EEBA Annual Conference – September 27, 2016

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

Building America Solution Center

SAM RASHKIN
Chief Architect,
DOE Building Technologies Office

August 24th, 2016

Building America Business Model

Product Development

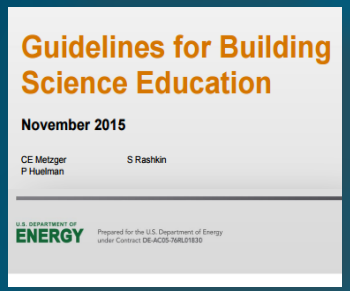
Building AMERICA

Product Distribution

ZERO ENERGY READY HOME
U.S. DEPARTMENT OF ENERGY

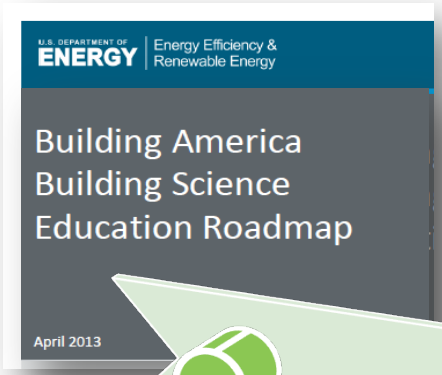
Supply Chain Development

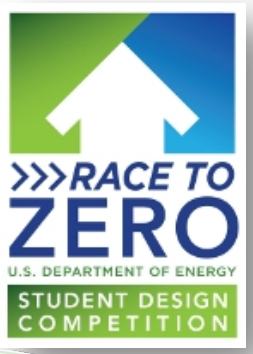
RACE TO ZERO
U.S. DEPARTMENT OF ENERGY
STUDENT DESIGN COMPETITION



Building America Timeline

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



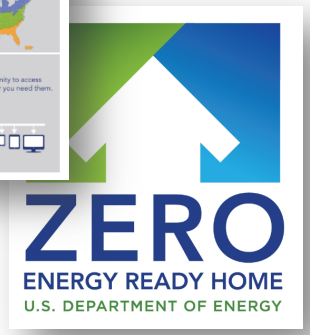


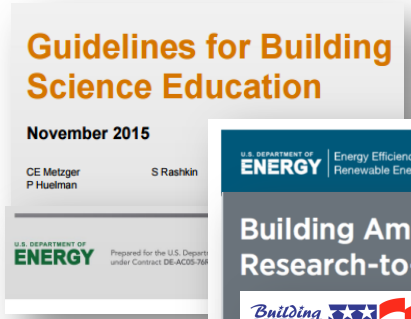
2013

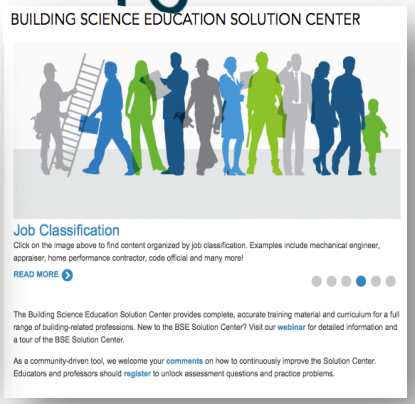
2014

2015

2016







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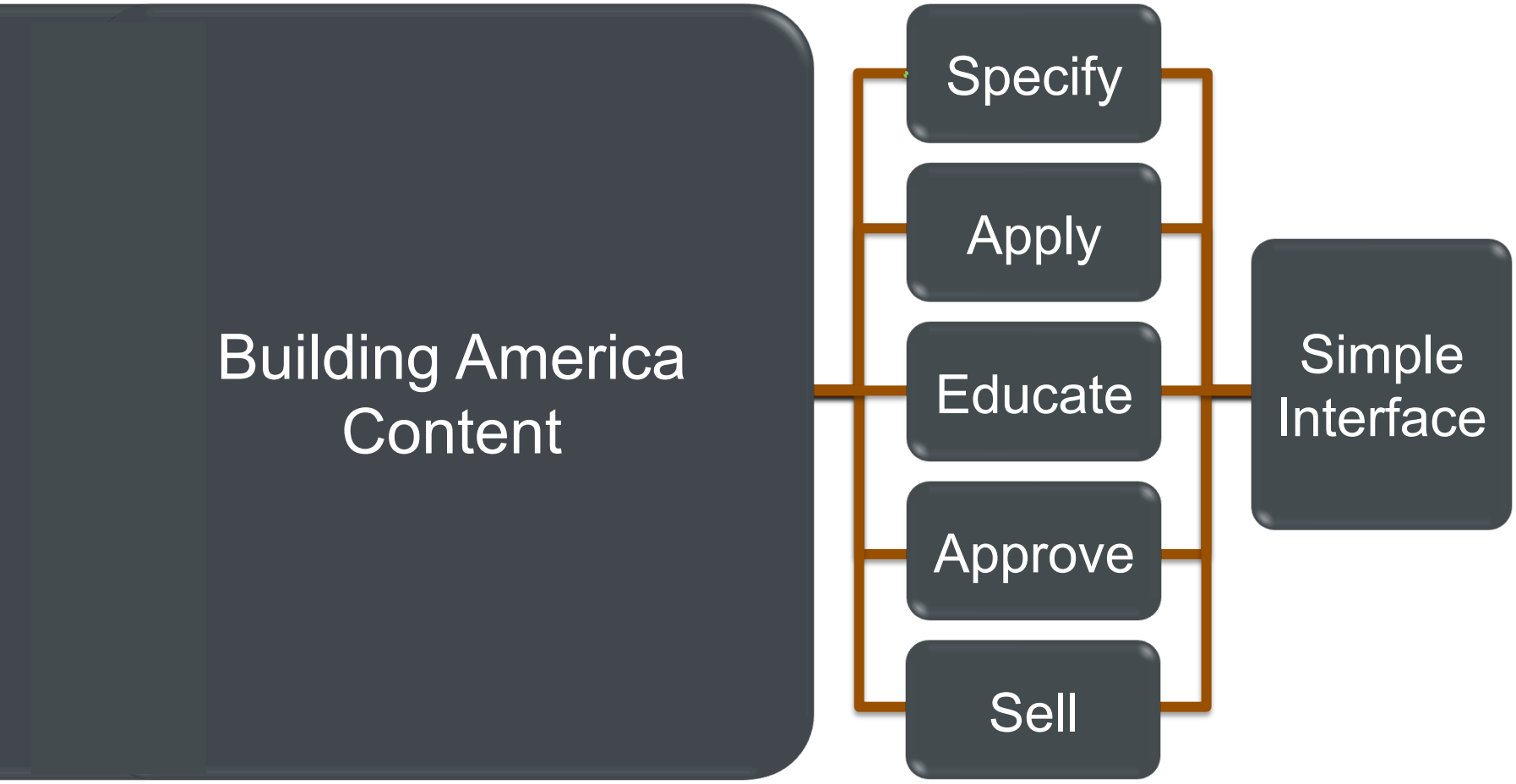
What BASC 'Is' & 'Is Not'

Is: Guidance

Is *Not*: Design Tool

BASC Guidance Concept



BASC Simple Interface

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Access guides directly from checklists for Zero Energy Ready Home, ENERGY STAR Certified Home, and Indoor airPLUS
ZERO
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EPA Indoor airPLUS
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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.
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Review new home energy efficiency specifications and case studies that
publications from Building America.
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ZERO
ENERGY READY HOME
U.S. DEPARTMENT OF ENERGY

ENERGY STAR
HOMES

ask about
EPA Indoor airPLUS
QUALIFIED HOMES

WaterSense
Meets EPA Criteria


Existing Homes

BASC Guides

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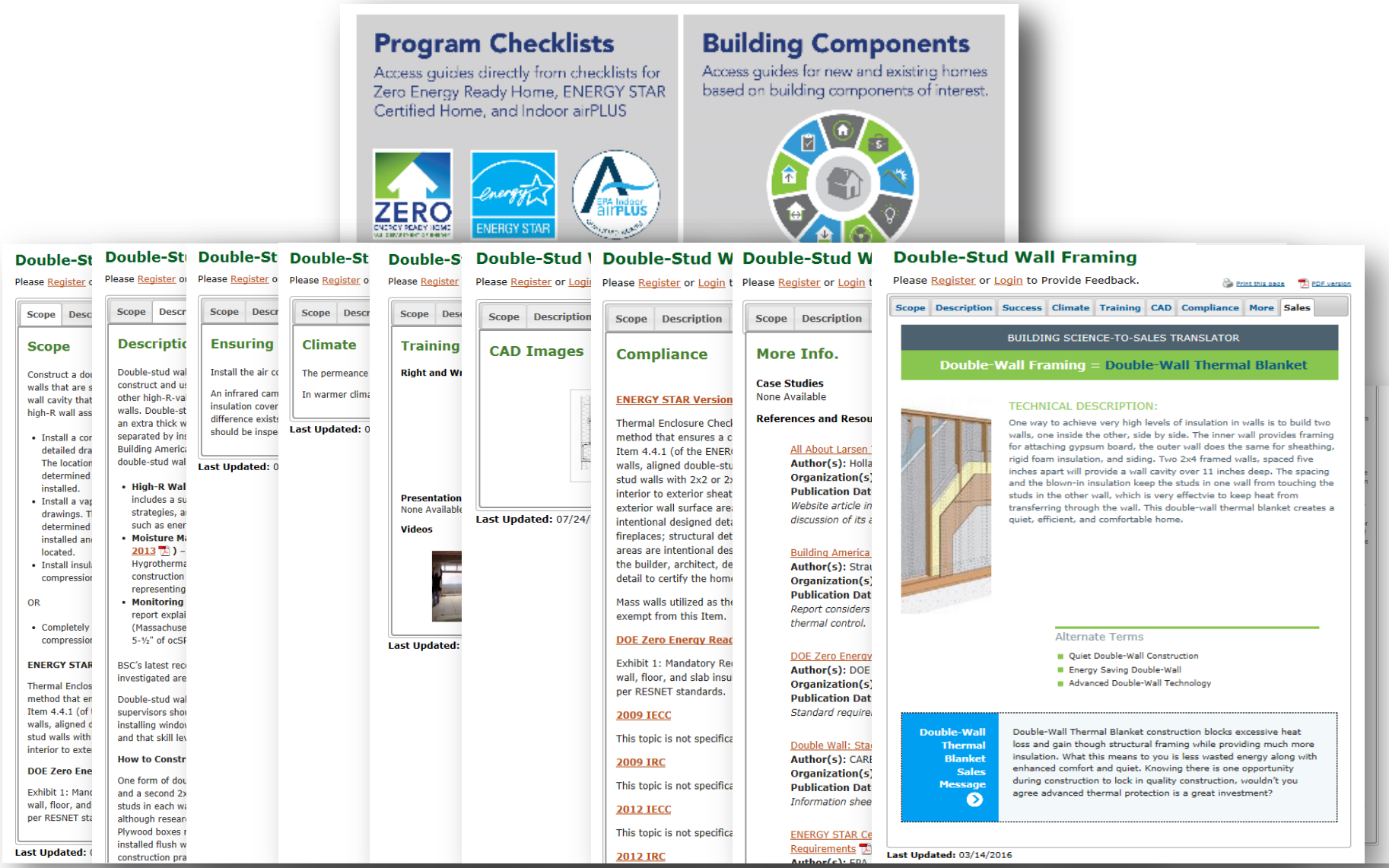
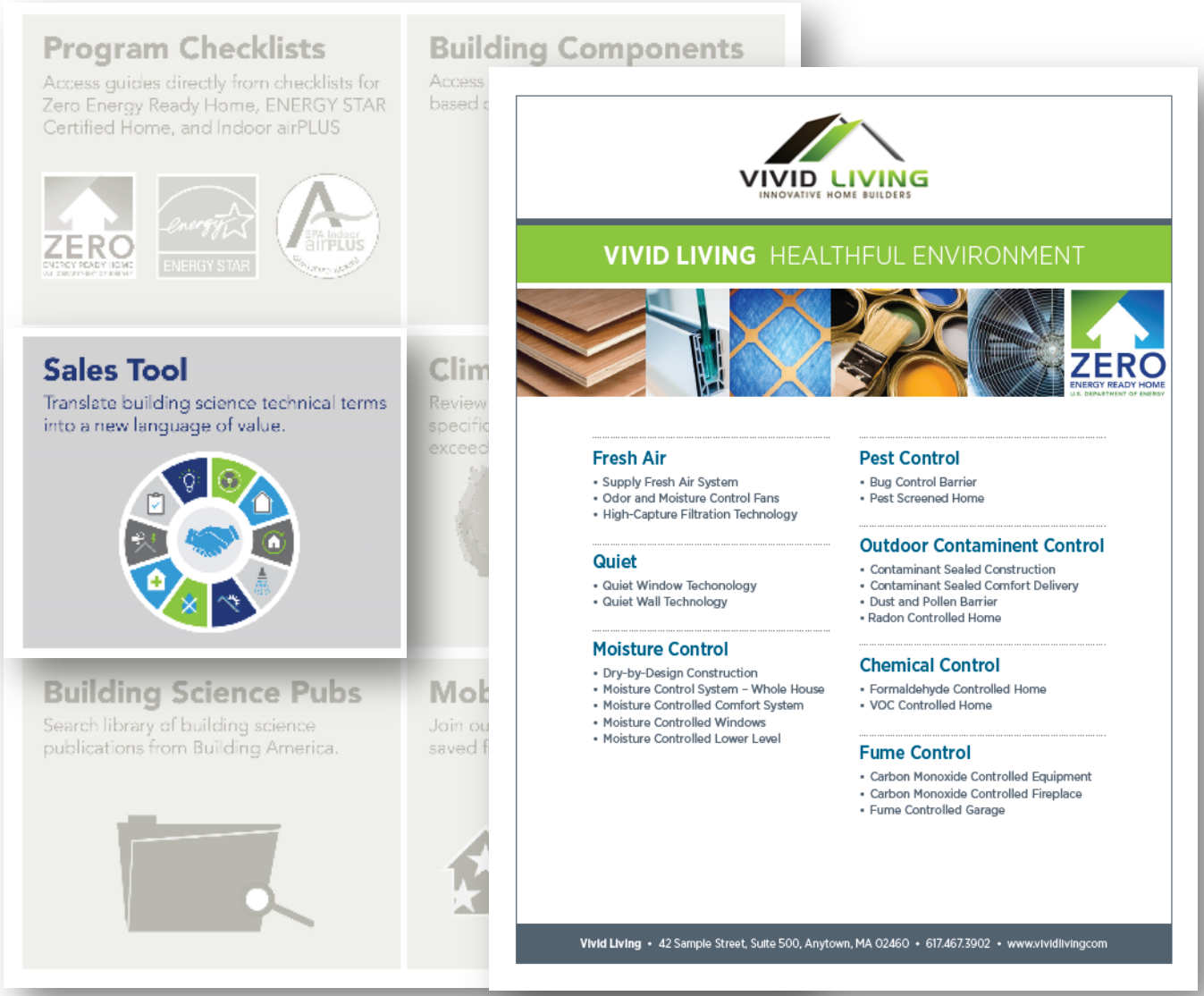


