



Where's WALDO?

Winning Assets Leading to
Dependable Outcomes

October 5, 2017



Housekeeping

Welcome

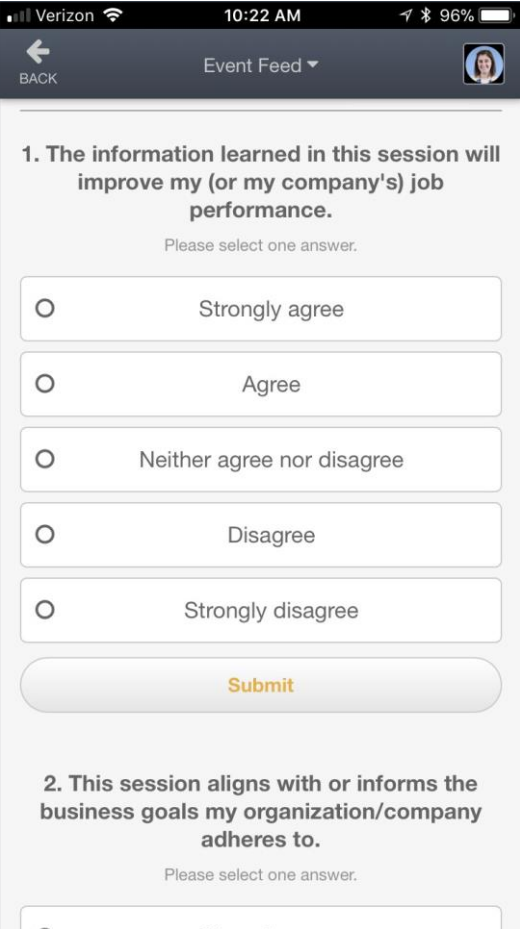
- Safety
- Bathrooms
- Cell phones



Session Survey Instructions

At the end of each session, you will be given 5 minutes to complete the session survey.

1. Open the “HEF2017” app
2. Navigate to “Agenda” and select the session
3. Scroll down to “Session Feedback”
4. For each question, select answer and hit “Submit”
5. Show completed survey to BetterBuiltNW rep to earn points
6. Prizes awarded Friday to the top point earners
 - See “Challenge” section in the app for activities
7. Assistance available at the BetterBuiltNW table



The screenshot shows a mobile app interface for a session feedback survey. At the top, the status bar shows 'Verizon', '10:22 AM', and '96%' battery. The app header has a 'BACK' button, 'Event Feed' with a dropdown arrow, and a user profile icon. The survey question is: '1. The information learned in this session will improve my (or my company's) job performance.' Below the question is the instruction 'Please select one answer.' and five radio button options: 'Strongly agree', 'Agree', 'Neither agree nor disagree', 'Disagree', and 'Strongly disagree'. A 'Submit' button is at the bottom of the question section. Below this is a second question: '2. This session aligns with or informs the business goals my organization/company adheres to.' with the instruction 'Please select one answer.' and a partially visible radio button option.

Agenda

Tools

- IAQ tools
- Materials
- Water tools
- Energy tools
- Construction tools

Websites

- BetterBuiltNW
- NetZero Project
- BASC



Image courtesy of Creative Commons



Indoor Air Quality

Indoor airPLUS

Why does indoor air quality matter?

People are increasingly concerned about mold, radon, carbon monoxide, and toxic chemicals in their homes. Poor indoor air quality can lead to eye irritation, headaches, allergies, respiratory problems such as asthma, and other serious health problems.

EPA studies show that levels of many indoor air pollutants can be two to five times higher than outdoor levels. And since most people spend close to 90% of their time indoors, keeping indoor pollution levels as low as possible is the right thing to do for you and your family.

How can building practices help improve indoor air quality?

Builders can use a variety of construction practices and technologies to decrease the risk of poor indoor air quality, including careful selection and installation of building materials; heating, ventilating, and air-conditioning (HVAC) systems; combustion-venting systems; and moisture control techniques.

It's not easy for homebuyers to keep track of all the preferred construction details that lead to improved indoor air quality. That's why EPA created the Indoor airPLUS label. Ask for it in your next new home.



Only ENERGY STAR Certified Homes are eligible to earn the Indoor airPLUS label.

