Building America Timeline

2013

Building America Solution Center

2014

Guidelines for Building Science Education

November 2015

GS Berger
P Husbands
S Remm

Building America Research-to-Market Plan

November 2015

2015

2016

BUILDING SCIENCE EDUCATION SOLUTION CENTER

Building Energy Ready Home

U.S. Department of Energy

Sales Tool

Translate building science technical terms into a new language of value.
World-Class Expert Guidance...

Building America Solution Center

...At Your Fingertips
What BASC ‘Is’ & ‘Is Not’

Is: Guidance

Is Not: Design Tool
BASC Guidance Concept

Building America Content

Specify

Apply

Educate

Approve

Sell

Simple Interface
BASC Simple Interface

Program Checklists
Access guides directly from checklists for Zero Energy Ready Home, ENERGY STAR Certified Home, and Indoor airPLUS.

Building Components
Access guides for new and existing homes based on building components of interest.

Sales Tool
Translate building science technical terms into a new language of value.

Climate Packages
Review new home energy efficiency specifications and case studies that exceed 2009 IECC by 30%.

Building Science Pubs
Search library of building science publications from Building America.

Mobile App
Join our mobile community to access saved field kits wherever you need them.
BASC Guides

Program Checklists
Access guides directly from checklists for Zero Energy Ready Home, ENERGY STAR Certified Home, and Indoor airPLUS

Existing Homes

Sales Tool
Translate building science technical terms into a new language of value.

Climate Packages
Review new home energy efficiency specifications and case studies that exceed building science.
BASC Guides

Program Checklists
Access guides directly from checklists for Zero Energy Ready Home, ENERGY STAR Certified Home, and Indoor airPLUS

Building Components
Access guides for new and existing homes based on building components of interest.

Double-Stud Wall Framing

Technical Description:
One way to achieve very high levels of insulation in walls is to build two walls, one inside the other, side by side. The inner wall provides framing for attaching gypsum board, and the outer wall does the same for sheathing, rig foam insulation, and siding. Two 2x4 framed walls, spaced five inches apart, will provide a wall cavity over 12 inches deep. The spacing and the blown-in insulation keep the studs in one wall from touching the studs in the other wall, which is very effective to keep heat from transferring through the wall. This double-wall thermal blanket creates a quiet, efficient, and comfortable home.

Alternate Terms
- Gypsum Double-Wall Construction
- Energy Saving Double-Wall
- Advanced Double-Wall Technology

Double-Wall Thermal Blanket

Double-Wall Framing = Double-Wall Thermal Blanket

Building America
Author(s): EPA Organization(s): N/A Publication Date: 10/26/2010

EPA Organization(s): N/A Publication Date: 10/26/2010
BASC Sales Tool

Program Checklists
Access guides directly from checklists for Zero Energy Ready Home, ENERGY STAR Certified Home, and Indoor airPLUS.

Building Components
Access comprehensive data for each category.

Sales Tool
Translate building science technical terms into a new language of value.

Building Science Pubs
Search library of building science publications from Building America.

VIVID LIVING
HEALTHFUL ENVIRONMENT

Fresh Air
- Supply Fresh Air System
- Odor and Moisture Control Fans
- High-Capture Filtration Technology

Quiet
- Quiet Window Technology
- Quiet Wall Technology

Moisture Control
- Dry-by-Design Construction
- Moisture Control System – Whole House
- Moisture Controlled Comfort System
- Moisture Controlled Windows
- Moisture Controlled Lower Levels

Pest Control
- Bug Control Barrier
- Pest Screened Home

Outdoor Contaminant Control
- Contaminant Sealed Construction
- Contaminant Sealed Comfort Delivery
- Dust and Pollen Barrier
- Radon Controlled Home

Chemical Control
- Formaldehyde Controlled Home
- VOC Controlled Home

Flue Control
- Carbon Monoxide Controlled Equipment
- Carbon Monoxide Controlled Fireplace
- Flue Controlled Garage

Vivid Living • 42 Simple Street, Suite 500, Anytown, MA 03450 • 617-673-3030 • www.vividliving.com
BASC ZERH Climate Packages

Building America’s Optimized Solutions for New Homes
Cold Climate

The U.S. Department of Energy’s (DOE’s) Building America program has been a source of innovations in residential building energy performance, durability, and affordability for over 20 years. This world-class research program partners with some of the top U.S. home builders, contractors, and manufacturers to bring cutting-edge construction and design solutions and resources to market.

