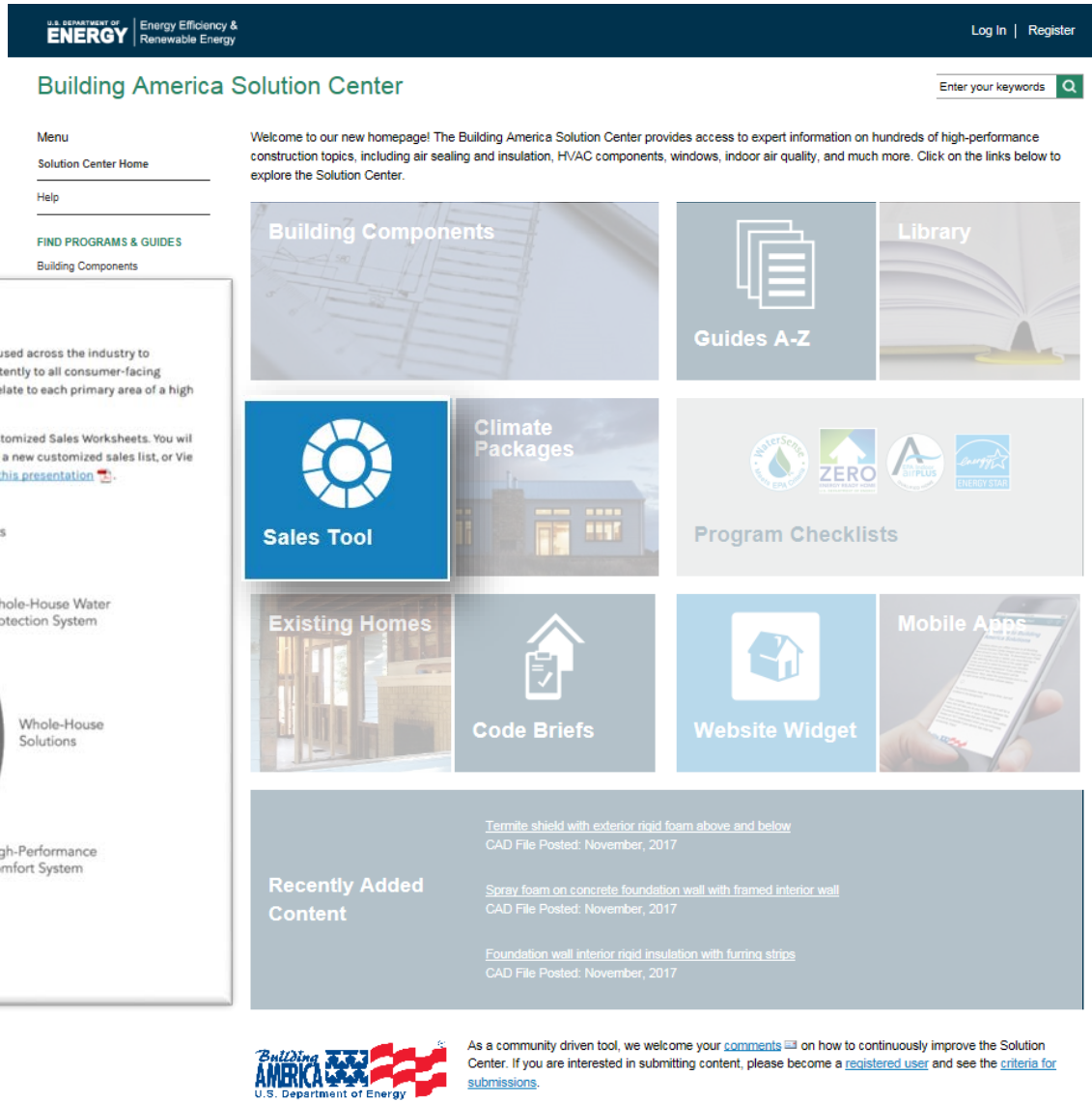




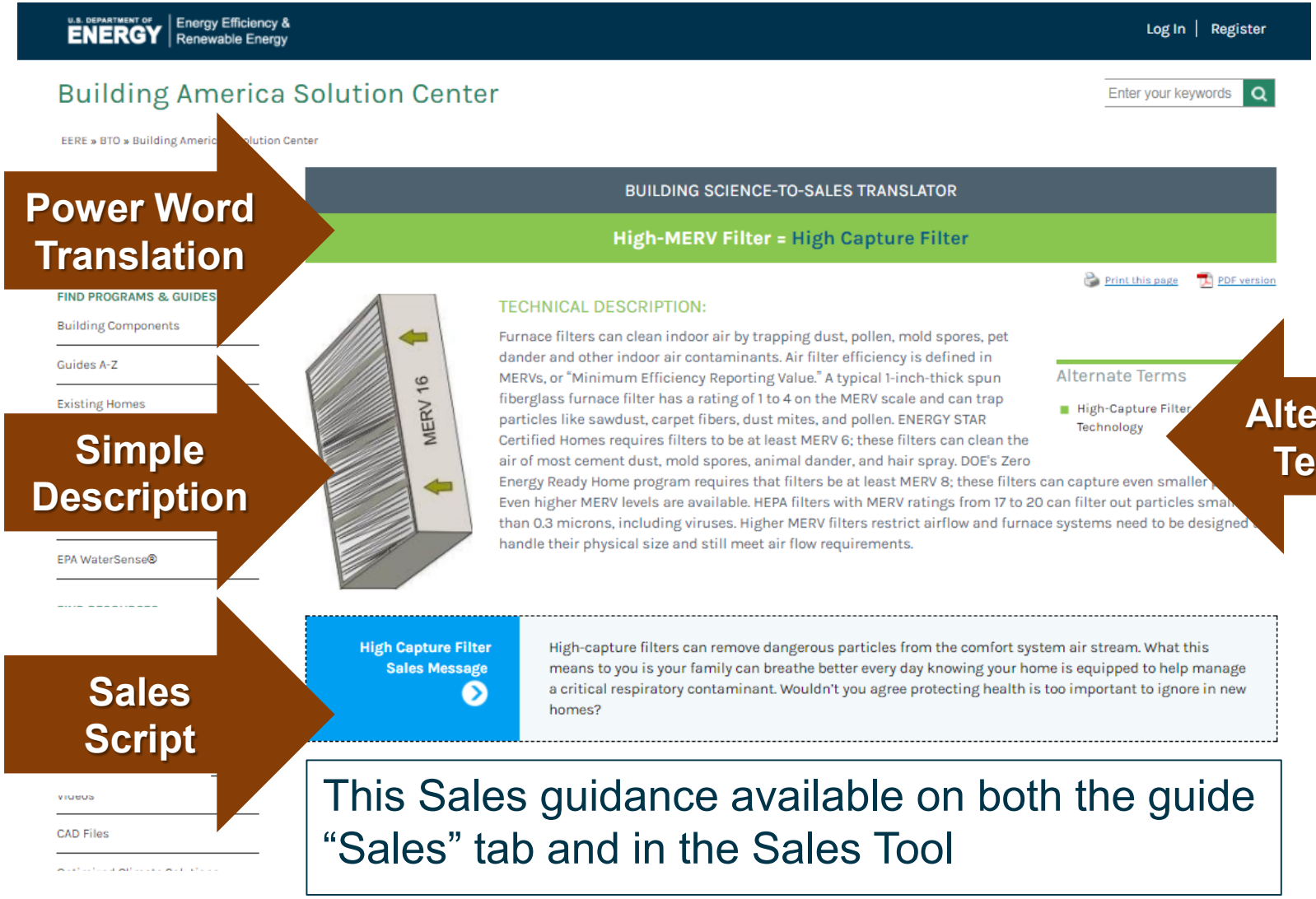
BASC Sales Tool

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy





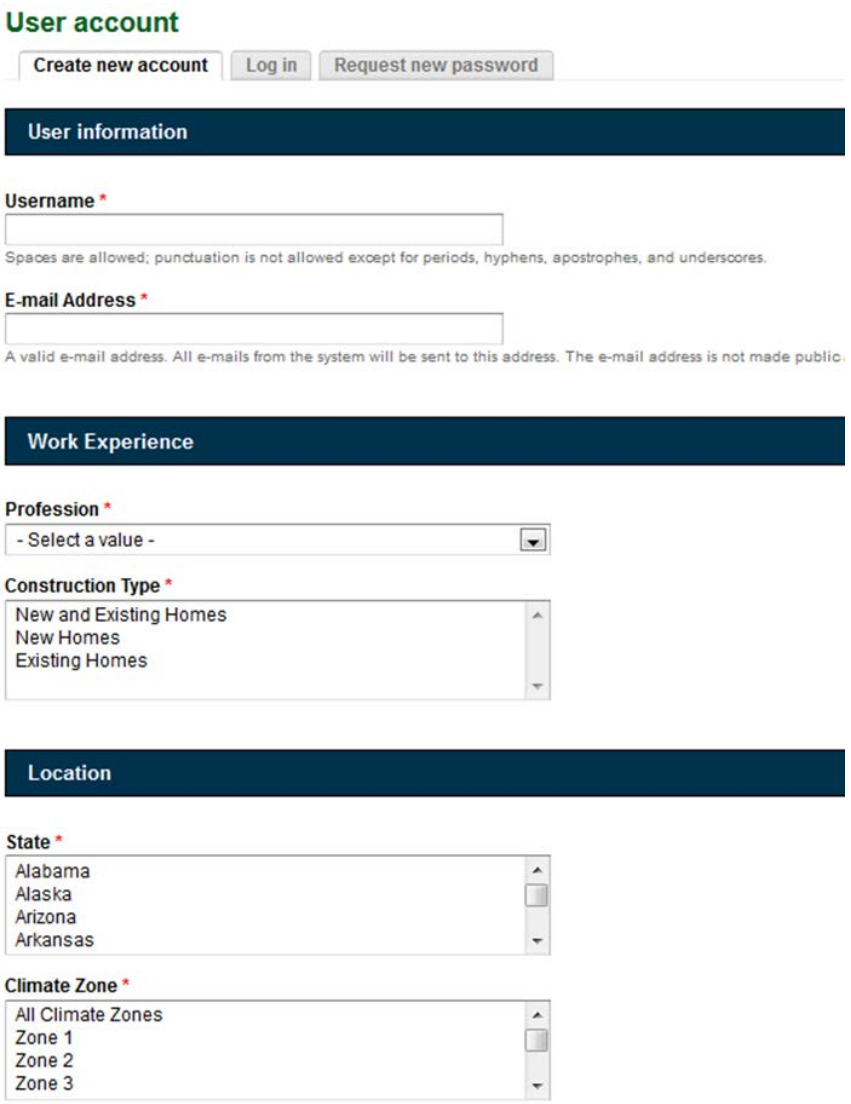
BASC Sales Tool



This Sales guidance available on both the guide "Sales" tab and in the Sales Tool

Register to Customize BASC Content

- Create Field Kits
- Create Point-of-Sale Fact Sheets and Training Materials
- Access saved and created content from your mobile device



Develop Guidance Materials

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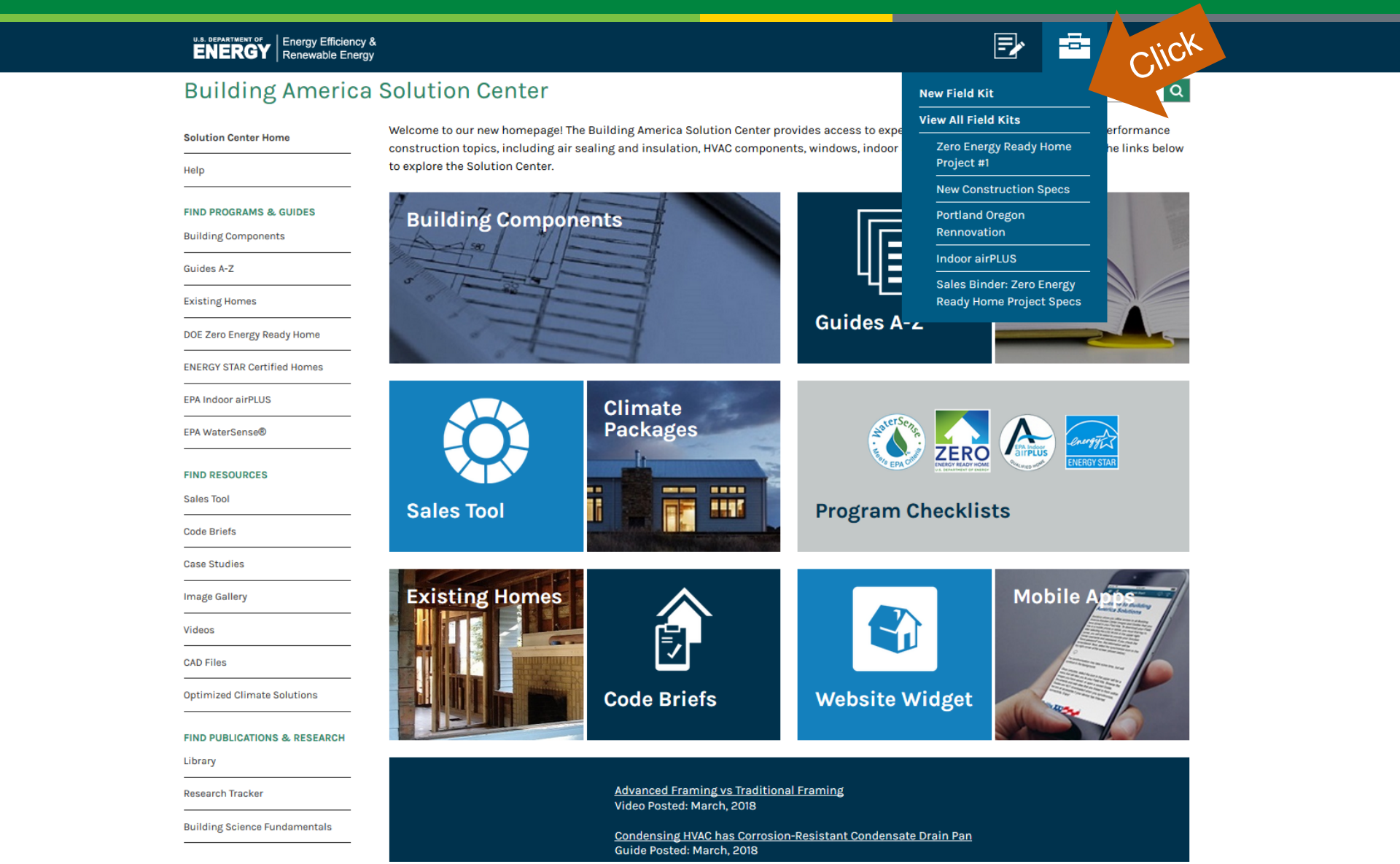

Develop Guidance Materials

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DOE Zero Energy Ready Home

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Optimized Climate Solutions

FIND PUBLICATIONS & RESEARCH

Library

Research Tracker

Building Science Fundamentals

Ducted Returns

Feedback

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Belongs to 0 Field Kits

Click

Scope | Description | Success | Climate | Training | CAD | Compliance | Retrofit | More | Sales

Scope

Provide for pressure balancing between bedrooms and the rest of the house.

- Install ducted returns or a combination of ducted returns, transfer grilles, jump ducts, and/or door undercuts in bedrooms to allow pressure balancing between bedrooms and the rest of the house in homes with ducted heating and cooling systems by providing a path for room air to return to the central air handler, thereby increasing the volume of conditioned air circulating in the room.
- Do not use building cavities alone for return air pathways. Return pathways should be ducted from the return grille to the return plenum of the central air handler. The return ducts should be sealed with mastic or metal tape at all seams and joints.
- ENERGY STAR Certified Homes requires that the dedicated return ducts, transfer grilles, jump ducts, and/or door undercuts together achieve a rater-measured pressure differential of ≤3 Pascals (0.012 inch water column) with respect to the main body of the house when bedroom doors are closed and the air handler is operating on the highest design fan speed. A rater-measured pressure differential of ≤5 Pascals (0.020 inch water column) is acceptable for rooms with a design airflow ≥150 cfm.
- Refer to the balancing report provided by the HVAC contractor for the bedroom air flows to size the return ducts. If a balancing report was not provided, the flow of the supply register when the air handler is on high speed may need to be measured using a flow hood, anemometer, or other flow measurement tool.
- Test the pressure differential with the bedroom doors closed.

A ducted central return brings air from central return registers back to the air handler through insulated, air-sealed ducts

See the Compliance Tab for related codes and standards requirements, and criteria to meet national programs such as DOE's Zero Energy Ready Home program, ENERGY STAR Certified Homes, and Indoor airPLUS.