Office of Air and Radiation
EPA 402/F-14/001 | February 2014

www.epa.gov/indoorairplus



Breathe Easy

In Your NEW

Indoor airPLUS Home

Designed and built for improved indoor air quality and energy efficiency.



All Indoor airPLUS qualified homes also meet strict guidelines for energy efficiency set by ENERGY STAR, the nationally-recognized symbol for energy efficiency.



Hayward Score

Dan Wildenhaus

tacoma, WA 98403
September 11, 2017

Your Hayward Score

42
▼

Very Poor

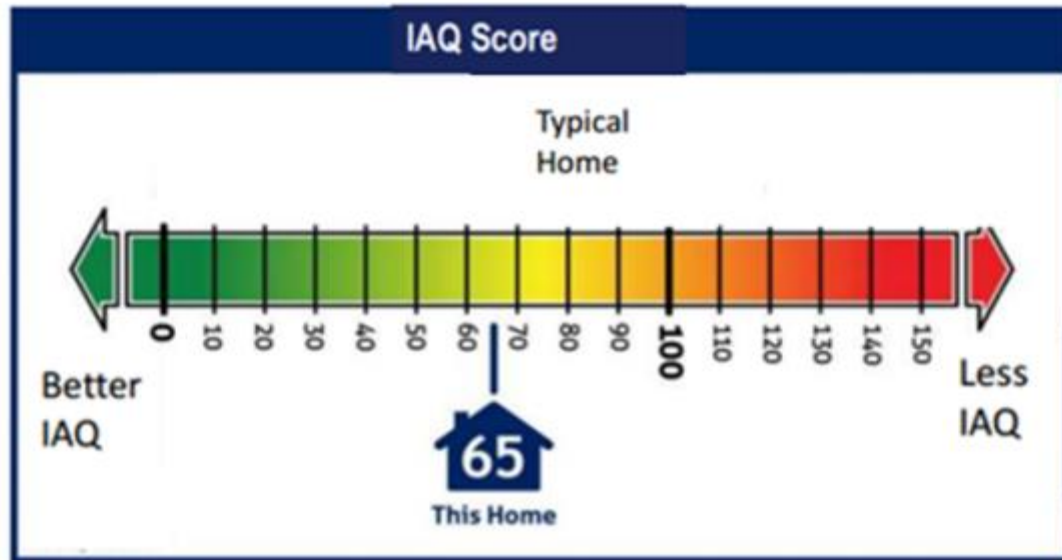
Poor

Fair

Good

Excellent

The future





Water Efficiency

WaterSense



Resource Manual for Building WaterSense® Labeled
New Homes

Version 1.2

July 24, 2014

Indoor Criteria:	Outdoor Criteria:
Leaks <ul style="list-style-type: none">No visible leaks Service Pressure <ul style="list-style-type: none">Service pressure test ≤ 60 psi Hot Water Delivery <ul style="list-style-type: none">10°F temperature change observed within ≤ 0.6 gallons Plumbing Fixtures <ul style="list-style-type: none">WaterSense labeled toilets, bathroom sink faucets, and showerheads Dishwashers and Clothes Washers* <ul style="list-style-type: none">ENERGY STAR certified dishwashers and clothes washers	Landscape Design <ul style="list-style-type: none">Complies with WaterSense's Water Budget Tool for water-smart design Irrigation System* <ul style="list-style-type: none">WaterSense labeled irrigation controllersDesigned or installed by an irrigation professional certified by a WaterSense labeled programAudited by an irrigation professional certified by a WaterSense labeled programMulti-family: Independently metered Pools and Spas* <ul style="list-style-type: none">Single-family: Cover installedMulti-family: Independently metered, gutter or grate system used, sorptive media (pre-coat) or cartridge filtration system installed

WERS

The WERS Program – A New Focus on Water

WERS



Project Information Inputs

•User to complete the information in the white boxes.

•Orange boxes are pull-downs that require a response.

•Purple boxes are informational and grey boxes need no action.

•Cells with a small red triangle have additional guidance provided in a "fly-out" box.