BASC Sales Tool



BASC ZERH Climate Packages

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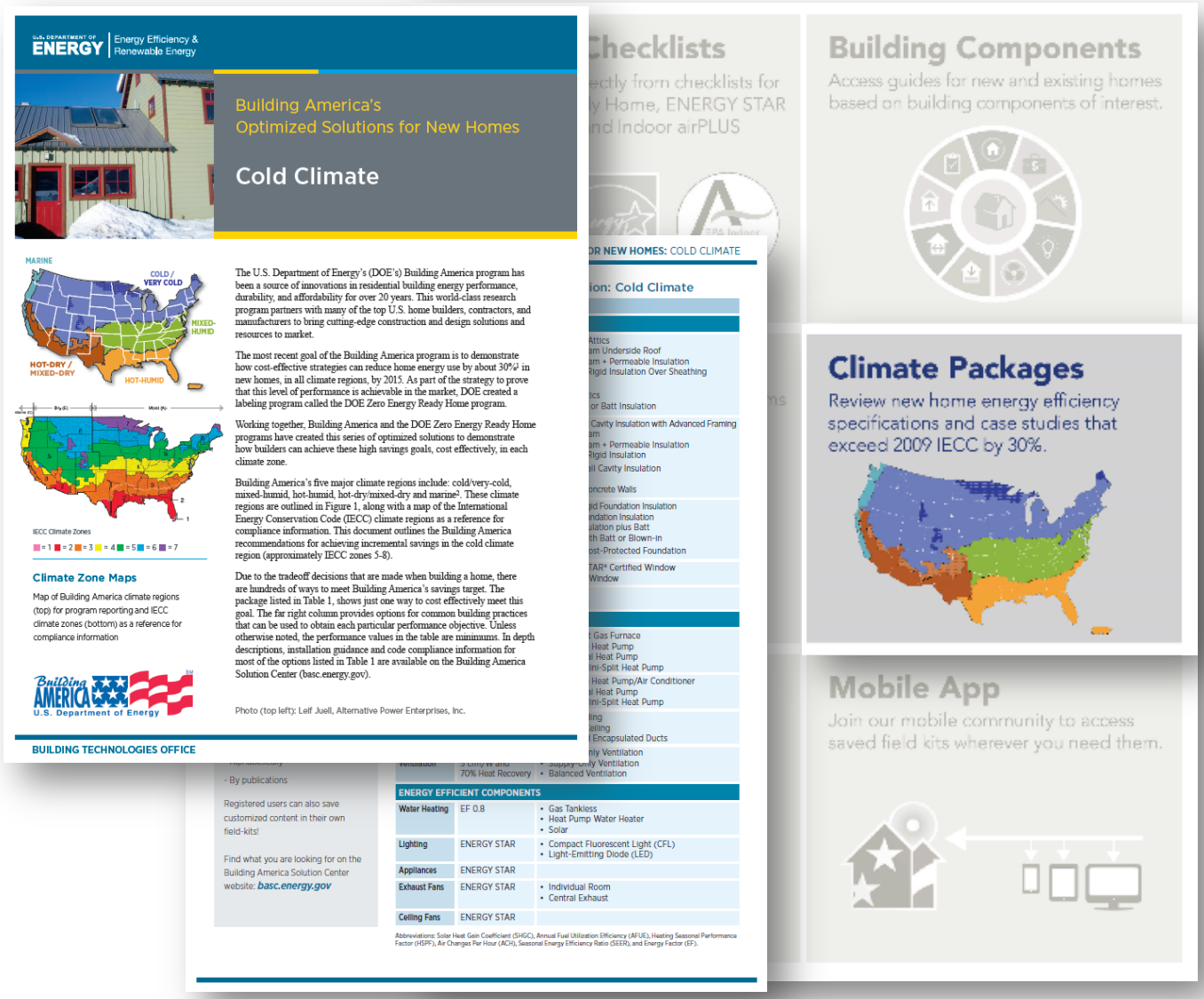

BASC Building Science Publications

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

BASC Mobile Application

BASC Code Briefs

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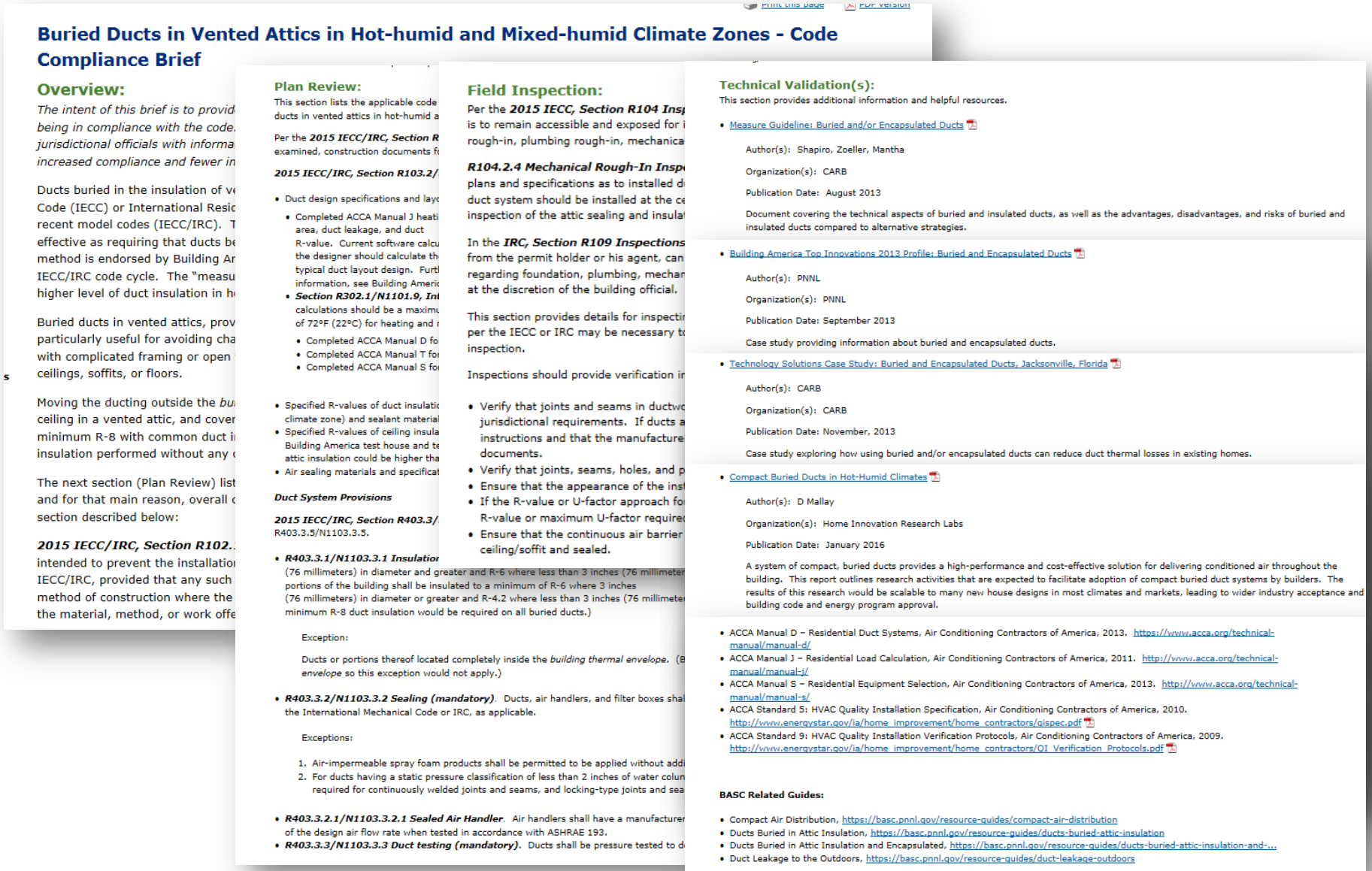
BASC Code Briefs

- 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

BASC 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 provid
being in compliance with the code.
jurisdictional officials with informa
increased compliance and fewer in

Ducts buried in the insulation of ve
Code (IECC) or International Resid
recent model codes (IECC/IRC). T
effective as requiring that ducts be
method is endorsed by Building Ar
IECC/IRC code cycle. The "measu
higher level of duct insulation in h

Buried ducts in vented attics, prov
particularly useful for avoiding cha
with complicated framing or open
ceilings, soffits, or floors.