Last Updated: 03/13/2018

BASC Field Kits for Guidance Materials

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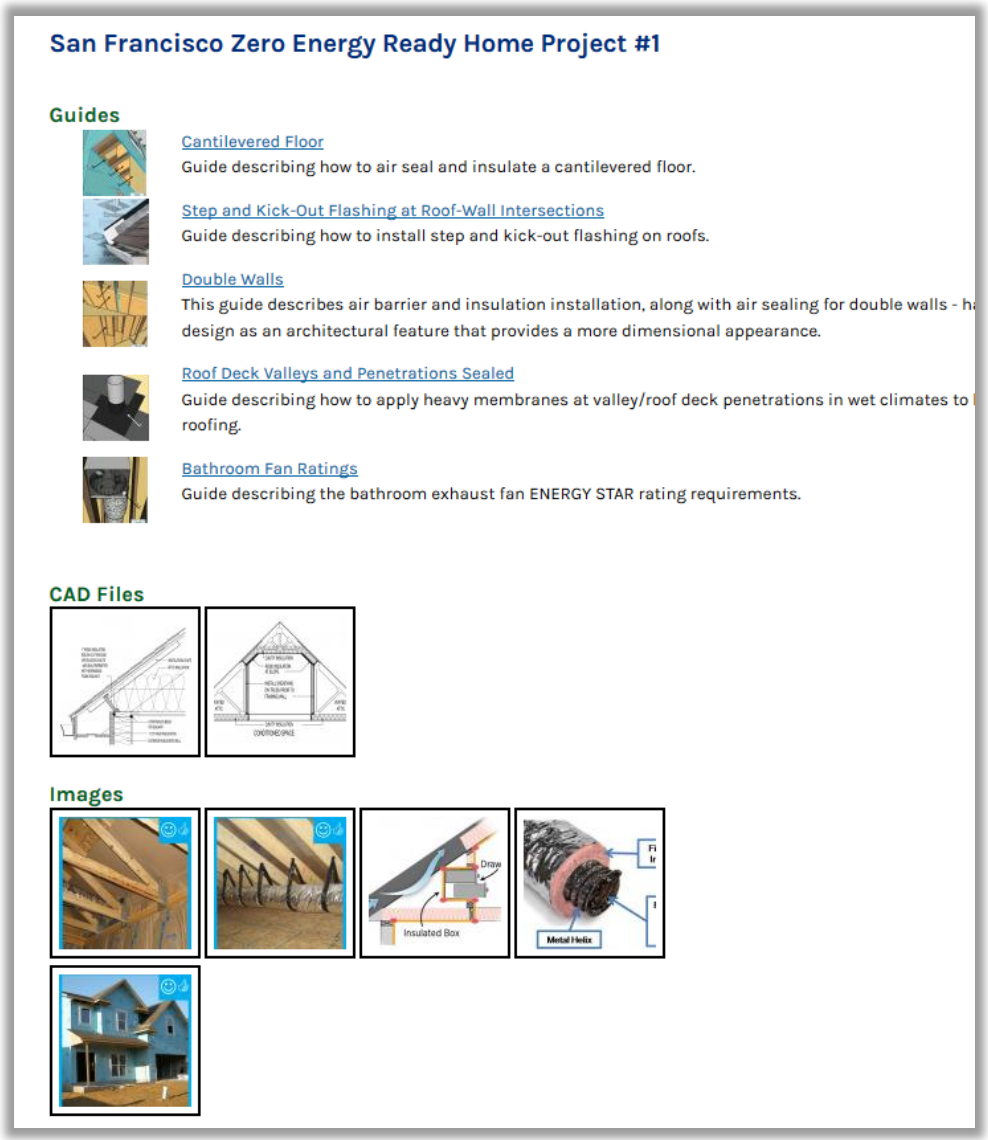
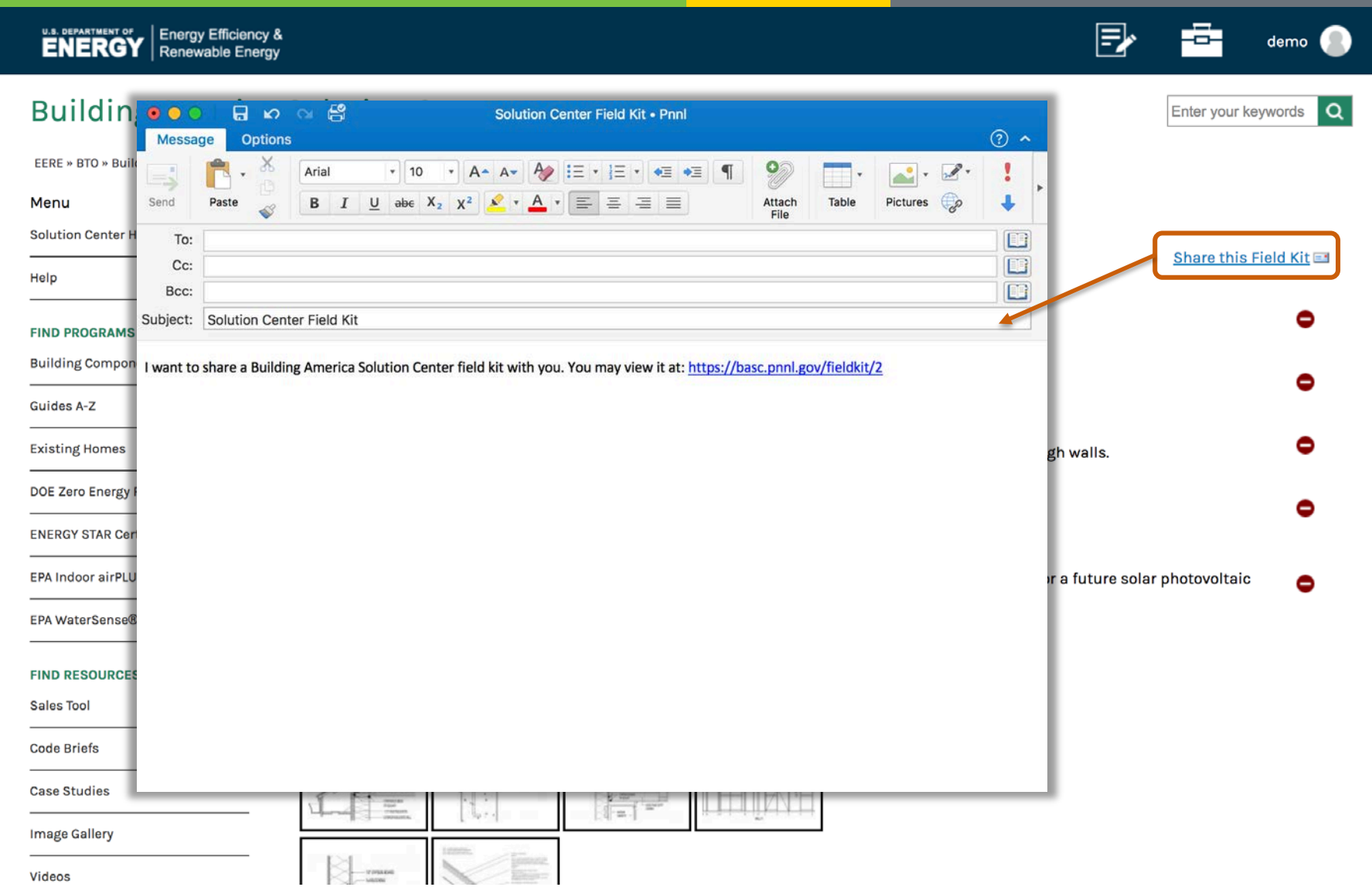


Create Field Kits to train installation crews. Add any type of BASC content:

- CAD files
- Images
- Guides
- Information Guides
- Videos
- Case Studies
- Sales Messages

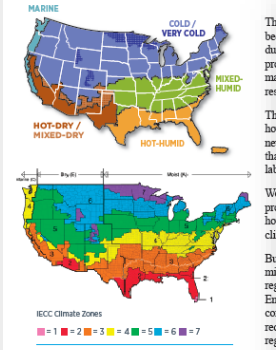
Share Field Kits



BASC Library

BASC Climate Packages

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy



Climate Zone Maps

Map of Building America climate regions (top) for program reporting and IECC climate zones (bottom) as a reference for compliance information

Building America U.S. Department of Energy

BUILDING TECHNOLOGIES OFFICE

2 BUILDING AMERICA'S OPTIMIZED SOLUTIONS FOR NEW HOMES: COLD CLIMATE

DOE's Building America Solution Center

Decades of research in energy efficient design have led to the Building America Solution Center. Builders and contractors are encouraged to use this resource to improve the durability and performance of energy efficiency options listed in Table 1.

The Building America Solution Center provides access to expert information on hundreds of high-performance construction topics, including air sealing and insulation, HVAC components, windows, indoor air quality, and much more.