Building Information		EXISTING		NEW	
New or Existing?	NEW	# of bedrooms			2
Type	Single Home	# of floors			1
# of units total		ave. floor to floor ht			10
Sample set size		main HW pipe dia.			0.75
House footprint in sf	3,190.00	distance from WH to MB shower			25.00
Roof sf	3,190.00	distance from WH to kitchen sink			15.00
Roof Type	Metal				

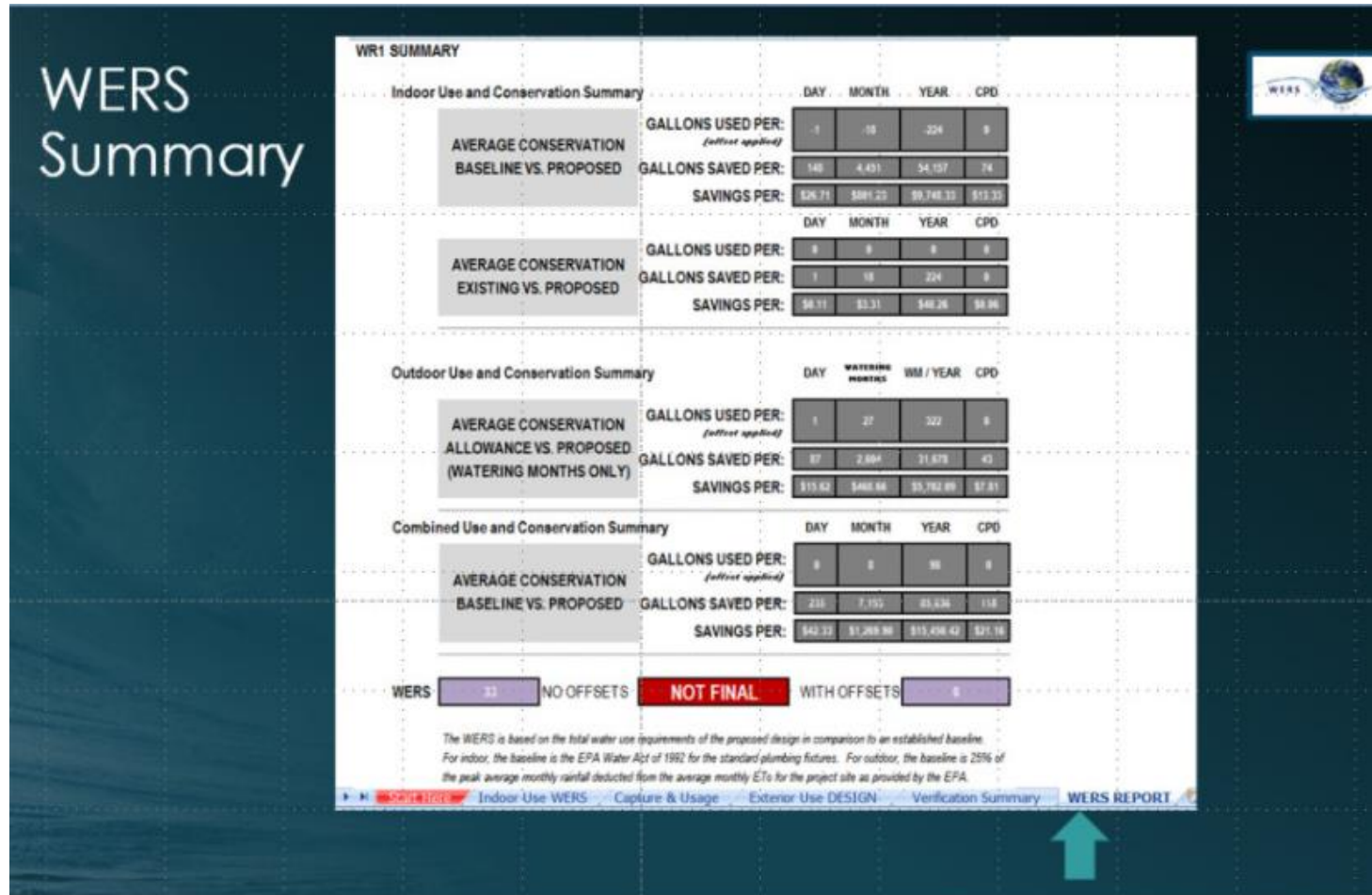
Climate Information		MUNICIPAL OVERRIDE	
Average Annual Rain	8.91	Average Annual Rain	TBD
Average Annual ETO	5.86	Average Annual ETO	TBD
Average Annual Watering Months	12.00	Average Annual Watering Months	TBD