Moving the ducting outside the *bu*
ceiling in a vented attic, and cover
minimum R-8 with common duct i
insulation performed without any

The next section (Plan Review) list
and for that main reason, overall
section described below:

2015 IECC/IRC, Section R102.
intended to prevent the installatio
IECC/IRC, provided that any such
method of construction where the
the material, method, or work offe

Plan Review:

This section lists the applicable code
ducts in vented attics in hot-humid a

Per the ***2015 IECC/IRC, Section R***
examined, construction documents f

2015 IECC/IRC, Section R103.2/

- Duct design specifications and layo
  - Completed ACCA Manual J heati
    area, duct leakage, and duct
    R-value. Current software calcu
    the designer should calculate th
    typical duct layout design. Furth
    information, see Building Americ
  - ***Section R302.1/N1101.9, Int***
    calculations should be a maximu
    of 72°F (22°C) for heating and
    - Completed ACCA Manual D fo
    - Completed ACCA Manual T fo
    - Completed ACCA Manual S fo

- Specified R-values of duct insulatio
  climate zone) and sealant material
- Specified R-values of ceiling insula
  Building America test house and te
  attic insulation could be higher tha
- Air sealing materials and specificat

Duct System Provisions

2015 IECC/IRC, Section R403.3/
R403.3.5/N1103.3.5.

- ***R403.3.1/N1103.3.1 Insulation***
  (76 millimeters) in diameter and greater and R-6 where less than 3 inches (76 millimeter
  portions of the building shall be insulated to a minimum of R-6 where 3 inches
  (76 millimeters) in diameter or greater and R-4.2 where less than 3 inches (76 millimeter
  minimum R-8 duct insulation would be required on all buried ducts.)

  Exception:

  Ducts or portions thereof located completely inside the *building thermal envelope*. (B
  envelope so this exception would not apply.)

- ***R403.3.2/N1103.3.2 Sealing (mandatory)***. Ducts, air handlers, and filter boxes shal
  the International Mechanical Code or IRC, as applicable.

  Exceptions:

  1. Air-impermeable spray foam products shall be permitted to be applied without addi
  2. For ducts having a static pressure classification of less than 2 inches of water colun
     required for continuously welded joints and seams, and locking-type joints and sea

- ***R403.3.2.1/N1103.3.2.1 Sealed Air Handler***. Air handlers shall have a manufacturer
  of the design air flow rate when tested in accordance with ASHRAE 193.
- ***R403.3.3/N1103.3.3 Duct testing (mandatory)***. Ducts shall be pressure tested to d

Field Inspection:

Per the ***2015 IECC, Section R104 Insp***
is to remain accessible and exposed for i
rough-in, plumbing rough-in, mechanica

R104.2.4 Mechanical Rough-In Insp
plans and specifications as to installed d
duct system should be installed at the ce
inspection of the attic sealing and insula

In the ***IRC, Section R109 Inspections***
from the permit holder or his agent, can
regarding foundation, plumbing, mechan
at the discretion of the building official.

This section provides details for inspecti
per the IECC or IRC may be necessary t
inspection.

Inspections should provide verification in

- Verify that joints and seams in ductwo
  jurisdictional requirements. If ducts a
  instructions and that the manufacture
  documents.
- Verify that joints, seams, holes, and p
- Ensure that the appearance of the inst
- If the R-value or U-factor approach fo
  R-value or maximum U-factor require
- Ensure that the continuous air barrier
  ceiling/soffit and sealed.

Technical Validation(s):

This section provides additional information and helpful resources.

- Measure Guideline: Buried and/or Encapsulated Ducts

  Author(s): Shapiro, Zoeller, Mantha

  Organization(s): CARB

  Publication Date: August 2013

  Document covering the technical aspects of buried and insulated ducts, as well as the advantages, disadvantages, and risks of buried and insulated ducts compared to alternative strategies.

- Building America Top Innovations 2013 Profile: Buried and Encapsulated Ducts

  Author(s): PNNL

  Organization(s): PNNL

  Publication Date: September 2013

  Case study providing information about buried and encapsulated ducts.

- Technology Solutions Case Study: Buried and Encapsulated Ducts, Jacksonville, Florida

  Author(s): CARB

  Organization(s): CARB

  Publication Date: November, 2013

  Case study exploring how using buried and/or encapsulated ducts can reduce duct thermal losses in existing homes.

- Compact Buried Ducts in Hot-Humid Climates

  Author(s): D Mallay

  Organization(s): Home Innovation Research Labs

  Publication Date: January 2016

  A system of compact, buried ducts provides a high-performance and cost-effective solution for delivering conditioned air throughout the building. This report outlines research activities that are expected to facilitate adoption of compact buried duct systems by builders. The results of this research would be scalable to many new house designs in most climates and markets, leading to wider industry acceptance and building code and energy program approval.

- ACCA Manual D – Residential Duct Systems, Air Conditioning Contractors of America, 2013. https://www.acca.org/technical-manual/manual-d/
- ACCA Manual J – Residential Load Calculation, Air Conditioning Contractors of America, 2011. http://www.acca.org/technical-manual/manual-j/
- ACCA Manual S – Residential Equipment Selection, Air Conditioning Contractors of America, 2013. http://www.acca.org/technical-manual/manual-s/
- ACCA Standard 5: HVAC Quality Installation Specification, Air Conditioning Contractors of America, 2010. http://www.energystar.gov/ia/home_improvement/home_contractors/qispec.pdf
- ACCA Standard 9: HVAC Quality Installation Verification Protocols, Air Conditioning Contractors of America, 2009. http://www.energystar.gov/ia/home_improvement/home_contractors/QI_Verification_Protocols.pdf

BASC Related Guides:

- Compact Air Distribution, https://basc.pnnl.gov/resource-guides/compact-air-distribution
- Ducts Buried in Attic Insulation, https://basc.pnnl.gov/resource-guides/ducts-buried-attic-insulation
- Ducts Buried in Attic Insulation and Encapsulated, https://basc.pnnl.gov/resource-guides/ducts-buried-attic-insulation-and-...
- Duct Leakage to the Outdoors, https://basc.pnnl.gov/resource-guides/duct-leakage-outdoors

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

Building America Old Content	Building America BASC Content
High-Cost	Low Cost
Fixed	Continuously Improved
Read-Only	User Feedback
Use-As-Is	Fully Customizable
Hard-to-Use	Easy-to-Use
Limited Accessibility	Mobile Application

BASC Community of Users

Business Applications Overview

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

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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.

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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%.

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Fully Flashed Window and Door Openings (2)
Video Posted: September, 2015
Continuous Rigid Insulation Sheathing/Siding 1
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Continuous Rigid Insulation Sheathing/Siding
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Building America U.S. Department of Energy

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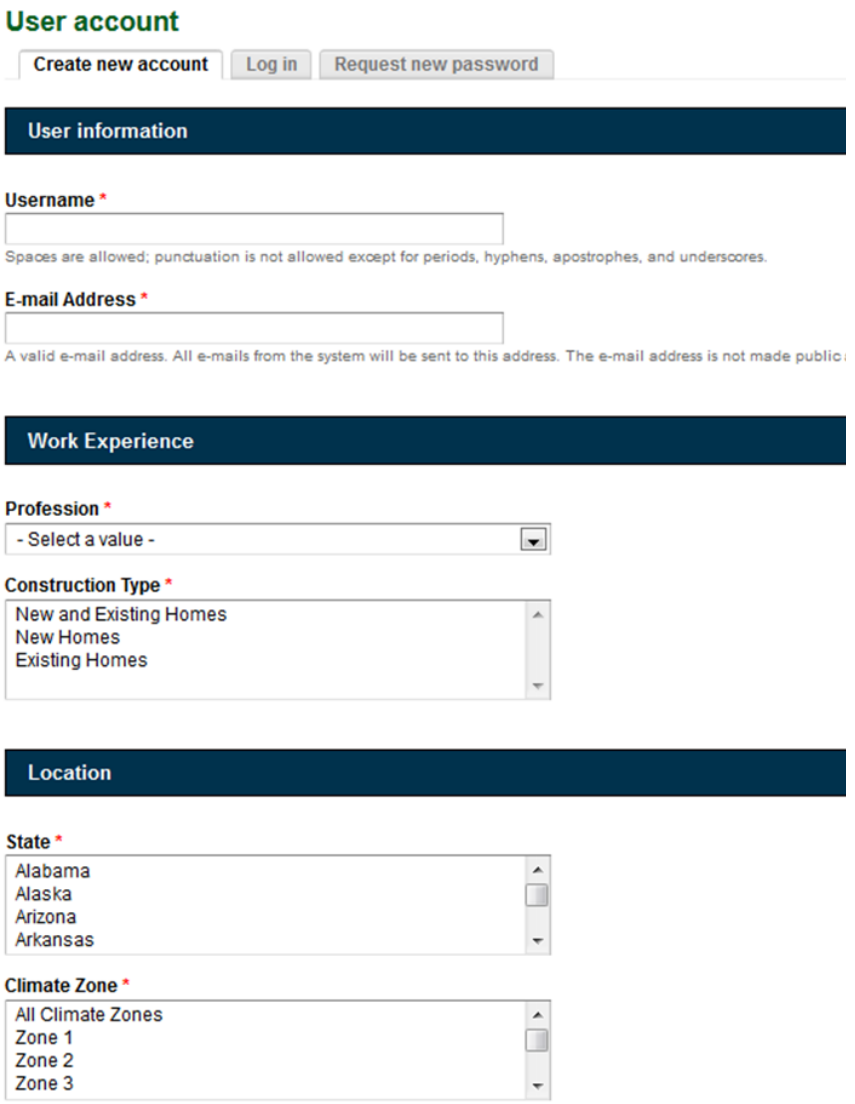

Field Kits

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MY FIELD KITS

Default Field Kit
10 items
Happy Valley homes subdivision Portland Oregon
12 items

New Field Kit

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Create Sales Worksheet
View All Sales Worksheets

Sales Agent Reference Guide for Happy Valley Homes
Last Updated: September 22, 2015
Fall 2015 Promotion
Last Updated: September 21, 2015

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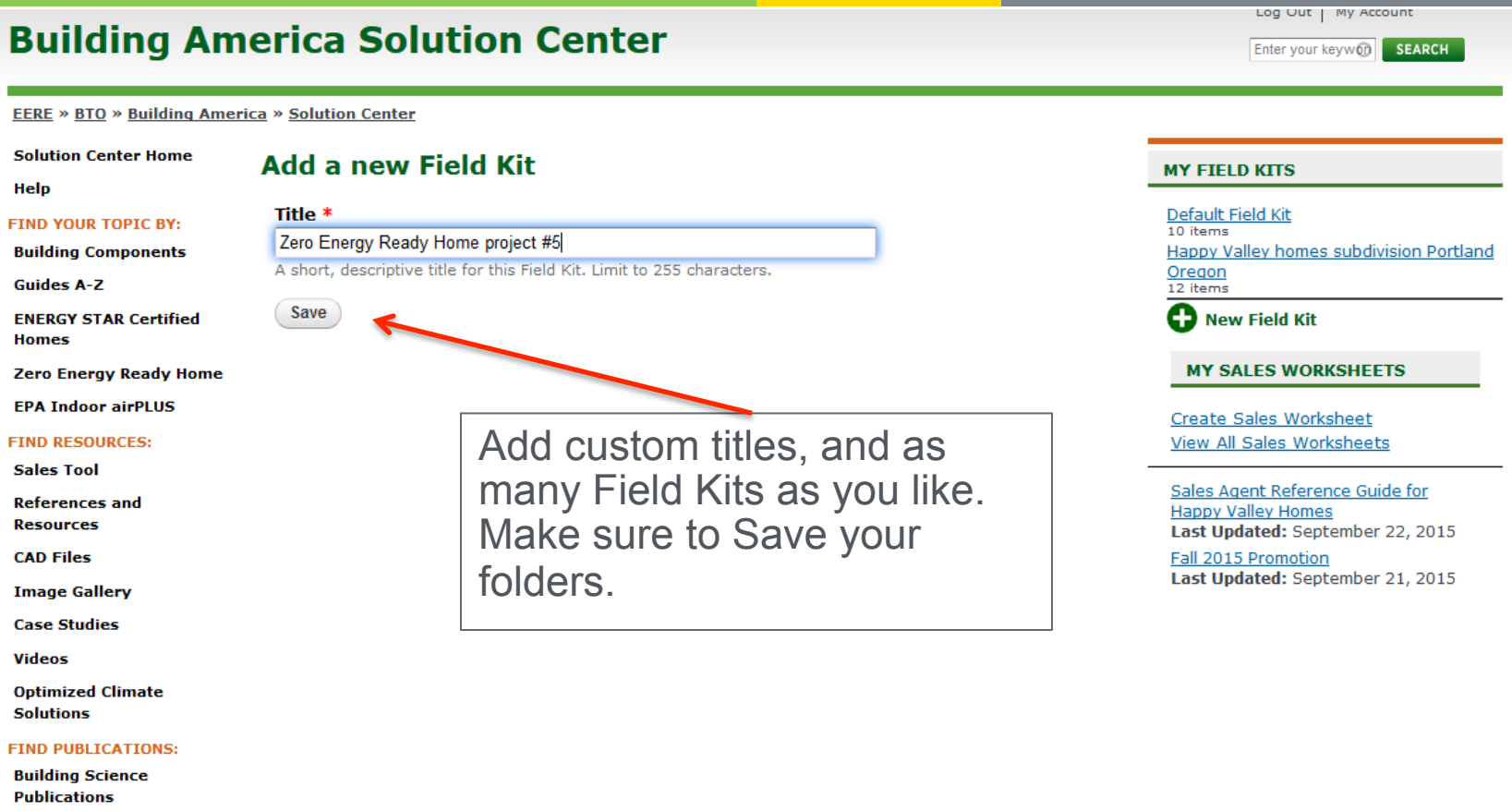
Field Kits