Users can navigate the Solution Center in one of four ways:

- Building components
- Labeling program checklists
- Alphabetically
- By publications

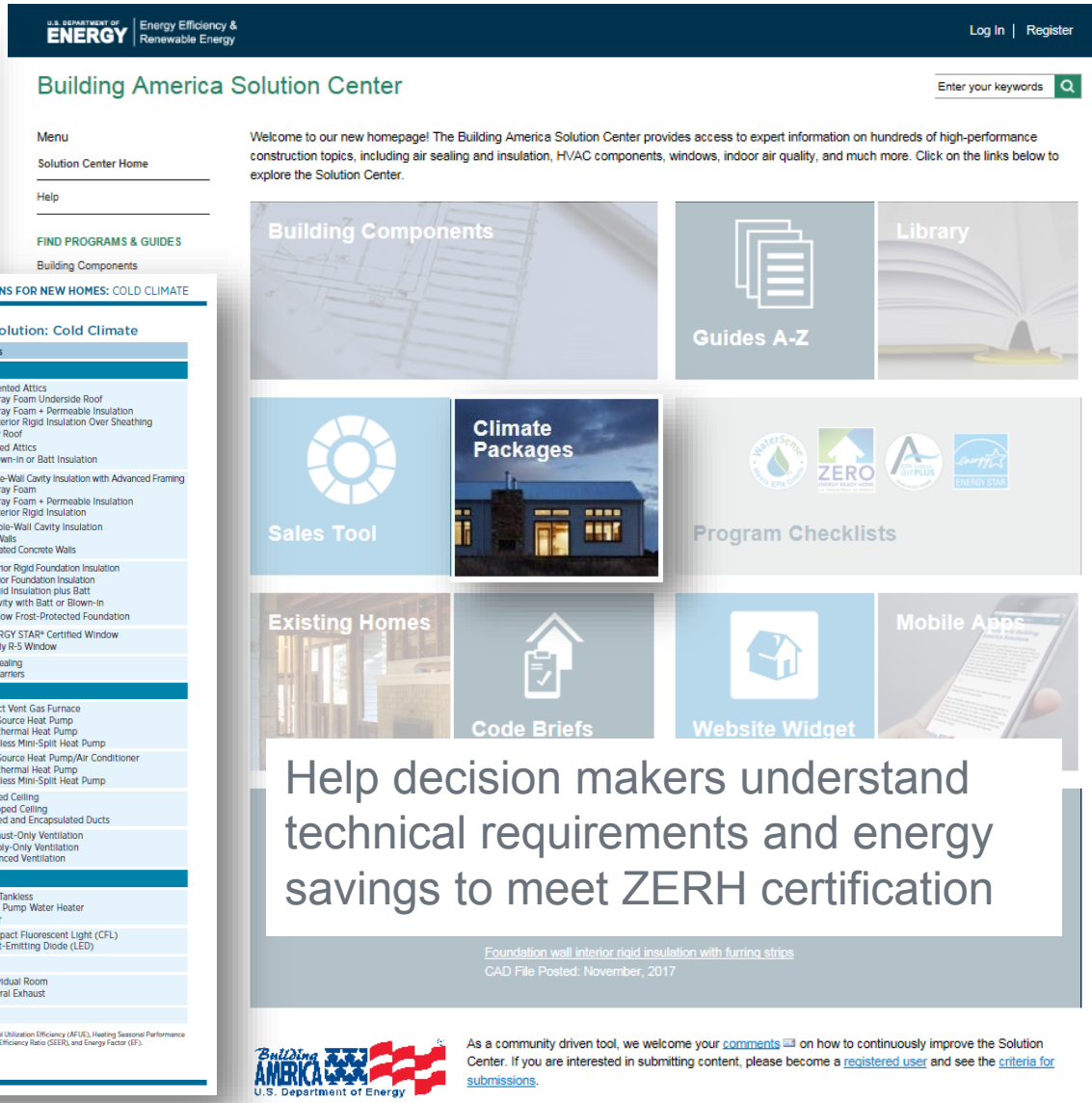
Registered users can also save customized content in their own field-kits!

Find what you are looking for on the Building America Solution Center website: ***basc.energy.gov***

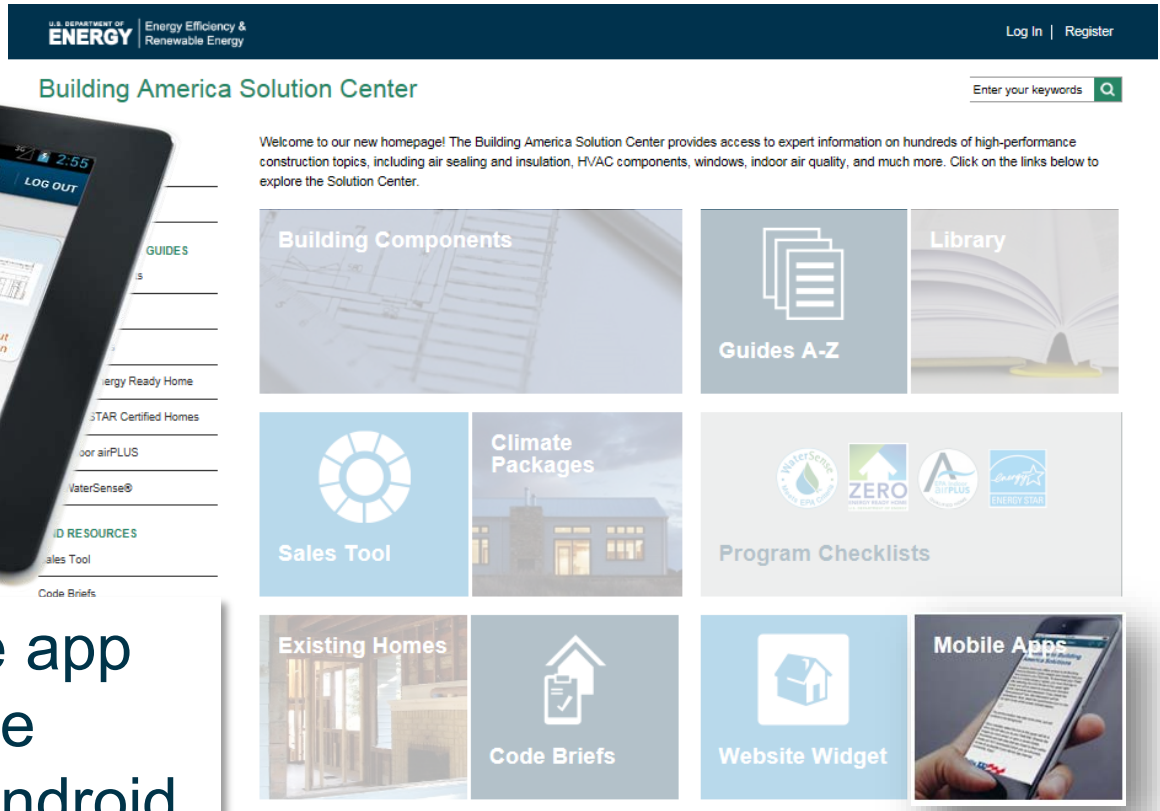
Table 1. Optimized Solution: Cold Climate

Measure	Performance	Options
THERMAL ENCLOSURE		
High-R Ceiling	R-49	• Unvented Attics - Spray Foam Underside Roof - Spray Foam + Permeable Insulation - Exterior Rigid Insulation Over Sheathing - SIP Roof • Vented Attics - Blown-in or Batt Insulation
High-R Walls	R-20 Cavity and R-10 Continuous	• Single-Wall Cavity Insulation with Advanced Framing - Spray Foam - Spray Foam + Permeable Insulation - Exterior Rigid Insulation • Double-Wall Cavity Insulation • SIP Walls • Insulated Concrete Walls
Basement Foundation	R-15 Continuous or R-19 Cavity	• Exterior Rigid Foundation Insulation • Interior Foundation Insulation - Rigid Insulation plus Batt - Cavity with Batt or Blown-In • Shallow Frost-Protected Foundation
High-R Window	U≤0.27 (R≥3.7) SHGC≥0.46	• ENERGY STAR® Certified Window • Ideally R-5 Window
Air Tightness	ACH50≤2	• Air Sealing • Air Barriers
HVAC SYSTEM		
Heating Equipment	94% AFUE (Gas), or 10 HSPF (Electric)	• Direct Vent Gas Furnace • Air-Source Heat Pump • Geothermal Heat Pump • Ductless Mini-Split Heat Pump
Cooling Equipment	13 SEER	• Air-Source Heat Pump/Air Conditioner • Geothermal Heat Pump • Ductless Mini-Split Heat Pump
Duct Location	Conditioned Space	• Raised Ceiling • Dropped Ceiling • Buried and Encapsulated Ducts
Whole-House Ventilation	ASHRAE 62.2 5 cfm/W and 70% Heat Recovery	• Exhaust-Only Ventilation • Supply-Only Ventilation • Balanced Ventilation
ENERGY EFFICIENT COMPONENTS		
Water Heating	EF 0.8	• Gas Tankless • Heat Pump Water Heater • Solar
Lighting	ENERGY STAR	• Compact Fluorescent Light (CFL) • Light-Emitting Diode (LED)
Appliances	ENERGY STAR	
Exhaust Fans	ENERGY STAR	• Individual Room • Central Exhaust
Ceiling Fans	ENERGY STAR	

Abbreviations: Solar Heat Gain Coefficient (SHGC), Annual Fuel Utilization Efficiency (AFUE), Heating Seasonal Performance Factor (HSPF), Air Changes Per Hour (ACH), Seasonal Energy Efficiency Ratio (SEER), and Energy Factor (EF).