The most recent goal of the Building America program is to demonstrate how cost-effective strategies can reduce home energy use by about 80% in new homes, as all climate regions, by 2025. As part of the strategy to prove that this level of performance is achievable in the market, DOE created a labeling program called the DOE Zero Energy Ready Home program.

Working together, Building America and the DOE Zero Energy Ready Home program has created a series of optimized solutions to demonstrate how builders can achieve these high energy goals, cost-effectively, in each climate zone.

Building America’s five major climate regions include: cold very cold, cold mixed, medium, mixed, and warm. These climate zones are outlined in Figure 1, along with a map of the International Energy Conservation Code (IECC) climate regions as a reference for compliance information. This document outlines the Building America recommendations for achieving increased savings in the cold climate region (approximately IECC zones 5-8).

Due to the tradeoffs decisions that are made when building a home, there are hundreds of ways to meet Building America’s energy targets. The package listed in Table 1, shows just one way to cost-effectively meet this goal. The first two columns provide options for common building practices that can be used to obtain such particular performance objectives. Unless otherwise noted, the performance values in the table are maximum. In-depth descriptions, quantities guidance and code compliance information for most of the options listed in Table 1 are available on the Building America Solution Center (basc.energy.gov).

Photo credit: Liz Ligon, Alternative Power Enterprises, Inc.

Checklists
Directly from checklists for ENERGY STAR and Indoor airPLUS

Building Components
Access guides for new and existing homes based on building components of interest.

Climate Packages
Review new home energy efficiency specifications and case studies that exceed 2009 IECC by 30%.

Mobile App
Join our mobile community to access saved field kits wherever you need them.
BASC Mobile Application

Program Checklist

My Field Kits
- Project site #1
- East Lake Project field kit
- Twin Peak Site

Mobile App
Join our mobile community to access saved field kits wherever you need them.
Building America Solution Center

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. Click on the links below to explore the Solution Center.

As a community-driven tool, we welcome your comments on how to continuously improve the Solution Center. If you are interested in submitting content, please become a registered user and see the criteria for submissions.

Program Checklists
Access guides designed to help teams for Zero Energy Ready Home, ENERGY STAR Certified Homes, and Indoor airPLUS.

Building Components
Access guides related to selecting homes between building components of interest.

Sales Tool
Translate building science technical terms into a user-friendly language of value.

Climate Packages
Review real homes energy efficiency tools and case studies that saved XPP FEEG by X%.

Building Science Pubs
Searchable library of building science publications from Building America.

Mobile App
Join our mobile community to access saved tools. It's everywhere you need them.
BASC Code Briefs

- Attic Knee Walls
- Air Sealing MF Common Walls
- Air Sealing/Insulating Garage Walls
- Bathroom Fan Ratings
- **Buried Ducts in Vented Attics**
- Continuous Insul. Cladding/Furring
- Double Wall Framing
- Ductless Mini-Split Heat Pumps
- Dynamic Glazing
- Evaporative Cooling
- Fireplaces, Proper Ventilation
- Floors Above Unconditioned Spaces
- Gas-Fired Boilers
- Heat Pump Water Heaters
- Insulated Wall Intersections
- Insulating and Sealing Structural Headers
- Oil-Fired Boilers
- Recessed Lighting
- Rooms Containing Fuel-Burning Appliances
- Sealing/Insulating Existing Crawl Space Walls
- Sealing and Insulating Existing Exterior Walls
- Sealing and Insulating Existing Floors above Unconditioned Spaces
- Sealing & Insulating Existing Attics
- Slab-on-Grade Insulation
- Window and Frame Replacement
**BASIC Code Briefs**

**Buried Ducts in Vented Attics in Hot-humid and Mixed-humid Climate Zones - Code Compliance Brief**

**Overview:**

The intent of this brief is to provide guidance on the installation of ducts in attics, particularly where there is a concern about the effectiveness of the attic in maintaining a conditioned space. The brief includes considerations for the design, installation, and performance of ducts in such environments.