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Add or remove this item in your Field Kits.
- Default Field Kit (10 items)
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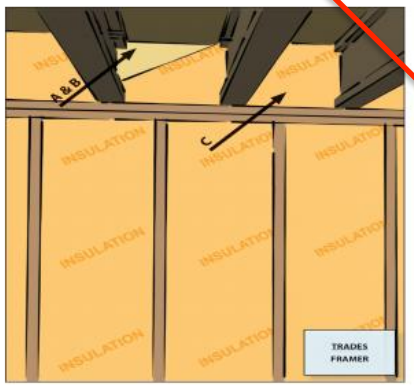
Air Sealing Attached Garage

Feedback | Belongs to 1 Field Kit | Print this page | PDF version

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

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 blower 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

10 items
Happy Valley homes subdivision Portland Oregon
12 items
Zero Energy Ready Home project #5
0 items

New Field Kit

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Sales Agent Reference Guide for Happy Valley Homes
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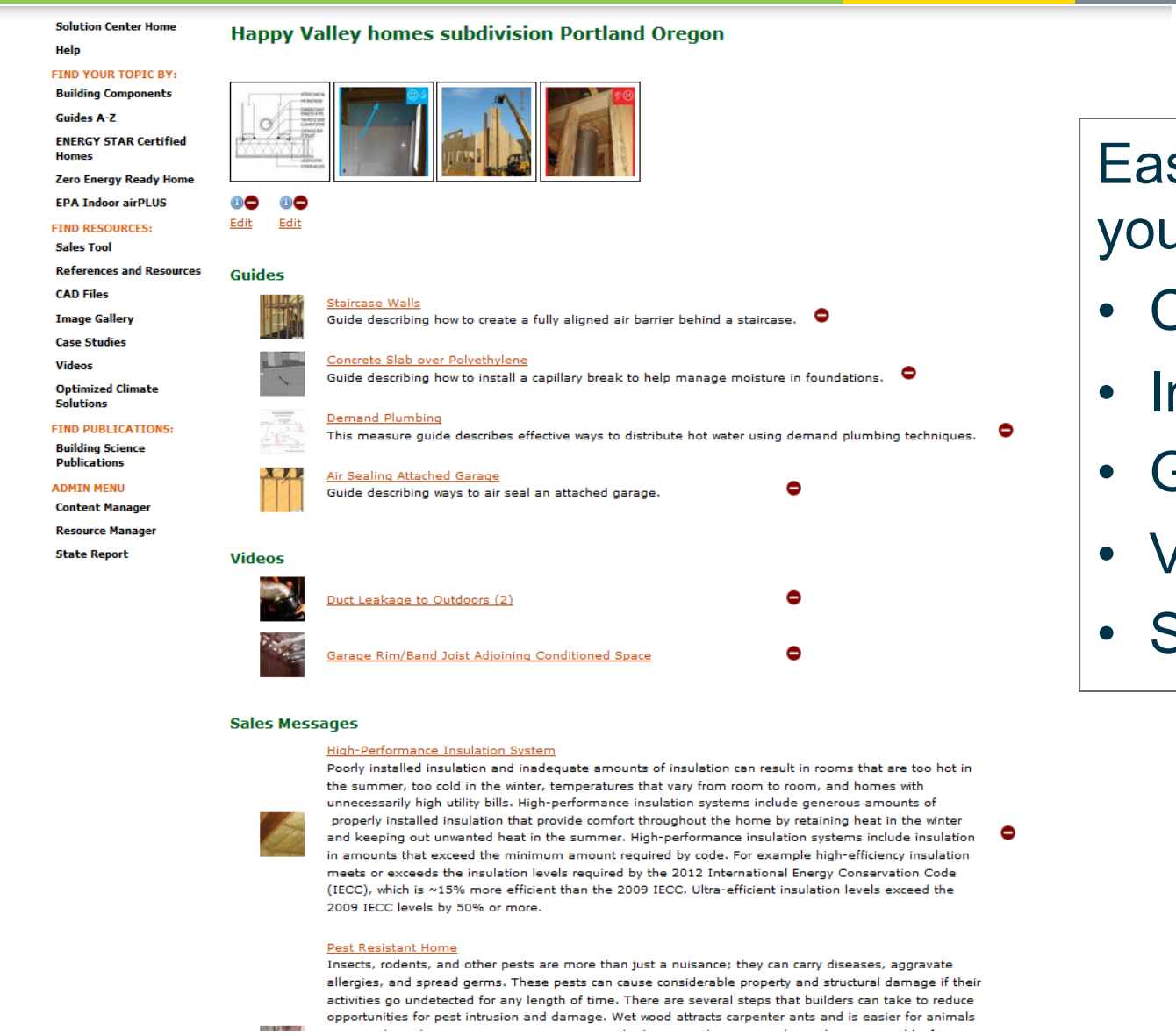
Hover over the Field Kit icon to add/delete content

Field Kits



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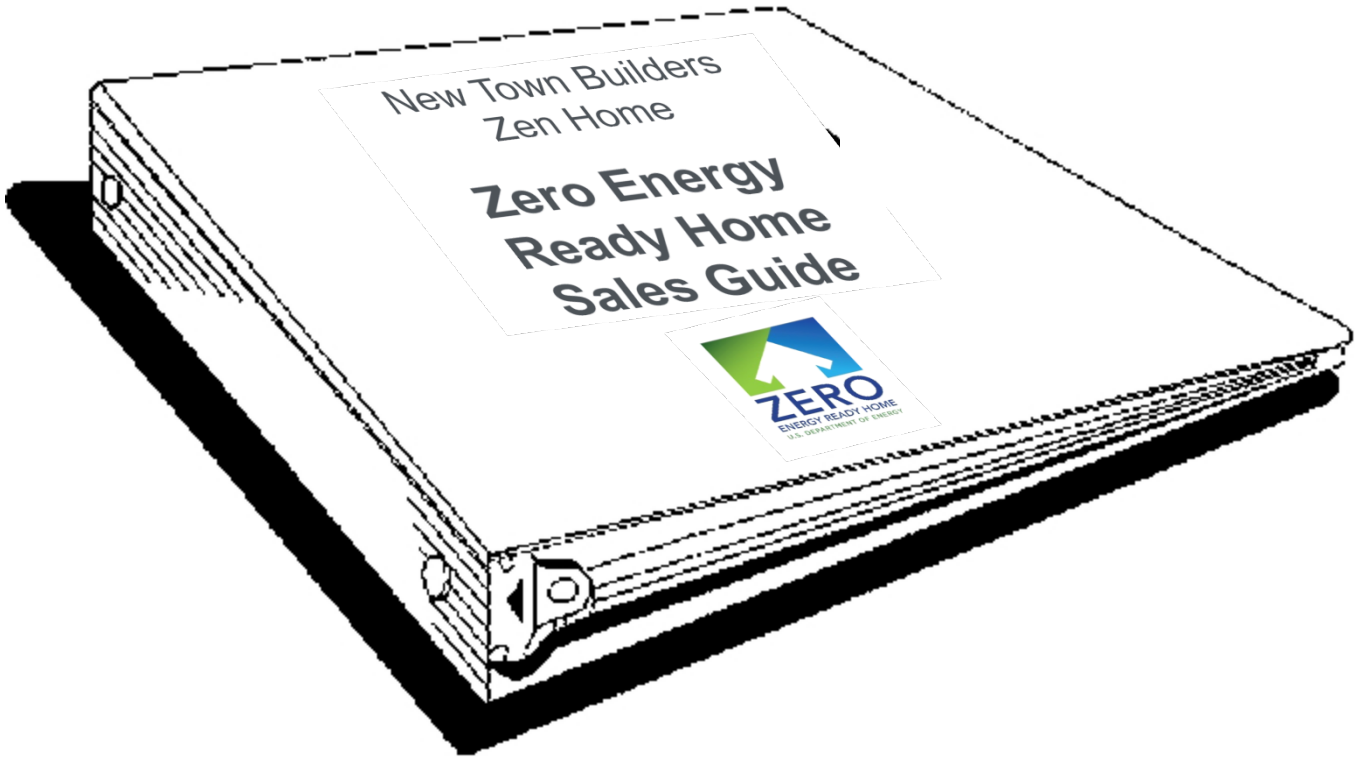
Sales Agent Reference Guide



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Primary BASC tools on homepage

Sales Tool

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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.

MY FIELD KITS

Zero Energy Ready Home Project #1
15 items
New Construction Specs
6 items
Portland Oregon Rennovation
4 items
Indoor airPLUS
2 items

New Field Kit

MY SALES TOOLS

Create Sales Tool
View All Sales Tools

Browse by 10 different building topics.

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.

Sales Tool

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Help
FIND YOUR TOPIC BY:
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FIND RESOURCES:
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BUILDING SCIENCE-TO-SALES TRANSLATOR

HVAC Ducts In Conditioned Space = Interior Comfort Delivery System

TECHNICAL DESCRIPTION:

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.

Alternate Terms

- Advanced Interior Comfort Delivery System
- Energy Saving Interior Comfort Delivery System

Interior Comfort Delivery System Sales Message

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?