BASC Mobile App

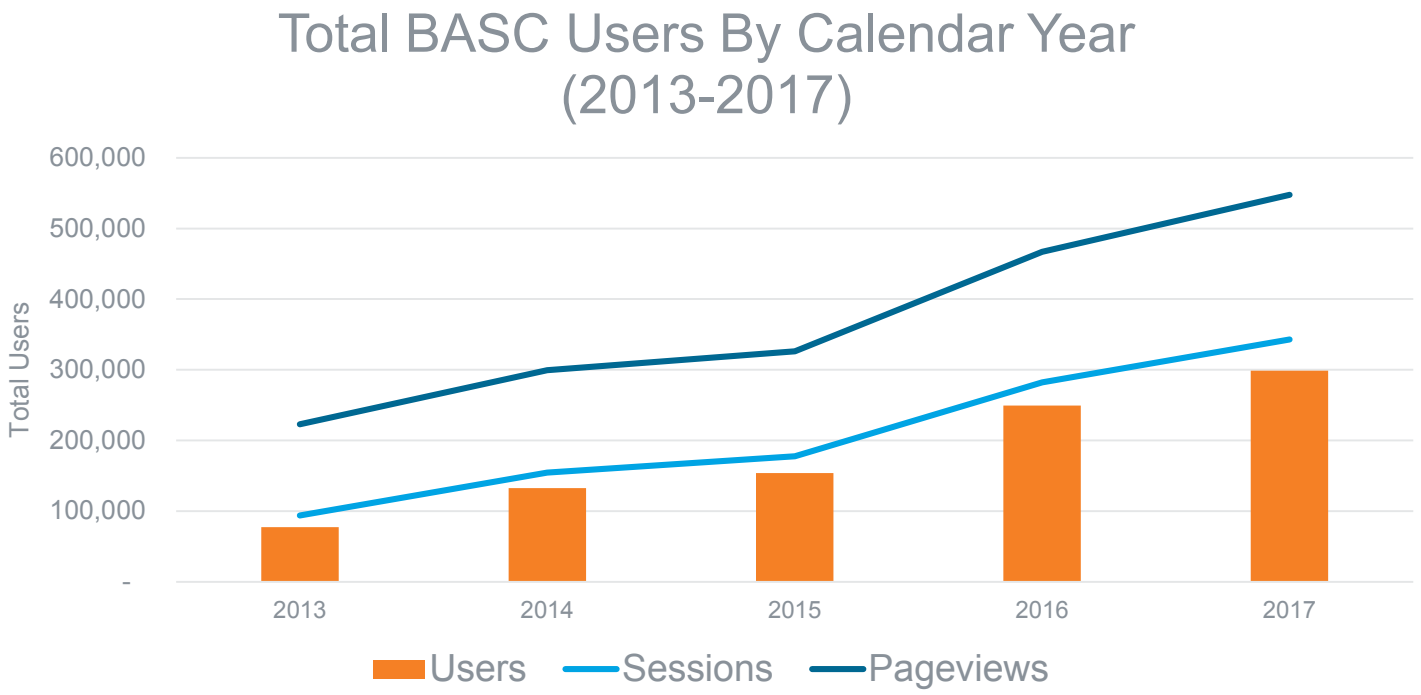


"Solutions" mobile app for iOS through the Apple store and Android via:

https://basc.energy.gov/solutions

Field kits can also be accessed from computers

Impact



"The Building America Solution Center is full of best practices. Every guide in there is based on the right way to do things."

C.R. Herro
V-P of Environmental Affairs, Meritage Homes

"We built our business on the shoulders of giants, including the Building America Solution Center."

Gene Myers
CEO, Thrive Home Builders
(Professional Builder Magazine Builder of the Year)

Thank you!

Chrissi Antonopoulos
Chrissi.Antonopoulos@pnnl.gov

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

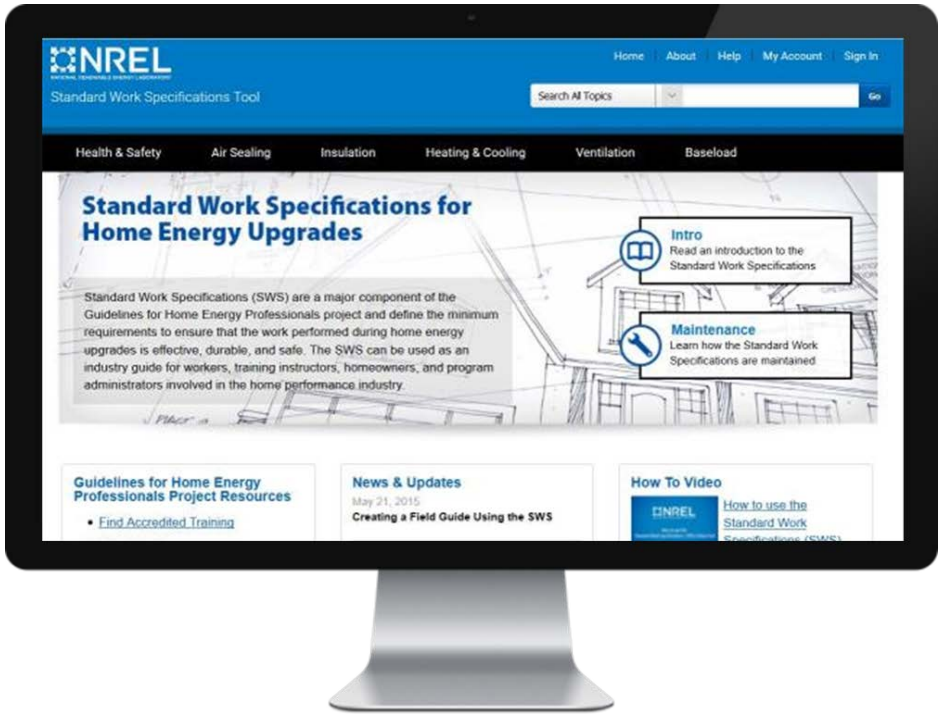
Guidelines for Home Energy Professionals:

Standard Work Specifications

David LoVullo, Engineer

June 25, 2018

Contents:



Guidelines for Home Energy Professionals Project

Home Performance Industry Collaboration

Goal:
Collaborate with industry to develop tools needed for a high-quality residential energy upgrade industry, supported by accredited training programs, and a skilled and credentialed workforce.

Guidelines for Home Energy Professional (GHEP) Project was developed in 2011 for whole-house Retrofits.

It has three basic pillars:

1. Standard Work Specifications (SWS)
   - Define quality work
   - Used for training, developing certifications and educating homeowners
2. Home Energy Professionals Certification
   - Competency based certifications that ensure skilled workers
   - Job Task Analysis (JTA) for four distinct occupations
3. Accredited Training
   - Interstate Renewable Energy Council (IREC) selected as an independent third-party to ensure proper training to competencies identified in the JTAs

Quality Work Plan

In 2015, the Weatherization Assistance Program (WAP) implemented the Quality Work Plan:

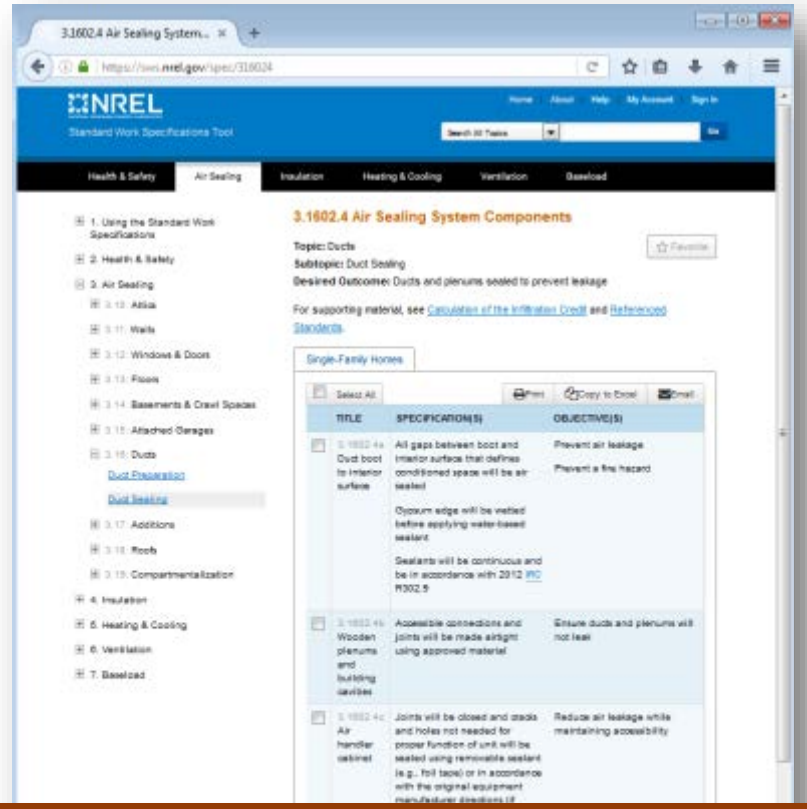
1. Standard Work Specifications (SWS)
   - Each grantee must have a field guide based on the SWS
2. Home Energy Professionals Certifications
   - Quality Control Inspector
     - Starting in 2015, every home weatherized must be inspected by a certified Quality Control Inspector
3. Accredited Training
   - All WAP workers must receive training aligned with the JTA from IREC-accredited training center

Standard Work Specifications

What are the Standard Work Specifications?