Site Information		Maximum Allowable Irrigation Per Code	
Lot Size (sf)	3528360.00	Please only use one method if required by code, otherwise leave both as zero	
Encroachments	0.00	by %	0%
Under Roof (sf)	3630.00	by sf	0.00
Remaining Lot (sf)	3524730.00		3,524,730.00

Collection / Infiltration / Land Use Worksheet					
All Turf (sf)	0.00	0.00%	Directed Imp. Paving (sf)	0.00	0.00%
New Softscape (sf)	730.00	0.02%	Remaining Impervious (sf)	0.00	0.00%
Existing Softscape (sf)	0.00	0.00%	Prohibited Landscape Area (sf)	3,524,000.00	99.98%
Water Features (sf)	0.00	0.00%	Other (sf)	0.00	0.00%
Permeable Paving (sf)	0.00	0.00%	must total 100%	0 sf to go	100.00%
TOTAL	730.00				

Starting Tab: Project information and data collection

WERS



WERS Report indicating complete indoor & outdoor WERS, with or without offsets

Same logic and mostly same inputs, but...

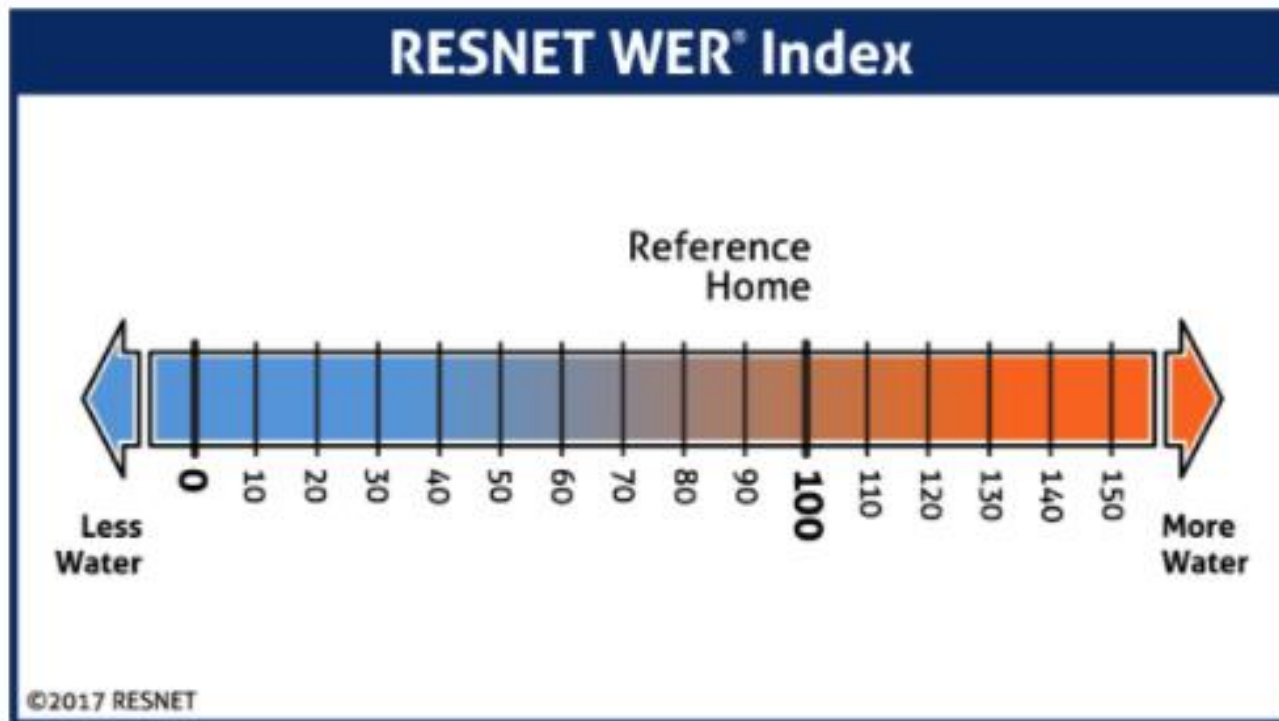
CFA 2400

	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1																
3	Home characteristics:		Drain Water Heat Recovery:		Table 4.2.2.5.2.11(1) Hot water fixture effectiveness					City	Tavg	% HW	(data from egUSA runs)			
4	CFA	2400	Showers connected	all	<u>Plumbing Fixture Description</u>		<u>Feff</u>			Duluth	39.2	9.52%				
5	Nbr	3	Equal flow?	yes	std		1			San Fran	56.8	14.45%				
6	Nfl	2	CSA 55.1 DWHR _{eff}	54.0%	low		0.95			Miami	76.1	4.02%				
7	Bsmt	0	Tmains = 74.1													
8	Appliances:		WHinTadj = 0.00		Table 4.2.2.5.2.11(2) Hot Water Distribution Factors					Pull down lists:						
9	Dishwasher	std	WHinT = 74.1		<u>System type</u>		<u>none</u>	<u>R-3</u>		sys type	fix eff	P-insul	WH Type	Eq. Flow?	#DWHRU	
10	Clothes washer	std			std		1.00	0.90		std	std	none	gas	no	all	
11	WF	9.5			re, none		1.11	1.00		re, none	low-flow	R-3	elec	yes	one	
12	Toilets:				re, temp		1.11	1.00		re, temp						
13	gpf	1.6			re, dmd		1.11	1.00		re, dmd						
14	Water Softener:				re, man		1.11	1.00		re, man						
15	Softener	no														
16	gallons/remove	5.0	gallons/1,000 grains removed		Table 4.2.2.5.2.11(3) Distribution system water use effectiveness					cWash	CAPw	LER	\$/kWh	\$/therm	AGC	WF
17					<u>Distribution System Description</u>		<u>none</u>			std	2.874	704	0.0803	0.58	23	9.5
18	Outdoors:				Std		1.0			2008	3.2	487	0.0803	0.688	23	8.5
19	Inground Pool?	no			re, none		0.1			e-Star	3.5	281	0.086	0.91	14	8
20	Automatic	yes			re, temp		0.1			BestAv	3.31	151	0.1065	1.218	12	7
21	Smart	no			re, dmd		0.1									

Water Use Calcs

RESNET WER Index

DRAFT RESNET WATER EFFICIENCY RATING INDEX TECHNICAL GUIDELINES OPEN FOR PUBLIC REVIEW AND COMMENT





Energy Efficiency

ENERGY STAR

Features & Benefits of an ENERGY STAR Certified Home