Ducts buried in the insulation of attics provide an efficient and cost-effective method of delivering conditioned air to occupied spaces. This brief is intended to assist HVAC contractors and engineers in selecting the most appropriate ducting solutions for attics in hot-humid and mixed-humid climate zones.

**Plan Review:**

- **2015 IECC/IRC, Section R102.2:**
  - Duct design specifications and layouts.
  - Completed ACCA Manual D calculations.
  - Field inspections, and duct leakage.
  - Current software tools assume that the designer can calculate the typical duct layout design. Further information can be found in the Building America Top Innovations 2013 Report.

**Field Inspection:**

- **2015 IECC/IRC, Section R104.4:**
  - Mechanical rough-in inspections.
  - Duct systems should be installed in compliance with the inspection of the attic sealing and insulation requirements.

**Technical Validation(s):**

- **Building America Top Innovations 2013 Report: Buried and Encapsulated Ducts**

**Duct System Previsions:**

- **2015 IECC/IRC, Section R403.7:**
  - Duct design considerations for attics.
  - Duct systems should be installed in compliance with the inspection of the attic sealing and insulation requirements.

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- **2015 IECC/IRC, Section R403.7:**
  - Duct design considerations for attics.
  - Duct systems should be installed in compliance with the inspection of the attic sealing and insulation requirements.

**BASIS Related Guides:**


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**References:**

Snapshot of BASC Content

- 200+ full guides
- 1,500+ images
- 115+ CAD drawings
- 95+ videos
- 270+ proven performance case studies
- 520+ peer-reviewed references
- 25 code compliance briefs
## BASC vs. Old Content

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Business Applications Overview

- Sales Agent Reference Guide
- Field Training Kit
- Point-of-Sale Innovation Fact Sheets
- Building Science Presentations
- Precedence Case Study List
Building America Solution Center

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. Click on the links below to explore the Solution Center.

Program Checklists
Access guides directly from checklists for Zero Energy Ready Home, ENERGY STAR Certified Home, and Indoor airPLUS.

Building Components
Access guides for new and existing homes based on building components of interest.

Sales Tool
Translate building science technical terms into a new language of value.

Climate Packages
Review new home energy efficiency specifications and case studies that exceed 2009 IECC by 50%.

Building Science Pubs
Search library of building science publications from Building America.

Mobile App
Join our mobile community to access saved field kits wherever you need them.

As a community driven tool, we welcome your comments on how to continuously improve the Solution Center. If you are interested in submitting content, please become a registered user and see the criteria for submissions.
Register to Customize Content:

- Create Field Kits
- Create Point-of-Sale Fact Sheets
Field Kits

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Add custom titles, and as many Field Kits as you like. Make sure to Save your folders.
Add Content to Your Field Kits

Building America Solution Center

Add or remove this item in your Field Kits.

- Default Field Kit
- Happy Valley homes subdivision Portland Oregon
- Zero Energy Ready Home project #5

MY SALES WORKSHEETS

Create Sales Worksheet
View All Sales Worksheets

Hover over the Field Kit icon to add/delete content

Scope

Ensure that the garage is separated from the conditioned space by a continuous rigid air barrier. Seal all seams, gaps, and holes in the air barrier with caulk or foam before installing the insulation.

DOE Zero Energy Ready Home Notes

The U.S. Department of Energy (DOE) Zero Energy Ready Home program requires that builders comply with the U.S. Environmental Protection Agency (EPA) Indoor airPLUS program criteria. The Indoor airPLUS checklist (Item 4.3) requires that builders not locate air handling equipment or ductwork in garages but notes that ducts and equipment may be located in building cavities adjacent to garage walls or ceilings if the cavities are separated from the garage space with a continuous air barrier. The Indoor airPLUS Construction Specifications (Item 5.4) requires that homes with exhaust-only whole-house ventilation either are equipped with an exhaust fan or that the builder verify that the garage-to-house air barrier can maintain a pressure difference of greater than 45 Pascals while the home maintains a 50 Pascal pressure difference with respect to the outdoors, with all doors and windows closed during the blow door test.