- The SWS is a **FREE** online tool that defines minimum outcomes:
  - ✓ Hundreds of home performance tasks
  - ✓ Simple written descriptions
  - ✓ Clearly defined outcomes
  - ✓ Organized from general-to-specific
- This document uses a whole-house approach to define weatherization tasks in *single-family*, *multifamily*, and *manufactured* housing.
  - ✓ Reduces variation
  - ✓ Increases consistency
  - ✓ Ensures quality work in all areas

Visit: sws.nrel.gov

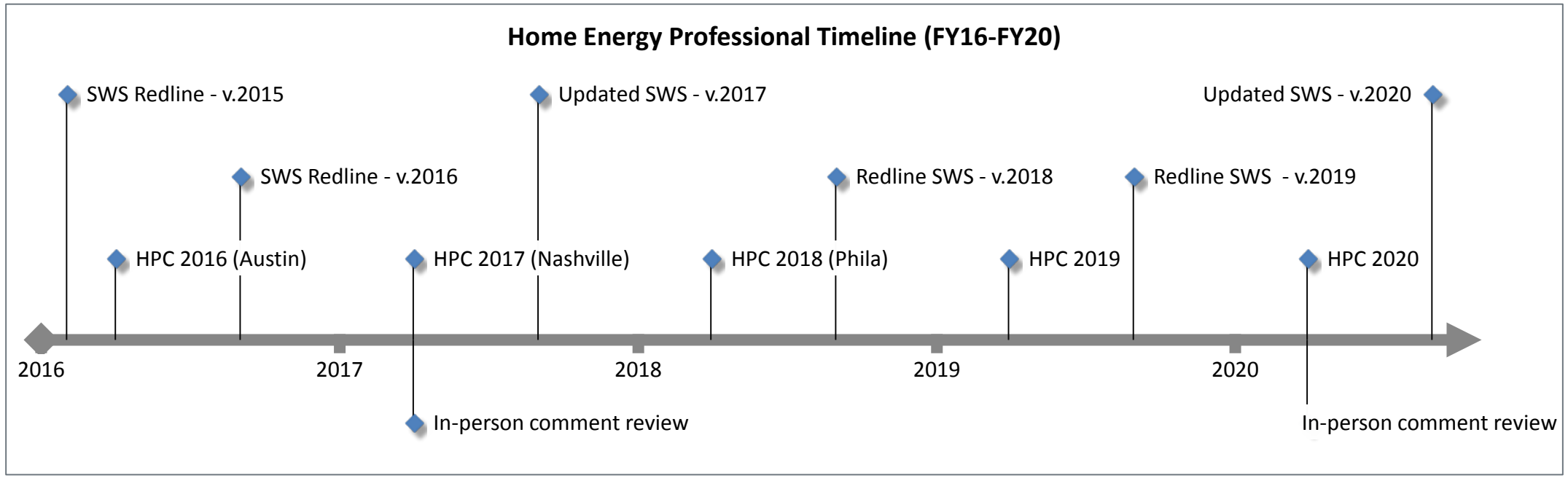


This is pretty sweet. It's like a social media platform for home energy professionals...I'm excited to use it!

– Michael Levinson, Group14 engineering

Development and Maintenance

- Robust consensus process
  - Developed by over 160 Subject Matter Experts (SMEs)
  - Received 2,000 comments from over 300 stakeholders
  - Over 40 SMEs currently active on JTA and SWS technical committees



The resulting SWS Online Tool

Features:

- ✓ Advanced search
- ✓ Integrated glossary
- ✓ Print details
- ✓ Email details
- ✓ Create lists of Favorites
- ✓ Create QC Checklists
- ✓ Submit comments
- ✓ Links to external resources, such as **BASC**
- ✓ Application programming interface (API)
- ✓ Create and share **Field Guides**

Possible Users:

Training Program Instructor

- Needs to find specific details to copy and paste into a lesson

Energy Auditor

- Needs to create a list of retrievable specifications that she can reference on the job

Quality Control/Building Inspector

- Needs to cite and link to SWS details when writing a home inspection

WAP Program Manager

- Needs to quickly refer to the SWS to confirm how the work should be done and send specifications via email

Benefits to Programs

- The Standard Work Specifications immediate benefits includes:
  - ✓ Consistency
  - ✓ Existing free resource
  - ✓ Covers wide array of measures
  - ✓ Use only what you need
  - ✓ Improves quality
  - ✓ Great training aid
  - ✓ Reduces liability

*"We do 4,000 jobs a year in Arizona and the work we are seeing now is **nearly flawless**. The only issues we ever see are contractors who have been doing this work for years and who assume they are doing it correctly…until they start failing inspections. **Then we put these tools in their hands, and they don't fail inspections anymore**"*

– Chris Baker, Arizona Public Service
On implementing the SWS in Arizona's Home Performance with Energy Star Program

Collaboration with Building America

Supporting Material

- SWS provides link to external resources where applicable
- Recent links to the Building America Solution Center (BASC) were identified throughout the SWS and added
- More that +100 identified connections were added that link directly to relevant pages and guides on the BASC website
- Additional BASC links are still being added to the SWS to strengthen both resources

Building America as a Resource

4.1005.1 Accessible Floors—Batt Installation

Favorite

Topic: Attics
Subtopic: Attic Floors
For supporting material, see Building America Solution Center.
Desired Outcome: Consistent, *thermal boundary* between conditioned and unconditioned space controls the heat flow

Single-Family Homes

Select All | Print | Copy to Excel | Email

	TITLE	SPECIFICATION(S)	OBJECTIVE(S)
☐	4.1005.1a Preparation	Subfloor or drywall will be removed to access cavities as necessary, including inaccessible knee-wall attic floor spaces All electrical junctions will be flagged to be seen above the level of the insulation Open electrical junction boxes will have covers installed	Access the workspace Provide location of electrical junctions for future servicing Prevent an electrical hazard
☐	4.1005.1b Installation	Batt insulation will be installed in accordance with manufacturer specifications without gaps, voids, compressions, misalignments, or wind intrusions Insulation will be installed to the	Insulate to prescribed R-value

Building America Solution Center

EERE » BTO » Building America » Solution Center » Guides

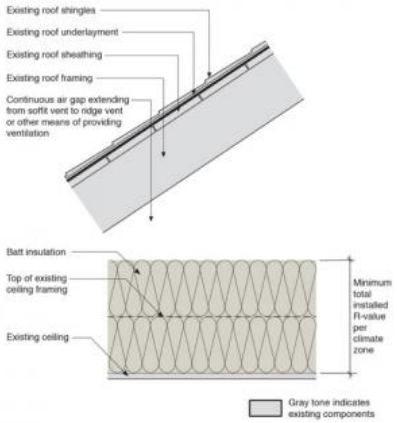
Batt Insulation for Existing Vented Attics

Feedback | Print this page | PDF version

Scope | Description | Success | Climate | Training | CAD | Compliance | More | Sales

Scope

Insulate a vented attic in an existing home by installing batt insulation on the ceiling plane of the attic, as follows:



- Before any retrofit work is done, inspect the roof and attic; repair any leaks, remove active knob and tube wiring, and remediate any hazardous materials.
- If existing bath fans vent into the attic, they must be vented to the outside.
- Remove any existing insulation, debris and dust, and prepare the attic floor for air sealing and fibrous batt insulation.
- Seal all attic floor penetrations with sealant, one-part spray foam, or rigid blocking material as needed.
- Verify that proper ventilation of the attic is provided with

MOBILE FIELD KIT

The Building America Field Kit allows you to save items to your profile for review or use on-site.