The blue ENERGY STAR label on a new home means it was designed and built to standards well above most other homes on the market today. When ENERGY STAR's rigorous requirements are applied to new home construction, the result is a home built better from the ground up, delivering better durability, better comfort, and reduced utility and maintenance costs.

BENEFITS FOR HOMEOWNERS

- **Peace of Mind:** Tried-and-true best building practices followed by independent inspections and testing from certified professionals mean that you can be confident that things were done right.
- **Enduring Quality:** Value-adding energy efficiency features and a combination of materials and equipment deliver better performance and an overall superior level of quality.
- **Wall-to-Wall Comfort:** You'll see, feel, and hear the difference of a heating and cooling system that has been engineered and installed to efficiently deliver comfort. Enjoy consistent temperatures across every room and a constant supply of fresh, filtered air reducing indoor pollutants, dust, pollen, and other allergens.
- **Proven Value:** Better energy efficiency and performance means lower utility and maintenance costs. Homes earning the ENERGY STAR label use 15-30 percent less energy than typical new homes, and even more when compared to most resale homes on the market today.

DOE ZERH



Exhibit 1: DOE Zero Energy Ready Home Mandatory Requirements for All Labeled Homes

Area of Improvement	Mandatory Requirements
1. ENERGY STAR for Homes Baseline	<input type="checkbox"/> Certified under ENERGY STAR Qualified Homes Program Version 3 or 3.1 ^{10, 11}
2. Envelope¹²	<input type="checkbox"/> Fenestration shall meet or exceed ENERGY STAR requirements. See End Note for specific U, SHGC values, and exceptions. ¹³ <input type="checkbox"/> Ceiling, wall, floor, and slab insulation shall meet or exceed 2012 or 2015 IECC levels ^{14, 15}
3. Duct System	<input type="checkbox"/> Duct distribution systems located within the home's thermal and air barrier boundary or an optimized location to achieve comparable performance ¹⁶
4. Water Efficiency	<input type="checkbox"/> Hot water delivery systems (distributed and central) shall meet efficient design requirements ¹⁷
5. Lighting & Appliances¹⁸	<input type="checkbox"/> All installed refrigerators, dishwashers, and clothes washers are ENERGY STAR qualified. <input type="checkbox"/> 80% of lighting fixtures are ENERGY STAR qualified or ENERGY STAR lamps (bulbs) in minimum 80% of sockets <input type="checkbox"/> All installed bathroom ventilation and ceiling fans are ENERGY STAR qualified
6. Indoor Air Quality	<input type="checkbox"/> Certified under EPA Indoor airPLUS ¹¹
7. Renewable Ready	<input type="checkbox"/> Provisions of the DOE Zero Energy Ready Home PV-Ready Checklist are Completed ¹⁹