ENERGY STAR Certified Homes Notes

The ENERGY STAR Certified Homes Thermal Enclosure Checklist requires (in Item 3 Fully Aligned Air Barriers) that a complete air barrier that is fully aligned with insulation be installed at each insulated location of the home including at the interior or exterior surface of ceilings in Climate Zones 1 through 3 and at the interior surface of ceilings in Climate Zones 4 through 8; at the exterior surface of walls in all climate zones and at the interior surface of walls in Climate Zones 4 through 8; and at the exterior surface of windows in Climate Zones 4 through 8.
Happy Valley homes subdivision Portland Oregon

**Guides**
- **Staircase Walls**
  Guide describing how to create a fully aligned air barrier behind a staircase.
- **Concrete Sill over Polyethylene**
  Guide describing how to install a capillary break to help manage moisture in foundations.
- **Demand Plumbing**
  This measure guide describes effective ways to distribute hot water using demand plumbing techniques.
- **Air Sealing Attached Garage**
  Guide describing ways to air seal an attached garage.

**Videos**
- **Duct Leakage to Outdoors (2)**
- **Garage Rim/Joist Sealing Air Conditioned Space**

**Sales Messages**
- **High-Performance Insulation System**
  Poorly installed insulation and inadequate amounts of insulation can result in rooms that are too hot in the summer, too cold in the winter, temperatures that vary from room to room, and homes with unnecessarily high utility bills. High-performance insulation systems include generous amounts of properly installed insulation that provide comfort throughout the home by retaining heat in the winter and keeping out unwanted heat in the summer. High-performance insulation systems include insulation in amounts that exceed the minimum amount required by code. For example, high-efficiency insulation meets or exceeds the insulation levels required by the 2012 International Energy Conservation Code (IECC), which is at least 15% more efficient than the 2009 IECC. Ultra-efficient insulation levels exceed the 2009 IECC levels by 50% or more.

**Pest Resistant Home**
Insects, rodents, and other pests are more than just a nuisance; they can carry diseases, aggravate allergies, and spread germs. These pests can cause considerable property and structural damage if their activities go unchecked for any length of time. There are several steps that builders can take to reduce opportunities for pest intrusion and damage. Wet wood attracts carpenter ants and is easier for animals...
The Sales Tool provides a new glossary of sales themes that can be used across the industry to consistently reinforce the value of high-performance homes.

Browse by 10 different building topics.
<table>
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<tr>
<td>HVAC Ducts In Conditioned Space = Interior Comfort Delivery System</td>
<td>Heating and cooling equipment and ducts are often located in uninsulated attics and crawlspaces where humidity and temperature extremes can prematurely age the equipment and encourage unwanted heat loss or heat gain to the conditioned air traveling through the ducts. If the ducts are not tightly air sealed, conditioned air can escape from the ducts, resulting in energy loss and potential moisture damage, or unfiltered attic or crawlspace air can be drawn into the ducts and distributed throughout the home. Interior comfort delivery systems with the air handler and ducts located inside the conditioned environment of the home minimize the effects of duct leakage. Any conditioned air that does leak from the ducts leaks into the conditioned areas of the home. This saves money by ensuring conditioned air produced by the comfort equipment is not wasted in places like the attic or crawlspace. Interior comfort delivery systems are installed inside the conditioned space rather than in unconditioned spaces. What this means to you is full comfort with much less wasted energy. Wouldn't you rather have your heating and cooling delivered from inside your home rather than effectively outdoors?</td>
<td>Advanced Interior Comfort Delivery System</td>
<td>Energy Saving Interior Comfort Delivery System</td>
</tr>
</tbody>
</table>
Sale Tab in BASC Guides

Find Sales Themes throughout BASC on the “Sales” tab without navigating through the Sales Tool.
How to Customize your Sales Tool

Sales Tool

Housing industry leaders today are successfully building and selling high-performance new and existing homes. However, many stakeholders are frustrated that the transaction process fails to recognize the value associated with lower cost of ownership, greater comfort, improved health, ensured combustion safety, and more durability. Communicating the value of high-performance homes begins by using terminology for measures that consistently convey the improved consumer experience, rather than the engineering function. This is an important and powerful first step which is fully under our control, particularly if we facilitate a collective impact process engaging all stakeholders to develop and embrace this new language of "value".