Sign Up or Log In

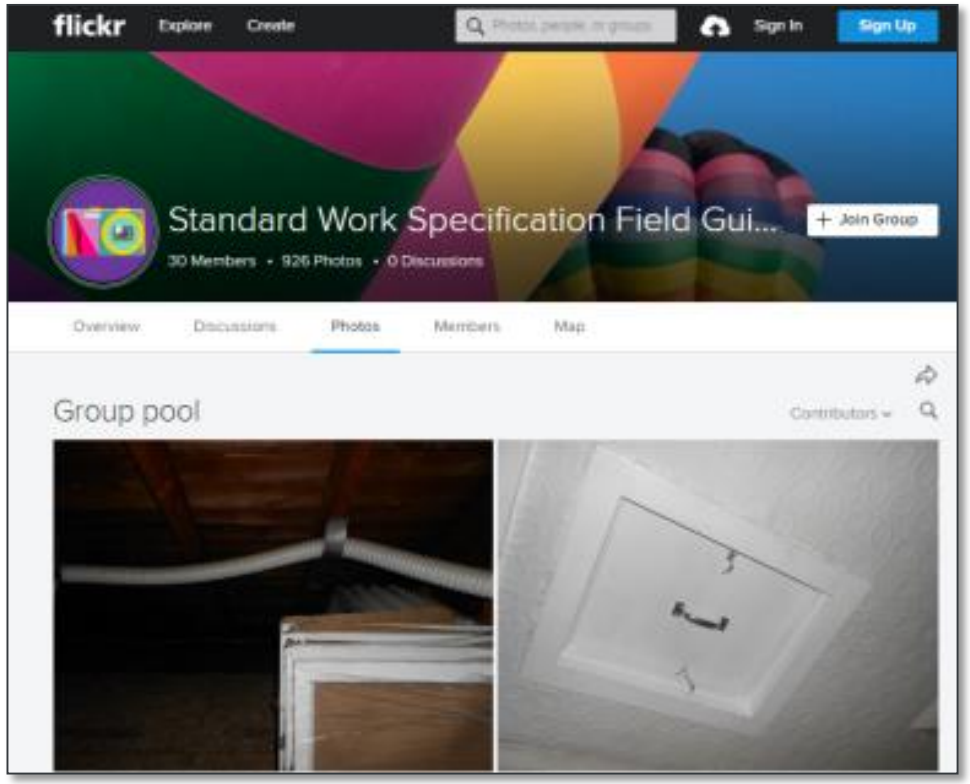
SWS Field Guides

State Field Guides and the SWS

A ***Field Guide*** is a jobsite manual that provides instructions to the crew with step-by-step, illustrated guidance on proper installation of common measures

- The SWS tool has the ability to quickly and simply allow users to create **field guides** from existing specifications

1. Select relevant **specifications**
2. Add necessary details such as **tools**, **materials**, **notes**, and **step-by-step** instruction
3. Select relevant **photos** from over 900+ public photos on the SWS Field Guide Flickr account
4. **Publish!**



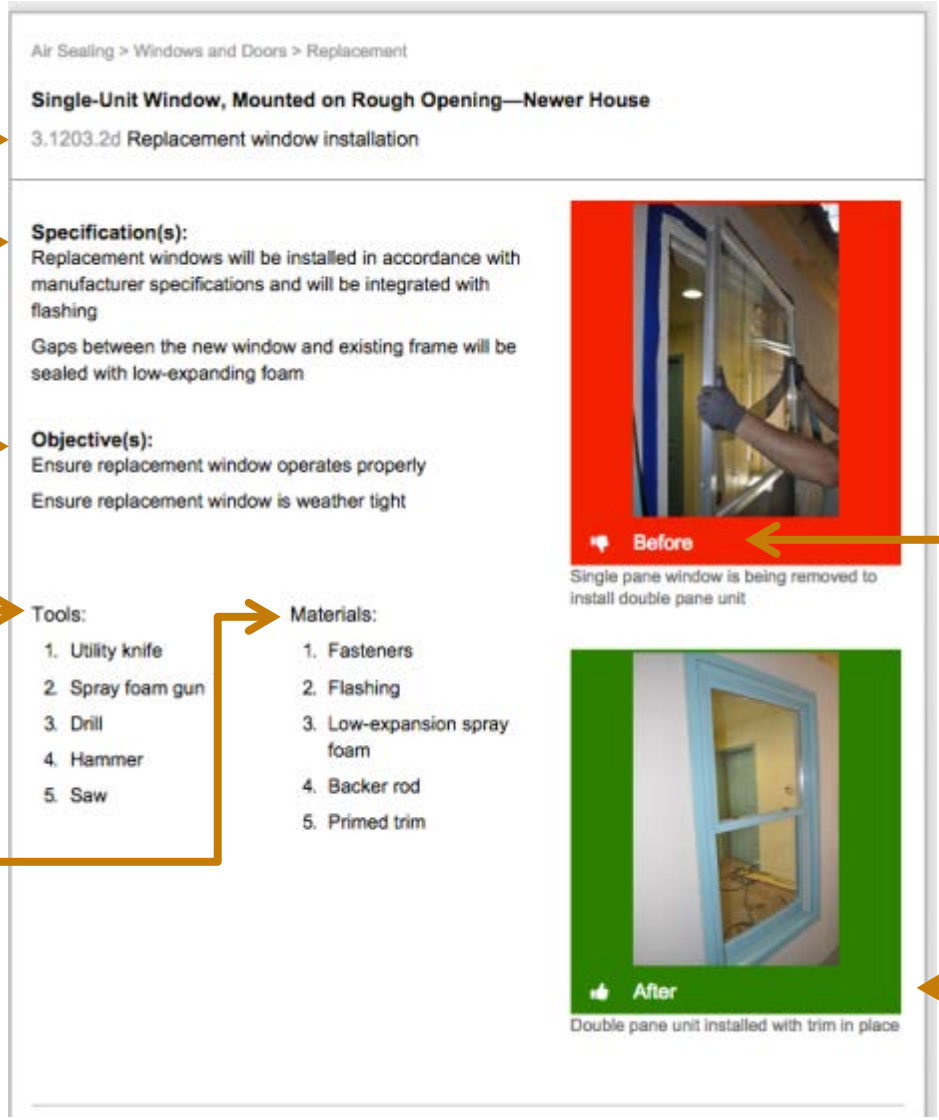
https://www.flickr.com/groups/sws_field_guide/

Built-in Field Guide Template

Select relevant SWS and the field guide template imports the **Title**, **Specification**, and **Objective**.