DOE Zero Energy Ready Home Builders are encouraged to:

	100% Commitment	Commit to constructing 100% of your homes to the U.S. DOE's Zero Energy Ready Home Requirements.
	PHIUS+	Take the next step on the continuous path to Zero Energy Ready Home by meeting the additional requirements of the Passive House Institute US.
	WaterSense	Minimize water use by participating in the EPA WaterSense for New Single-Family Homes program.
	Fortified for Safer Living	Embrace disaster resistance by following the Institute for Business and Home Safety (IBHS) FORTIFIED for Safer Living or FORTIFIED Home provisions for regionally specific natural hazards.
	Quality Management Program	Implement comprehensive quality management practices.
	Solar Hot Water	Accomplish additional savings by using the solar hot water-ready checklist and EPA's solar thermal systems guide. These requirements are no longer mandatory but encouraged.
		Ask buyers to sign a waiver allowing DOE Zero Energy Ready Home access to one year of utility bill data.

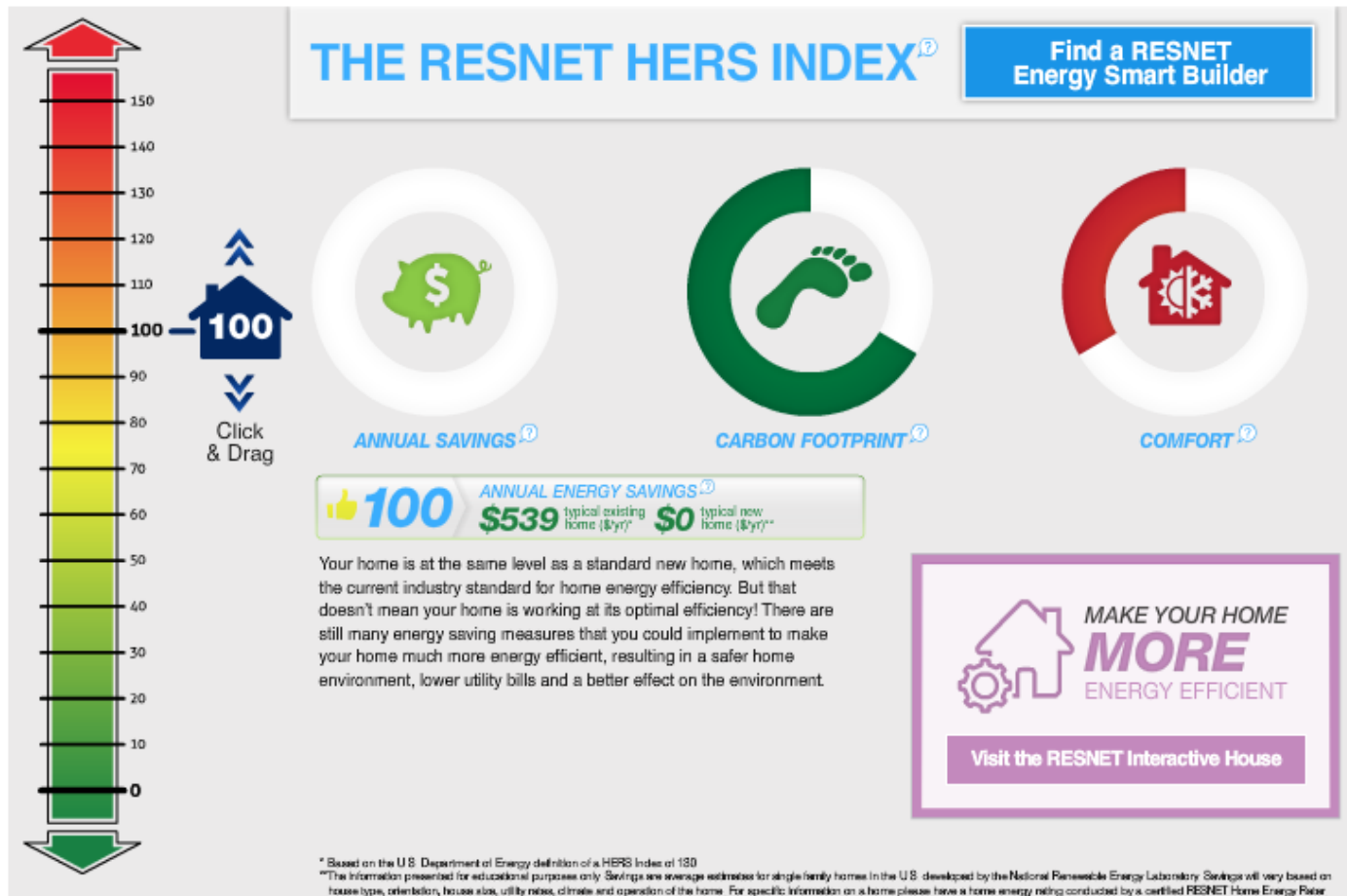
PHIUS



Passive House Institute US