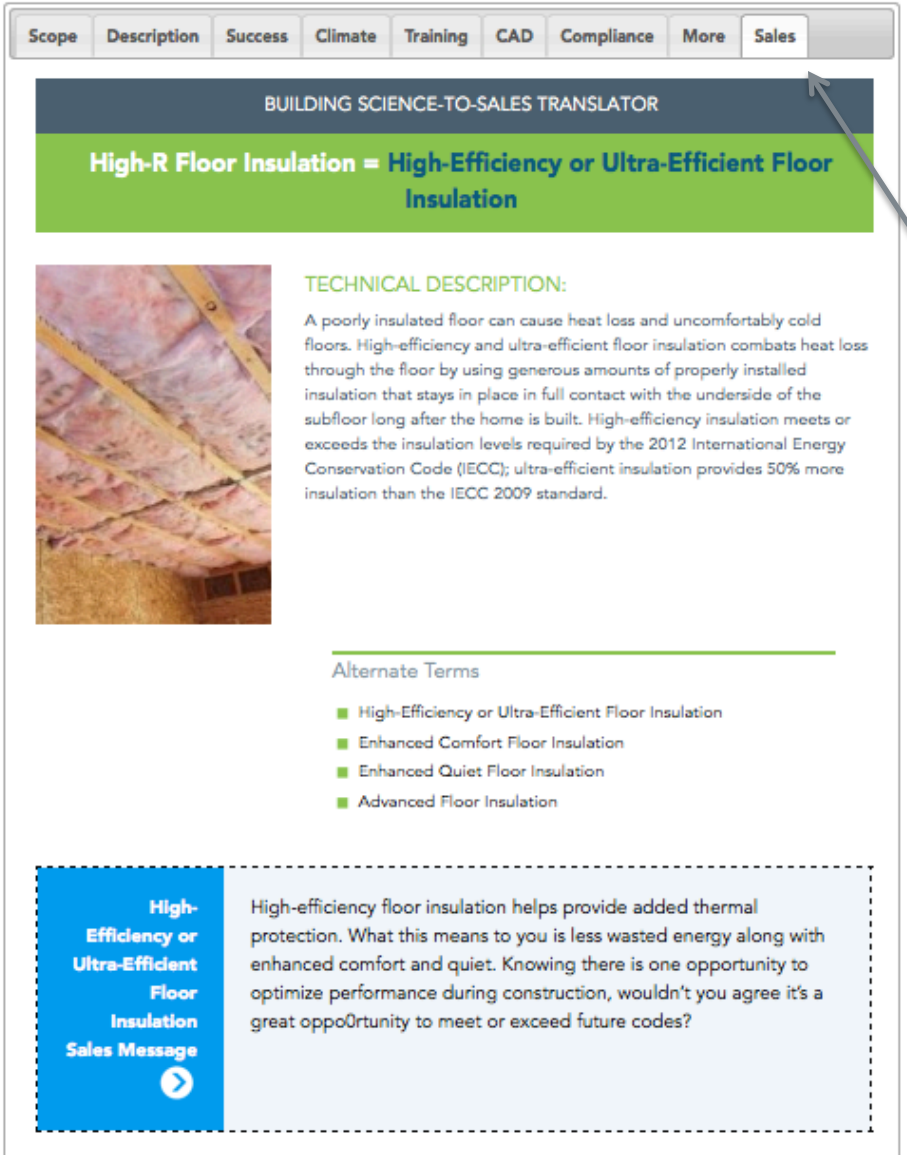
Translation

Simplified Description

Alternate Terms

Sales Script

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

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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.

MY FIELD KITS

Zero Energy Ready Home Project #1
15 items
New Construction Specs
6 items
Portland Oregon Rennovation
4 items
Indoor airPLUS
2 items

New Field Kit

MY SALES TOOLS

Create Sales Tool
View All Sales Tools

My Sales Tools mirrors Field Kits, and allows you to create customized, point-of-sale worksheets for homeowners

Sales Agent Reference Guide

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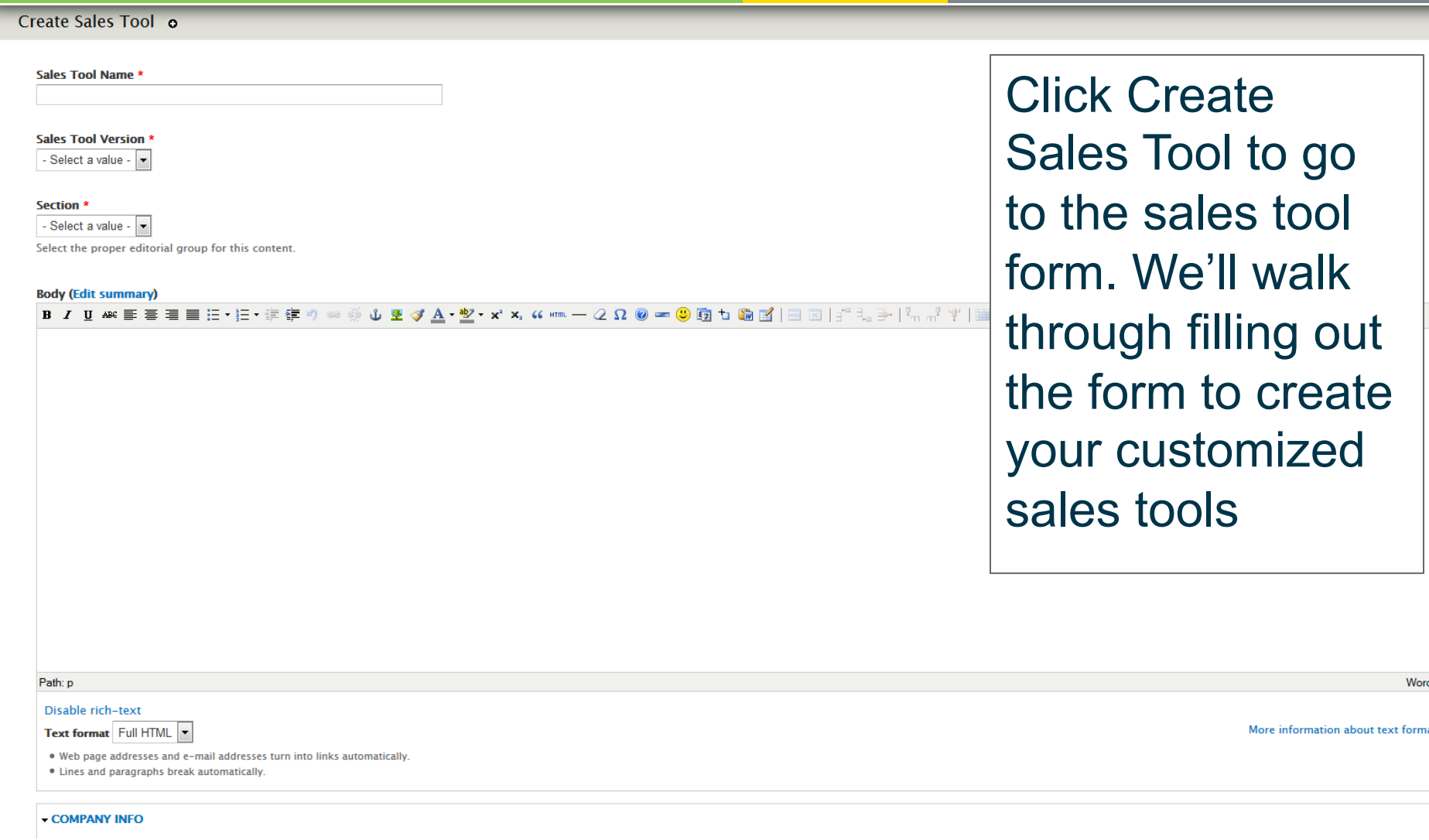
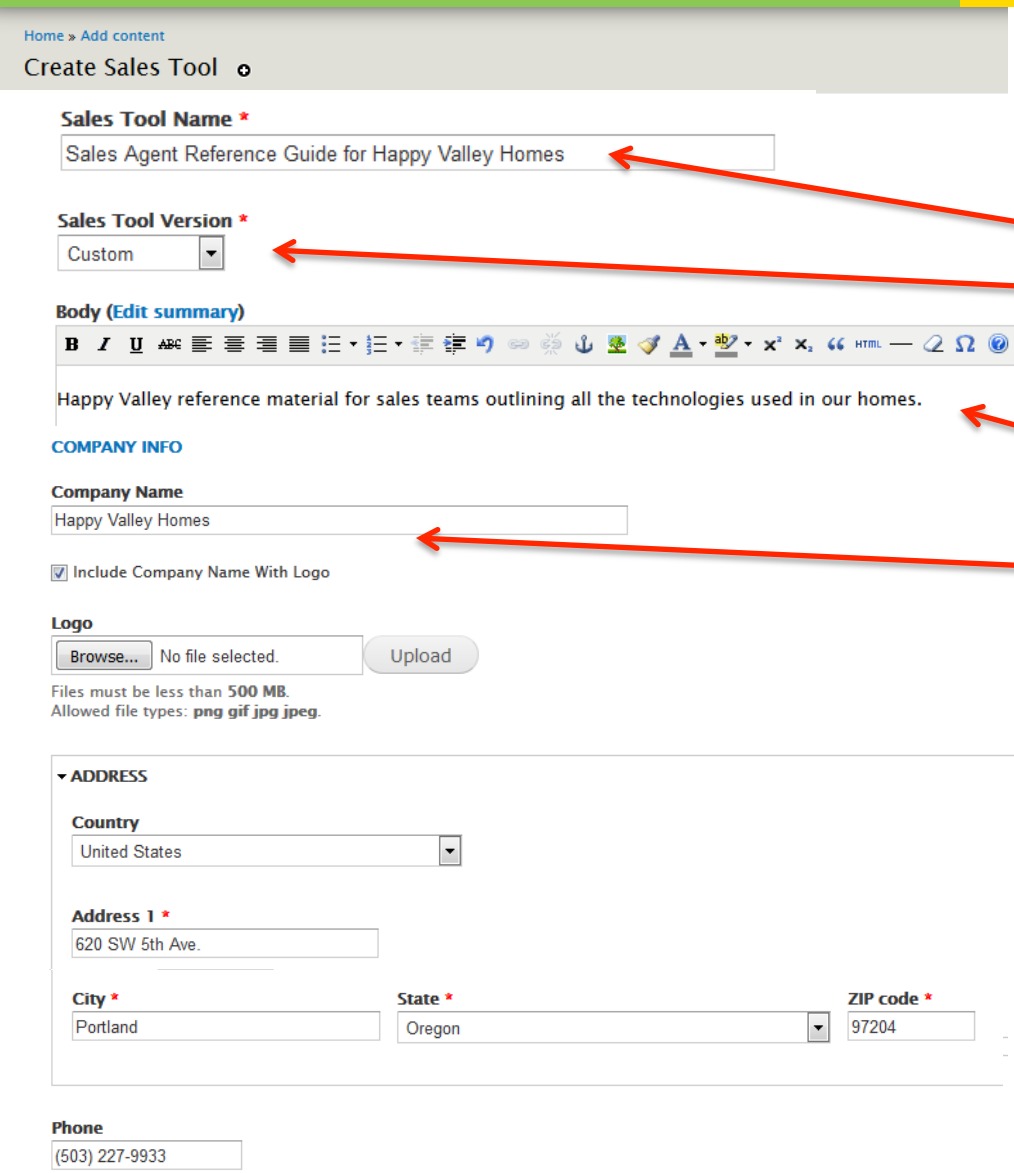


Click Create Sales Tool to go to the sales tool form. We'll walk through filling out the form to create your customized sales tools