The goal of this Building Science-to-Sales Translator is to begin this process by providing a new glossary of sales themes that can be used across the industry to consistently reinforce the value of high-performance homes. This includes applying this new language consistently to all consumer-facing materials used by government programs and industry alike. Use the tool below to explore sales themes that relate to each primary area of a high-performance home.
Click Create Sales Tool to go to the sales tool form. We’ll walk through filling out the form to create your customized sales tools.
Each Sales Tool Contains the following general information:

- **Title (Sales Tool Name)**
- **Sales Tool Version** (predetermined or customized list)
- **Body** (description that appears on the top of the worksheet)
- **Company Info:**
  - Name
  - Logo (upload image file)
  - Address, Phone, URL
Add your custom sales themes:

- Hold “Ctrl” scroll and click measures in the list.
- Once you are done, click the green “+” icon to move them to your selected options box.
- Click Save at the bottom of the form to save your selections and generate your Sales Tool.
Saved Sales Agent Reference

Sales Agent Reference Guide for Happy Valley Homes

• See your saved sales tools under your field kits
• Print/download forms
• Add your sales tool to your Field Kits
• Edit your sales tools
Building America Solution Center

Sales Agent Reference Guide for Happy Valley Homes

Happy Valley reference material for sales teams outlining all the technologies used in our homes.

Sales Agent Reference Guide for Happy Valley Homes

Continuous Thermal Blanket Construction

Continuous thermal blanket construction blocks excessive heat loss and gain through structural framing. What this means to you is less wasted energy along with enhanced comfort and quiet. Knowing there is one opportunity during construction to lock in quality construction, wouldn’t you agree advanced thermal protection is a great investment?

Fresh Air System
Happy Valley Homes

Fresh Air System

Fresh air systems help ensure adequate dilution of any indoor contaminants. What this means to you is your home is supplied with enough fresh air every day so your family can breathe better. Wouldn’t you agree protecting health is too important to ignore in new homes?

High-Efficiency or Ultra-Efficient Floor Insulation

Continuous Thermal Blanket Construction

Continuous thermal blanket construction blocks excessive heat loss and gain through structural framing. What this means to you is less wasted energy along with enhanced comfort and quiet. Knowing there is one opportunity during construction to lock in quality construction, wouldn’t you agree advanced thermal protection is a great investment?

Fresh Air System

Fresh air systems help ensure adequate dilution of any indoor contaminants. What this means to you is your home is supplied with enough fresh air every day so your family can breathe better. Wouldn’t you agree protecting health is too important to ignore in new homes?
DOE’s Zero Energy Ready Home program has created six value propositions to use for selling high efficient homes.

The Sales Tool will create lists of innovations based on any one of these value propositions:

- Advanced Technology
- Engineered Comfort
- Enhanced Durability
- Healthful Environment
- Quality Built
- Ultra Efficient
Use the same link we used before to create our custom list. “Create Sales Worksheet”
• In the Sales Tool form, select the Predetermined Sales Tool Version.
• At the bottom of the form, choose your value proposition theme grouping.
• Enter all the other information the same as the custom lists.
• Click save.
High-Efficiency Enclosure
- Energy Saving Air Barrier
- Energy Saving Thermal Blanket
- Comprehensive Energy Seal
- Sun Barrier
- Ultra-Efficient Window System
- Ultra-Efficient Insulation System

High-Efficiency Comfort System
- Energy Saving Comfort System Sizing
- Energy Saving Comfort Control System
- Energy Saving Interior Comfort Delivery System
- Ultra-Efficient Comfort Equipment

Water Saving System
- Water Conservation Technologies
• Use the Solution Center to create materials for presentations, classes or other uses.
• Print/Download are available for:
  – Handbooks
  – Images
  – Case Studies
  – CAD Files
  – Sales Messages
## Compact Air Distribution

### Scope

**Planning and Design**

The builder, architect or designer, and HVAC contractor shall coordinate the location of equipment and ducting prior to finalizing construction drawings with the goal of minimizing the length of duct runs and providing adequate space to allow for quality installation.

**Duct and Equipment Layout and Grille Selection**

- Locate furnace or heat pump air handler as close to the center of the house as possible.
- Locate supply grilles close to interior walls of rooms where possible. Side wall registers are preferred.
- Select supply grilles that provide sufficient throw to reach exterior walls.
- Avoid supplying air to low-load interior spaces such as closets and powder rooms.