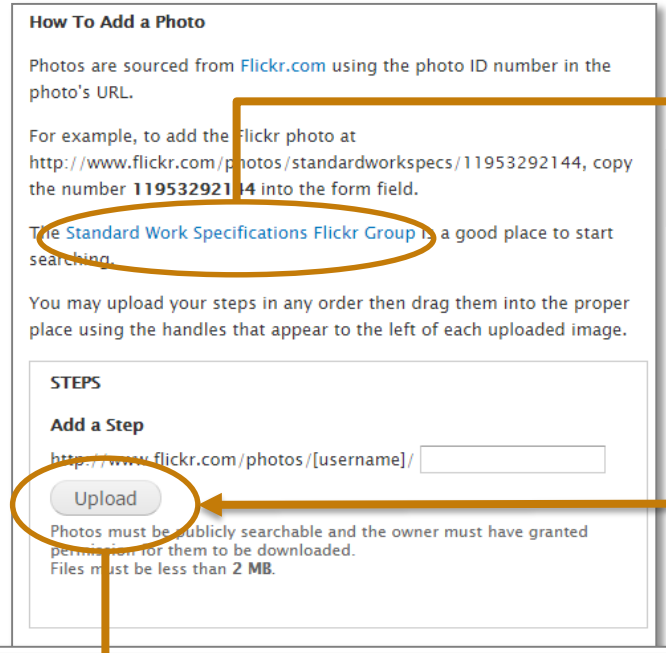
Add **Tools**

Add **Materials**

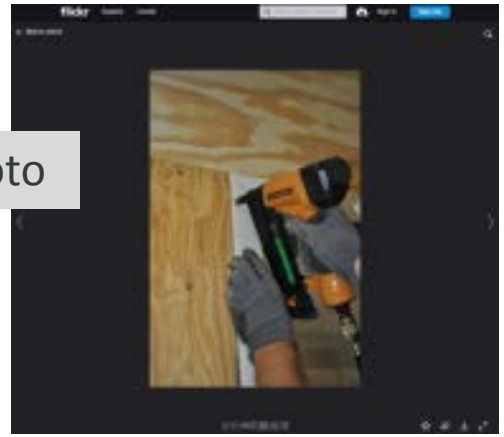


Add **Before** and **After** Images with descriptions and color-coded borders

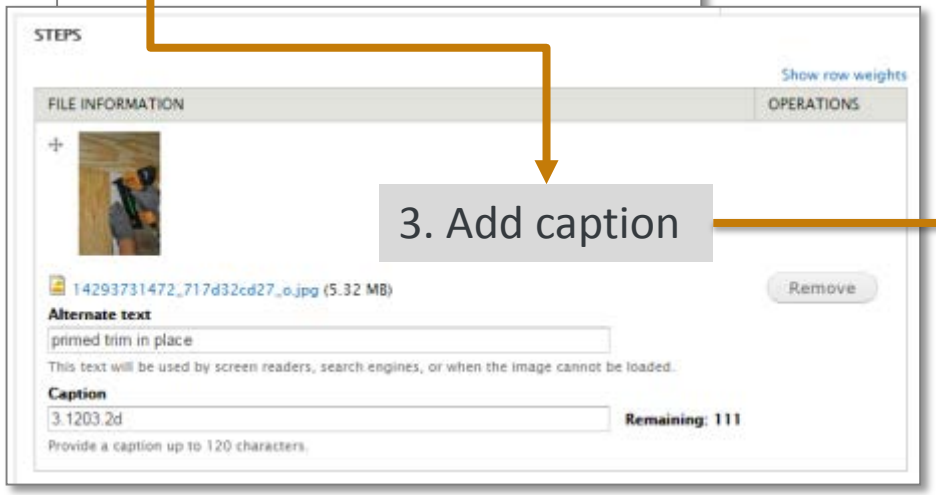
Add Photos from SWS Flickr Account



1. Find photo

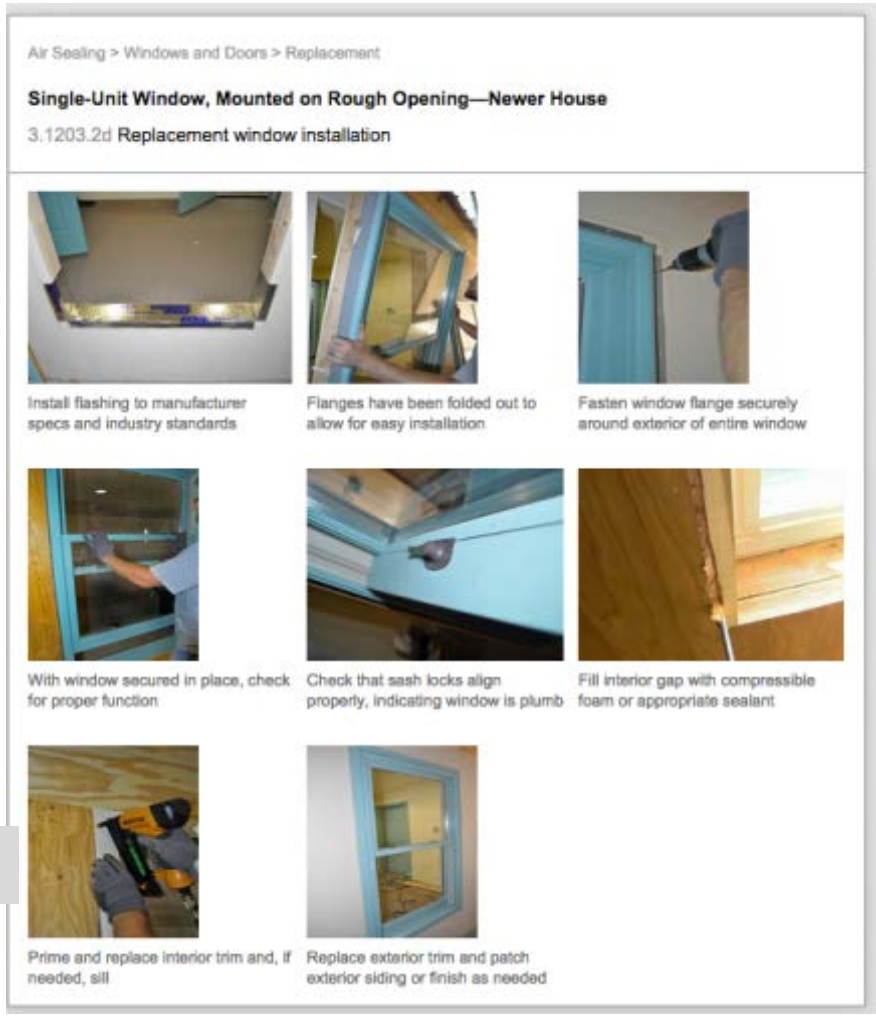


2. Upload



3. Add caption

4. Add to guide



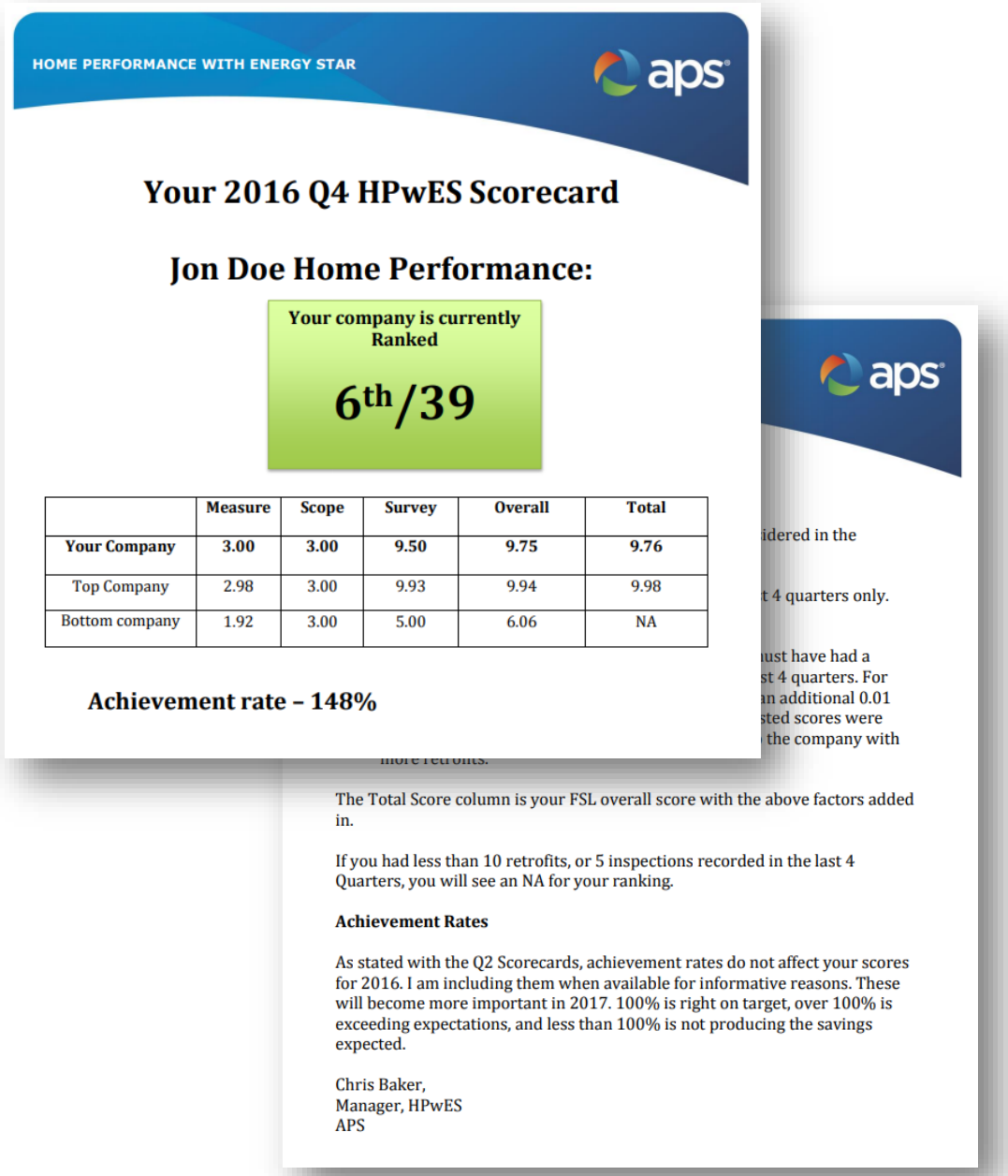
How is the SWS Being Used

Quality Assurance

- Communicate quality expectations from installers to Quality Control Inspectors
  - Pictures are less subject to interpretation and removes subjectivity
  - Completed work either passes or fails
- Set standards across states, counties, cities

Performance Assessment For Contractors

- Contractor scorecards based on the SWS measure and rank contractors
  - 0 to 10 scores
  - Measured work against SWS
  - Contractors receive scorecards and feedback
  - Contractors know their rank
- Utilities residential programs can use to incentivize performance
  - E.g., smart thermostat program offered to top-10 ranking contractors



HOME PERFORMANCE WITH ENERGY STAR

aps

Your 2016 Q4 HPwES Scorecard

Jon Doe Home Performance:

Your company is currently Ranked

6th/39

	Measure	Scope	Survey	Overall	Total
Your Company	**3.00**	**3.00**	**9.50**	**9.75**	**9.76**
Top Company	2.98	3.00	9.93	9.94	9.98
Bottom company	1.92	3.00	5.00	6.06	NA

Achievement rate – 148%

aps

idered in the

t 4 quarters only.

ust have had a
st 4 quarters. For
an additional 0.01
sted scores were
the company with

The Total Score column is your FSL overall score with the above factors added in.

If you had less than 10 retrofits, or 5 inspections recorded in the last 4 Quarters, you will see an NA for your ranking.

Achievement Rates

As stated with the Q2 Scorecards, achievement rates do not affect your scores for 2016. I am including them when available for informative reasons. These will become more important in 2017. 100% is right on target, over 100% is exceeding expectations, and less than 100% is not producing the savings expected.

Chris Baker,
Manager, HPwES
APS

Training

- Train *new* workers to the home performance industry
- Train *existing* workers for different job tasks
- Develop training materials and curriculum
  - IREC
  - WAPTAC
  - Arizona Public Service

Thanks

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Workforce.guidelines@nrel.gov

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