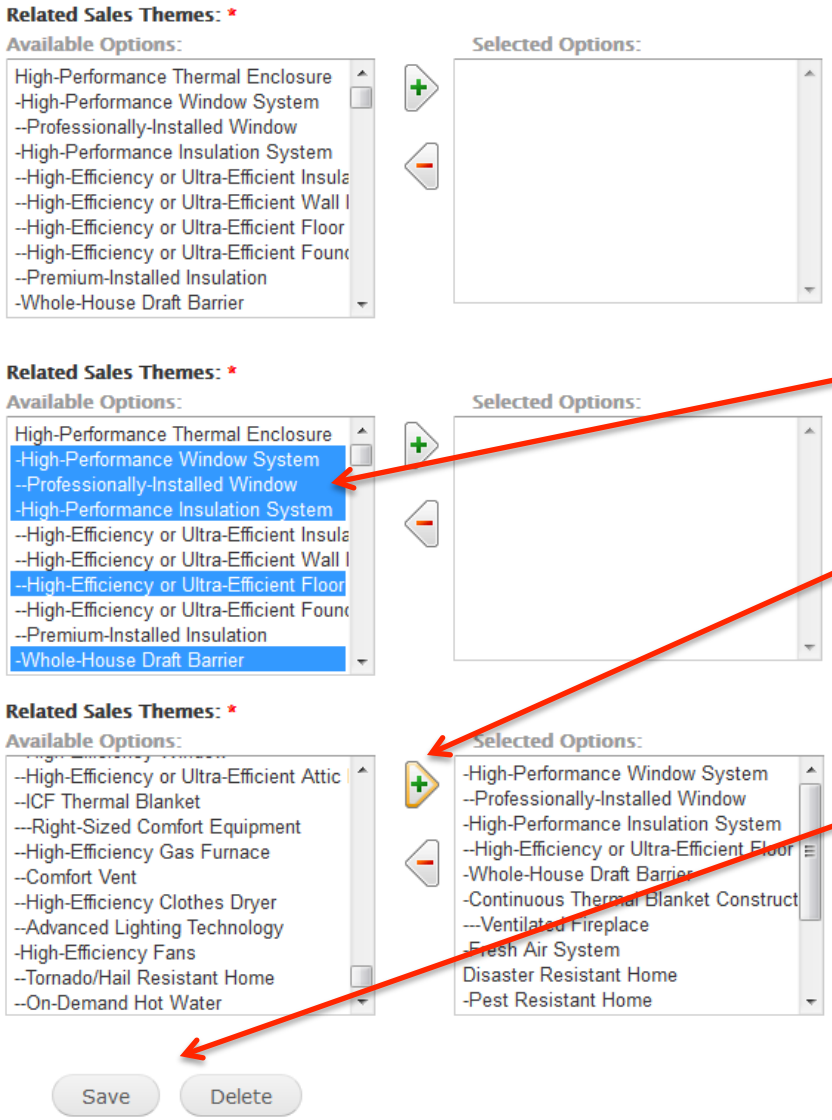
Sales Agent Reference Guide



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

Sales Agent Reference Guide



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

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Sales Agent Reference Guide for Happy Valley Homes

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Belongs to 0 Field Kits | Print this page | PDF version

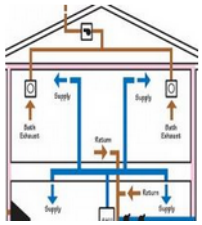
Happy Valley Homes

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 though 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?

MY FIELD KITS

Default Field Kit
8 items

New Field Kit

MY SALES WORKSHEETS

Create Sales Worksheet
View All Sales Worksheets

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Last Updated: September 22, 2015

Fall 2015 Promotion
Last Updated: September 21, 2015

Save your form!

- See your saved sales tools under your field kits
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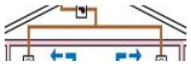

Fresh Air System

MY FIELD KITS

Field Kit #1
10 items

Happy Valley homes subdivision Portland Oregon
12 items

Zero Energy Ready Home project #5
4 items

New Field Kit

MY SALES WORKSHEETS

Create Sales Worksheet
View All Sales Worksheets

Ultra Efficient list
Last Updated: September 23, 2015

Quality Built list
Last Updated: September 23, 2015

Healthful environment list
Last Updated: September 23, 2015

Enhanced Durability List
Last Updated: September 23, 2015

Advanced Technology list
Last Updated: September 23, 2015

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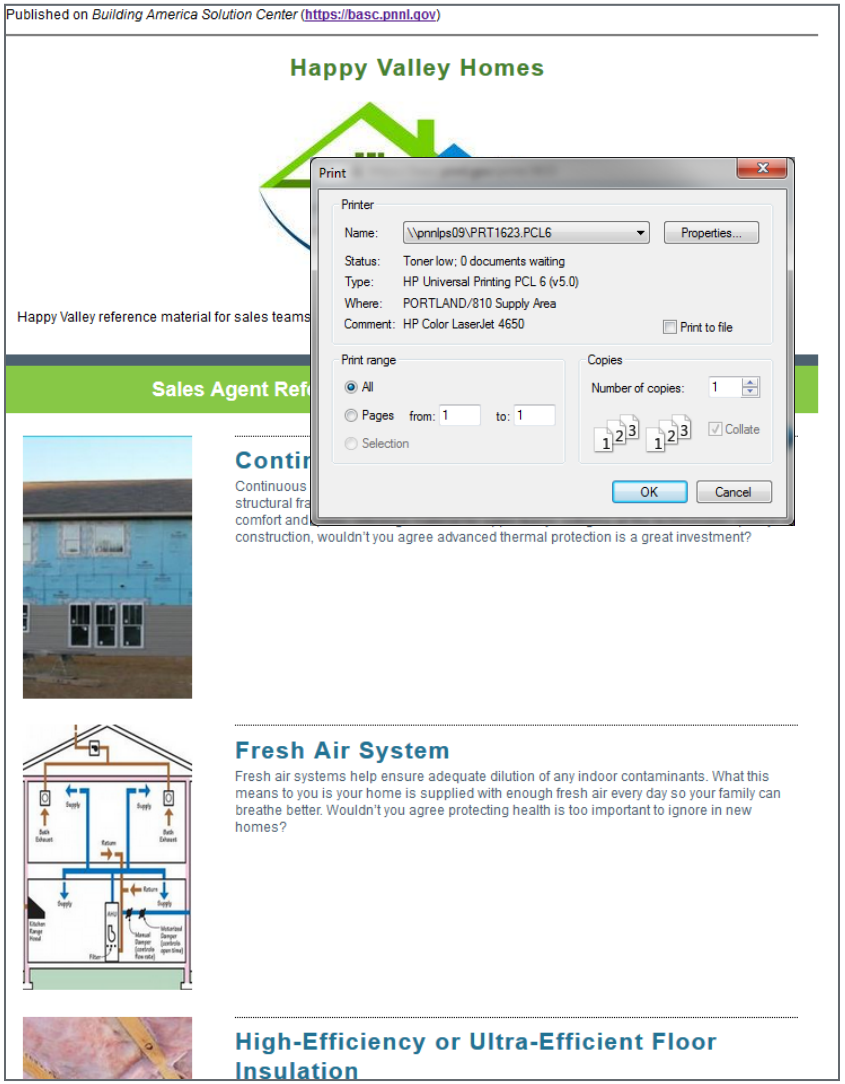
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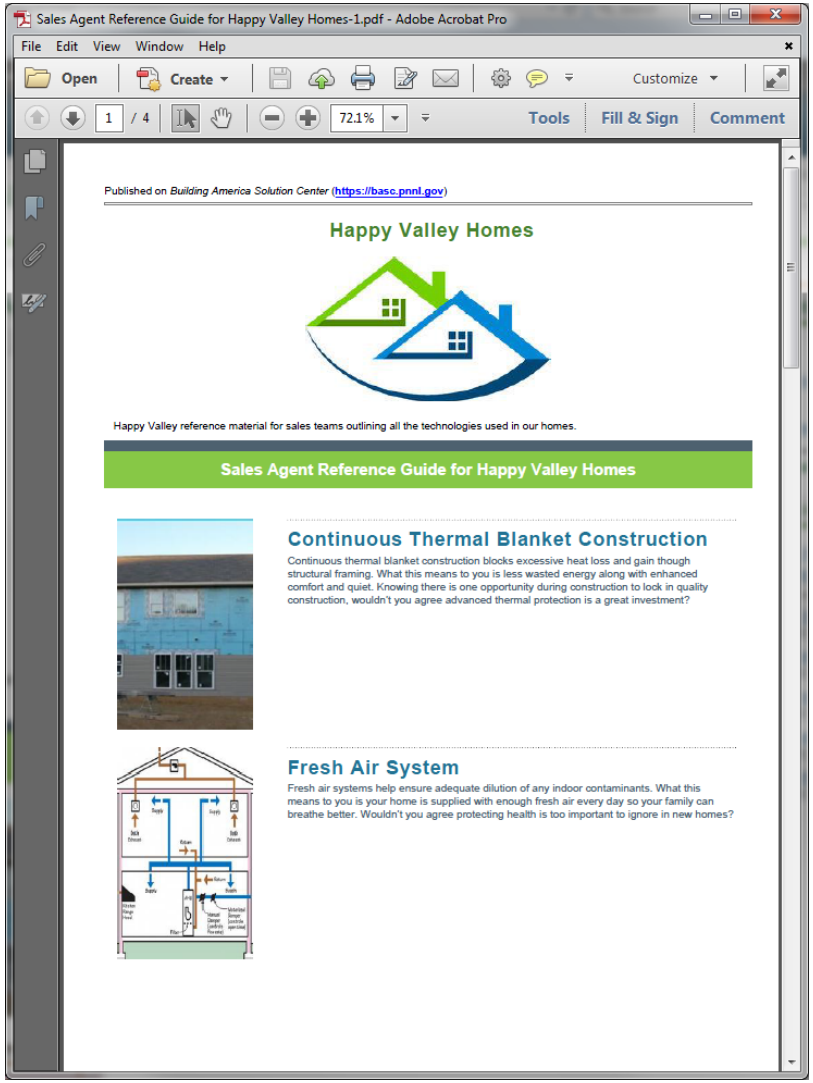
construction, wouldn't you agree advanced thermal protection is a great investment?
Fresh Air System
Fresh air systems help ensure adequate dilution of any indoor contaminants. What this means to you is your home is supplied with enough fresh air every day so your family can breathe better. Wouldn't you agree protecting health is too important to ignore in new homes?
High-Efficiency or Ultra-Efficient Floor Insulation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Happy Valley reference material for sales teams outlining all the technologies used in our homes.
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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?

Point-of-Sale Innovation Fact Sheets

- 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

Point-of-Sale Innovation Fact Sheets

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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'.

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MY FIELD KITS

Field Kit #1
10 items
Happy Valley homes subdivision Portland Oregon
12 items
Zero Energy Ready Home project #5
1 items

New Field Kit

MY SALES WORKSHEETS

Create Sales Worksheet
View All Sales Worksheets

Sales Agent Reference Guide for Happy Valley Homes
Last Updated: September 22, 2015
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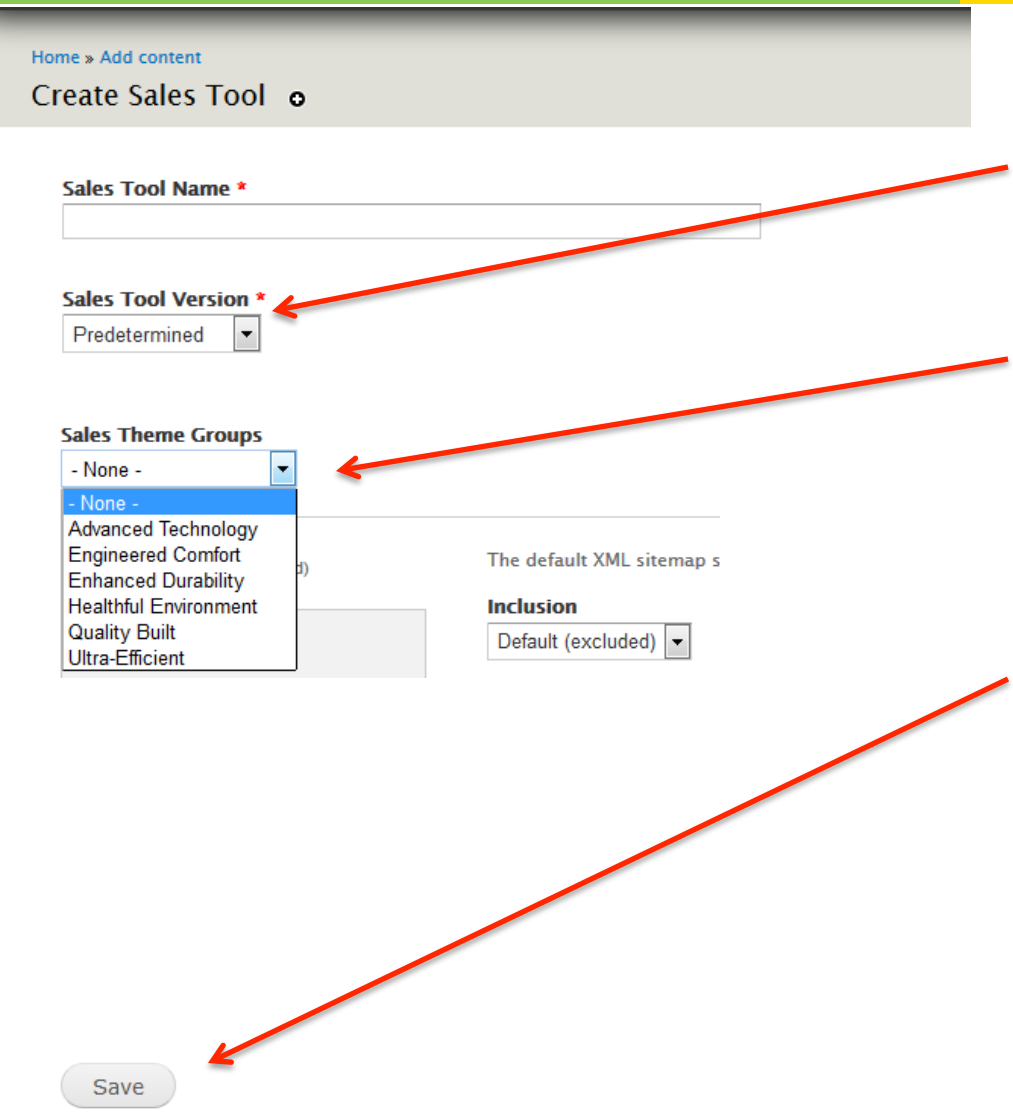
Use the same link we used before to create our custom list. "Create Sales Worksheet"

Point-of-Sale Innovation Fact Sheets



- 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.