**Duct and Equipment Sizing**

- Use ACCA Manual J to calculate loads using the 0.060/0.06 cfm/sq ft supply/return leakage assumption (Leakage Class CL-3), the appropriate insulation (R-8 for attic ducts), and the 7C-4E duct location option.
- Size equipment in accordance with Manual J and the ENERGY STAR HVAC System Quality Installation Checklist.
- Use ACCA Manual D to size ducts based on Manual J loads.

**Duct Installation**

- Tightly seal all duct connections and joints with mastic and test to confirm leakage rate is not more than 5% of total system airflow.
- Stretch flex ducts out to full length and avoid kinks and compression.
- Bury ducts in ceiling insulation, install in non-vented attic, or route through chases that are within the house’s thermal barrier.

### DOE Zero Energy Ready Home Notes

The U.S. Department of Energy’s DOE Zero Energy Ready Home program (ZERH) includes in its Mandatory Requirements the requirement that all tested homes are certified to the U.S. Environmental Protection Agency’s Indoor airPLUS criteria. Indoor airPLUS requires that homes meet ENERGY STAR Certified Homes criteria including the requirement that all duct systems are installed to be substantially airtight and properly balanced. Another mandatory requirement of DOE’s Zero Energy Ready Home program is that duct systems be located within the home’s thermal and air barrier boundary. There are no requirements for compact duct design, but compact ducts are highly compatible with and facilitate meeting ZERH requirements.

**ENERGY STAR Version 3.0 (Rev. 07)**

1. HVAC System Quality Installation Rating Checklist,

**Description**

A compact duct system locates the heating/cooling equipment and supply plenum near the center of the home, and locates each room supply grille as close as possible to the supply plenum (see Figure 1). The advantages of a compact duct system...
A modern single-inlet direct evaporative cooler draws outside air through an 8- to 12-inch media filter.
For CAD Files, save a PDF or the original DWG file
Use the new Optimized Climate Solutions tool to access building packages designed to achieve 30% energy savings better than the 2009 IECC, by climate zone.
For each climate zone, find:

- Energy savings data
- Guidance for thermal enclosure, HVAC and efficient components
- Detailed case studies
Each climate zone will include a list of case studies

Use the case studies to show precedence for targeted building science measures that might be used to secure approval by a code official or builder executive.
Find Case Studies by Topic

Case Studies

Building America Top Innovations 2014 Profile: HVAC Cabinet Air Leakage Test Method
Author(s): PNNL, LBNL
Organization(s): PNNL, LBNL
Publication Date: December, 2014
Case study describing research results that helped develop a standardized testing method for testing the air leakage of HVAC air handlers and furnace cabinets.

Building America Top Innovations 2014 Profile: Valuing Green in the Appraisal Process
Author(s): PNNL, BARA
Organization(s): PNNL, BARA
Publication Date: December, 2014
Case study describing research leading to using the Home Energy Rating System (HERS) software to auto-generate a fact-filled Green and Energy Efficiency Addendum intended for real estate appraisers for every home rated by a RESNET-certified HERS rater.

Building America’s Optimized Solutions for New Homes: Cold Climate
Author(s): PNNL
Organization(s): PNNL
Publication Date: March, 2015
Building America Optimized Solution in the cold and very cold climates.

Building America’s Optimized Solutions for New Homes: Hot-Dry Climate
Author(s): PNNL
Organization(s): PNNL
Publication Date: March, 2015
Building America Optimized Solution in the hot-dry and mixed-dry climate.

Building America’s Optimized Solutions for New Homes: Hot-Humid Climate
Author(s): PNNL
Organization(s): PNNL
Publication Date: March, 2015
Building America Optimized Solution in the hot-humid climate.

Building America’s Optimized Solutions for New Homes: Marine Climate
Author(s): PNNL
Organization(s): PNNL
Publication Date: March, 2015
Building America Optimized Solution in the marine climate.

Filter by Author(s)
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- BSC (10)
- Steven Winter Associates (7)
- NREL (2)
- CARB (1)
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- Access guides
- Access Field Kits for specific projects
Questions?

Thank You

For More Information:

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Building America Solution Center:
http://energy.gov/eere/buildings/building-america-solution-center