Point-of-Sale Innovation Fact Sheets

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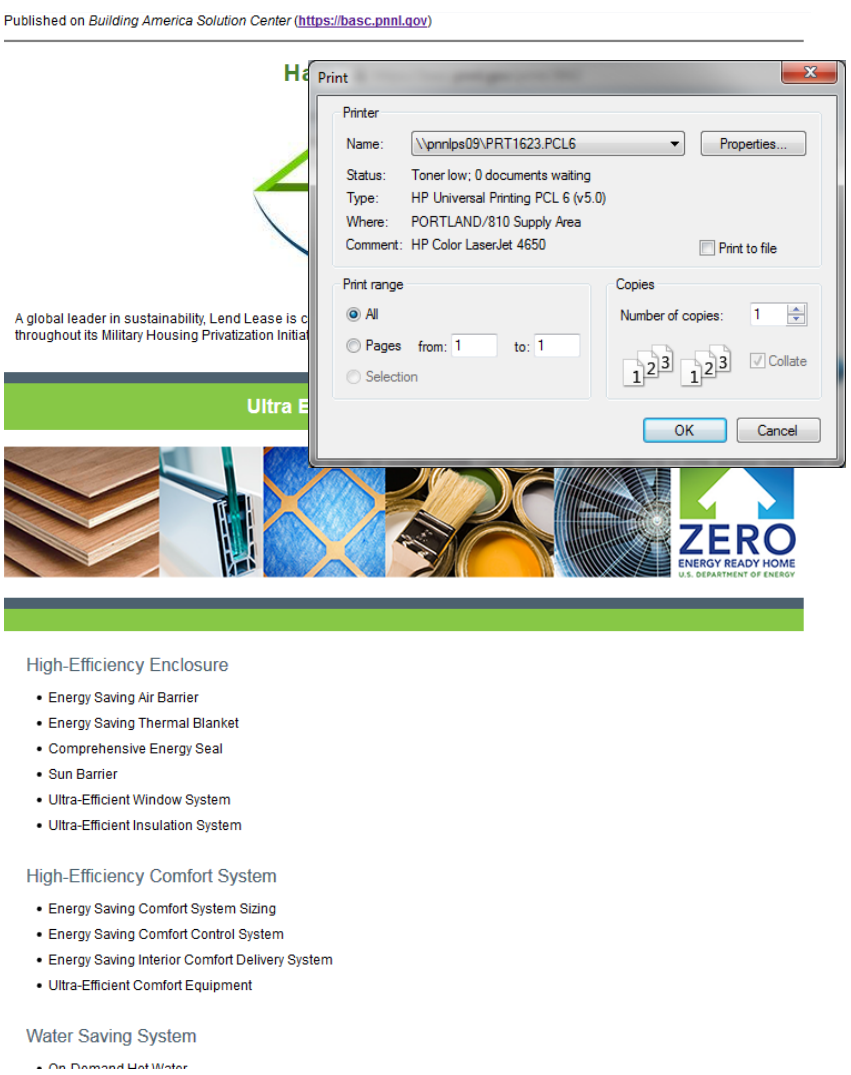

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Compact Air Distribution

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Feedback

Belongs to 1 Field Kit | Print this page | PDF version

Scope | Description | Success | Climate | Training | CAD | Compliance | [illegible] | Sales

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 0.06/0.06 cfm/sq.ft. supply/return leakage assumption (Leakage Class CL-3), the appropriate insulation (R-8 for attic ducts), and the 7C-AE 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 of 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.

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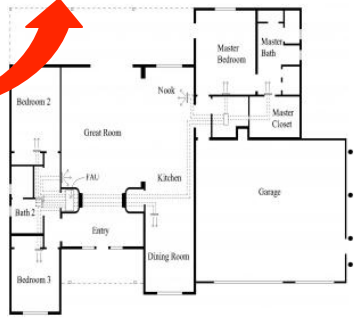
Compact Air Distribution

Last Updated: 06/16/2015

Scope



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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 labeled 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, (Rev. 07)

HVAC System Quality Installation Rater Checklist,
2. Duct Quality Installation - Applies to All Heating, Cooling, Ventilation, Exhaust, and Pressure Balancing Ducts, 2.1 Connections and routing of ductwork completed without kinks or sharp bends. , 2.2 No excessive coiled or looped flexible ductwork.

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 [illegible]

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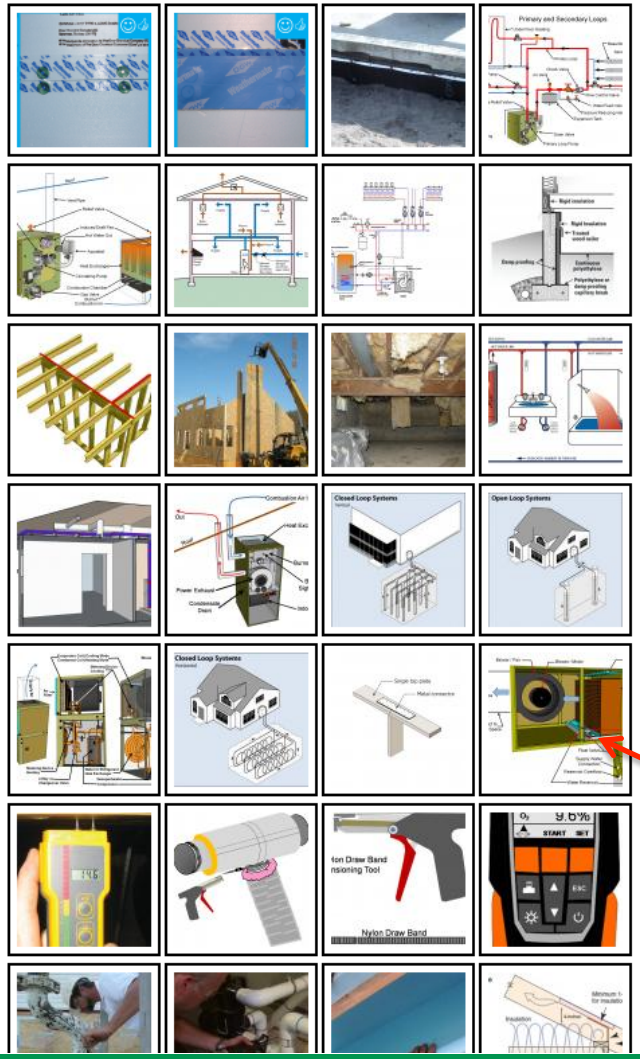

MY FIELD KITS

Field Kit #1
10 items
Happy Valley homes subdivision Portland Oregon
12 items
Zero Energy Ready Home project #5
3 items

New Field Kit

MY SALES WORKSHEETS

Create Sales Worksheet
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Happy Valley Homes Value Proposition
Last Updated: September 22, 2015
Sales Agent Reference Guide for Happy Valley Homes
Last Updated: September 22, 2015

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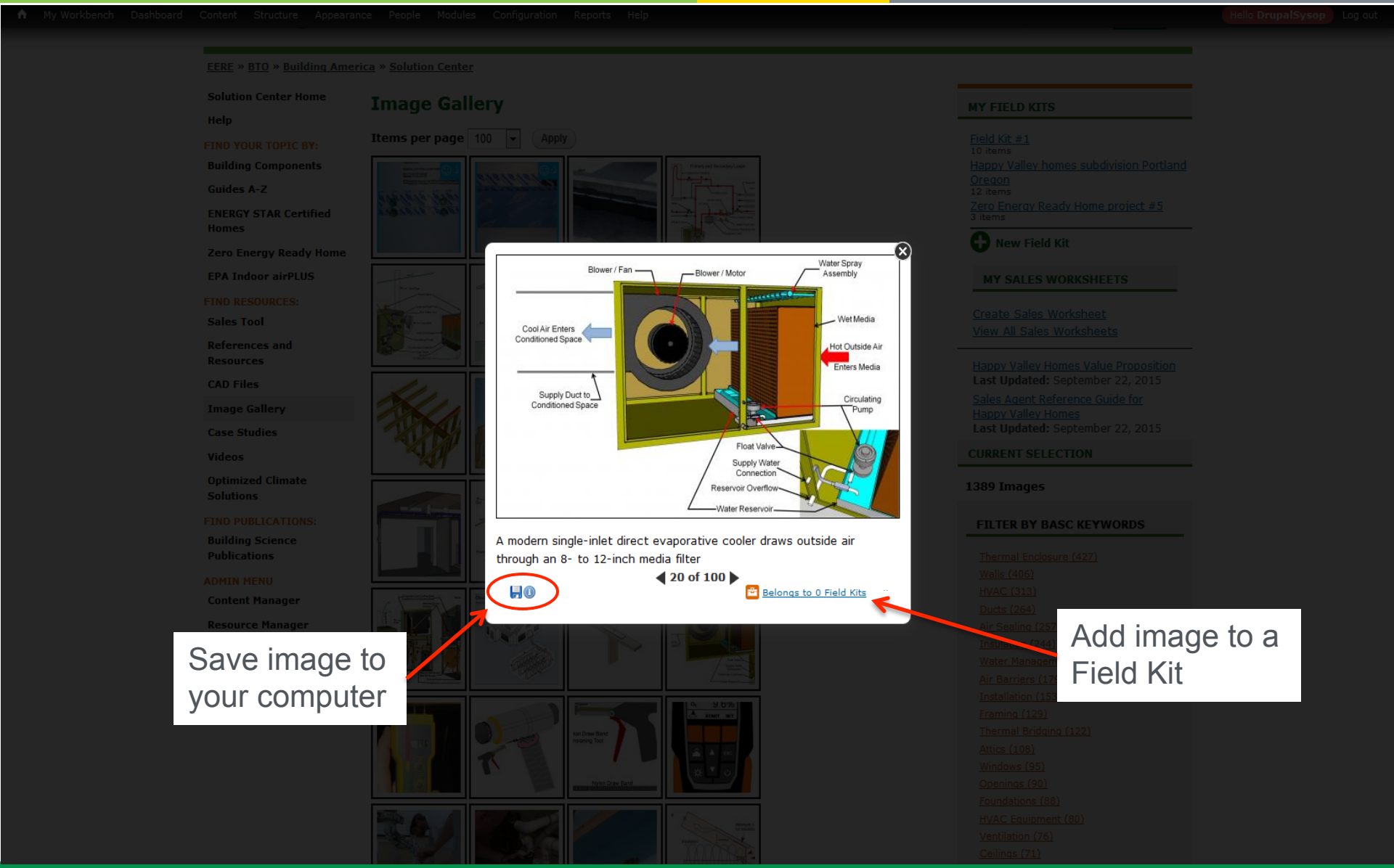

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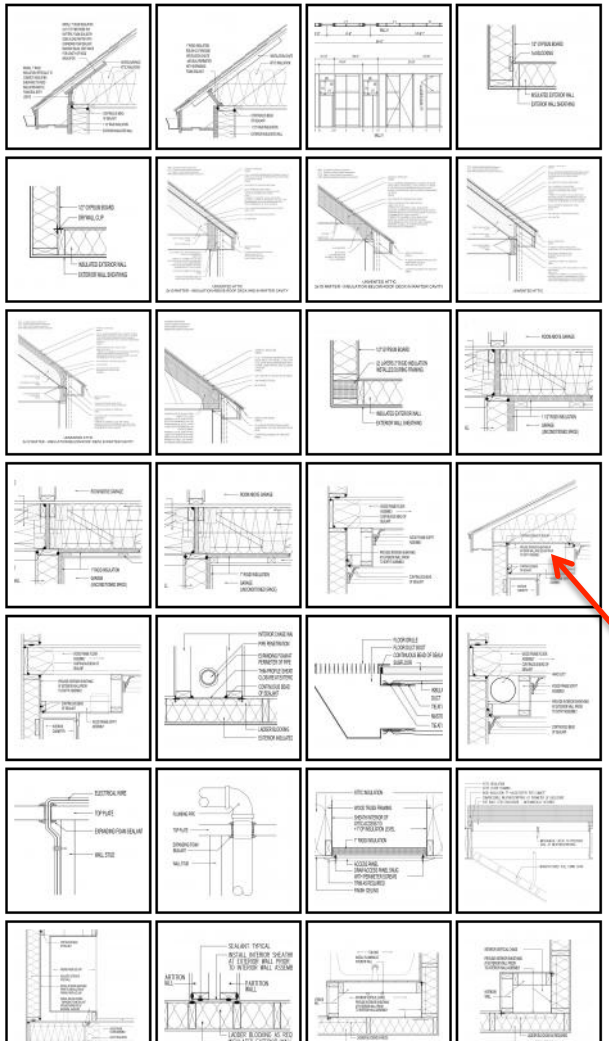

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New Field Kit

MY SALES WORKSHEETS

Create Sales Worksheet
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Happy Valley Homes Value Proposition
Last Updated: September 22, 2015
Sales Agent Reference Guide for Happy Valley Homes
Last Updated: September 22, 2015

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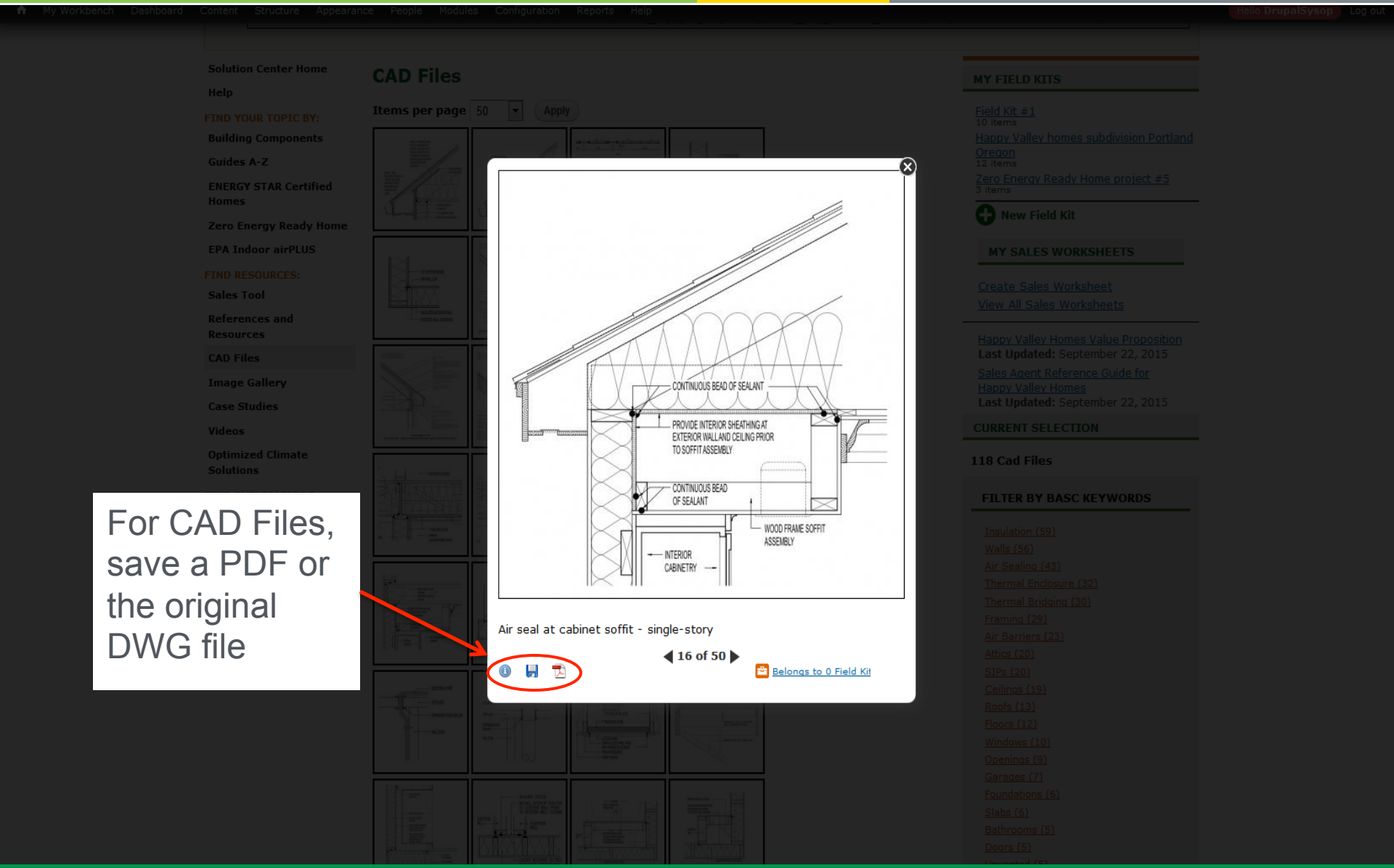

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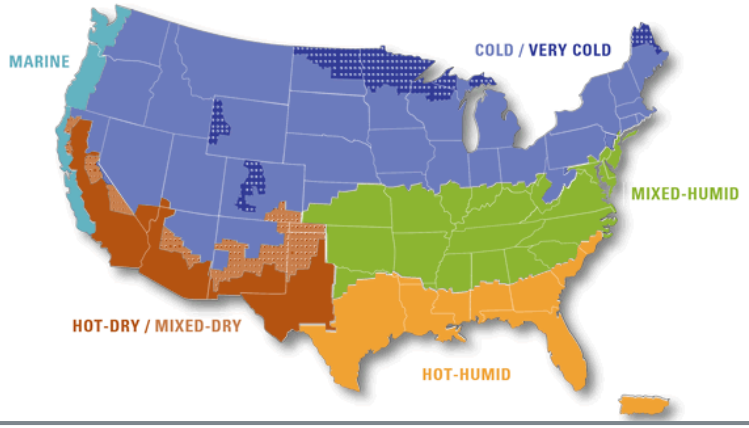
Optimized Climate Solutions

The Building America Program, funded by the Department of Energy (DOE), has worked for the last five years to reach the next level of cost effective energy performance in homes (approximately 30% above the B10 Benchmark – roughly consistent with the 2009 International Energy Conservation Code). To prove to industry that this level of performance is achievable and market viable, DOE created a labeling program called the DOE Zero Energy Ready Home (ZERH). The climate-specific guidance in this section of the Building America Solution Center provides detailed information on optimized solutions that meet or exceed the ZERH program requirements, cost effectively.

Use the interactive map below to find climate-specific guidance on Building America's Optimized Solutions for New Homes. For more information about climate designations, see the Building America Guide to Determining Climate Regions by County.



MY FIELD KITS

- Zero Energy Ready Home Project #1 — 21 items
- New Construction Specs — 6 items
- Portland Oregon Rennovation — 4 items
- Indoor airPLUS — 2 items

New Field Kit

Building America's Optimized Solutions for New Homes can help you meet or exceed the requirements of the Zero Energy Ready Home (ZERH) program.

ZERO ENERGY READY HOME U.S. DEPARTMENT OF ENERGY

A Department of Energy (DOE) ZERH represents a whole new level of energy performance, with rigourous requirements that ensure outstanding levels of energy savings, comfort, health and durability.

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

Find Case Studies by Climate Zone

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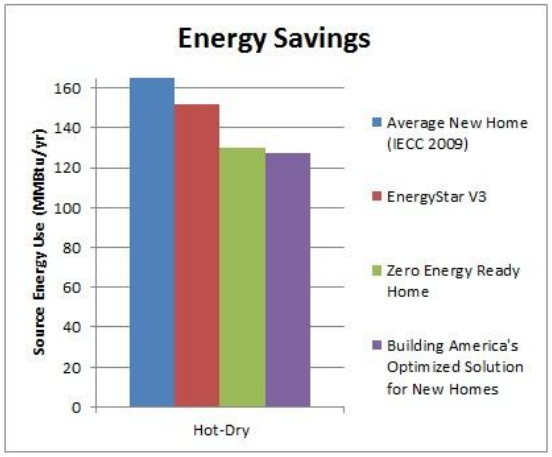
Hot-Dry/Mixed-Dry

This Building America Optimized Solution describes a set of building practices necessary to achieve the next step in energy performance for new homes (approximately 30% energy savings above the B10 Benchmark - roughly consistent with the 2009 International Energy Conservation Code). This package of measures meets and exceeds DOE's Zero Energy Ready Home (ZERH) program requirements and was selected for its performance in the following areas:

- Energy Savings
- Affordability
- Buildability
- Durability
- Healthy Indoor Environment

The high performance builders profiled in the **case studies found below** the interactive box show just a few examples of the hundreds of ways a builder can meet the premium levels of energy savings Building America strives for, while qualifying for the ZERH. Print the Optimized Solution for the Hot-Dry/Mixed-Dry Climate.

Energy Savings | Thermal Enclosure | HVAC System | Efficient Components



For each climate zone, find:

- Energy savings data
- Guidance for thermal enclosure, HVAC and efficient components
- Detailed case studies

Find Case Studies by Climate Zone

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Case Studies

DOE Zero Energy Ready Home Case Study: KB Homes, San Marcos, California
Author(s): PNNL
Organization(s): PNNL
Publication Date: September, 2013
Case study about a DOE 2014 Housing Innovation Award winner.

DOE Zero Energy Ready Home Case Study: Palo Duro Homes, Albuquerque, New Mexico
Author(s): PNNL
Organization(s): PNNL
Publication Date: September, 2013
Case study about a DOE 2014 Housing Innovation Award winner.

DOE Zero Energy Ready Home Case Study: Mandalay Homes, Prescott Valley, AZ
Author(s): PNNL
Organization(s): PNNL
Publication Date: October, 2014
Case study about zero energy ready home construction project in the hot-dry climate.

- 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

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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 (2 MB)
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 (2 MB)
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 (2 MB)
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 (2 MB)
Author(s): PNNL
Organization(s): PNNL
Publication Date: March, 2015
Building America Optimized Solution in the marine climate.

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Field Kit #1
10 items
Happy Valley homes subdivision Portland Oregon
12 items
Zero Energy Ready Home project #5
3 items

New Field Kit

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Happy Valley Homes Value Proposition
Last Updated: September 22, 2015

Sales Agent Reference Guide for Happy Valley Homes
Last Updated: September 22, 2015

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