						Source Zero Renewable Energy System
						Balanced Ventilation HRV/ERV
						Balanced Ventilation HRV/ERV
				SOLAR READY Depends on climate	SOLAR READY ALWAYS	SOLAR READY ALWAYS
				Eff. Comps. & H ₂ O Distrib	Eff. Comps. & H ₂ O Distrib	Eff. Comps. & H ₂ O Distrib
				 EPA Indoor airPLUS	 EPA Indoor airPLUS	 EPA Indoor airPLUS
				Ducts in Condit. Space	Ducts in Condit. Space	Ducts in Condit. Space
		HVAC QI w/WHV	HVAC QI w/WHV	HVAC QI w/WHV	Micro-load HVAC QI	Micro-load HVAC QI
		Water Management	Water Management	Water Management	Water Management	Water Management
		Independent Verification	Independent Verification	Independent Verification	Independent Verification	Independent Verification
IECC 2009 Enclosure	IECC 2012 Enclosure	IECC 2009 Enclosure	IECC 2012 Enclosure	IECC 2012/15 Encl./ES Win.	Ultra-Efficient Enclosure	Ultra-Efficient Enclosure
HERS 85-90	HERS 70-80	HERS 65-75	HERS 55-65	HERS 48-55	HERS 35-45	HERS < 0
 IECC 2009	 IECC 2012	 ENERGY STAR v3	ENERGY STAR v3.1	 ZERH	 PHIUS PHIUS+	 PHIUS+ SourceZero

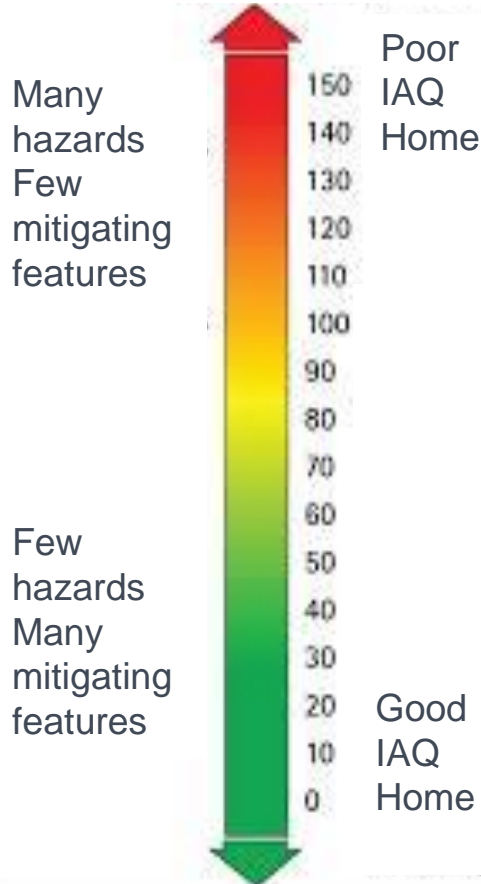
HERS Index



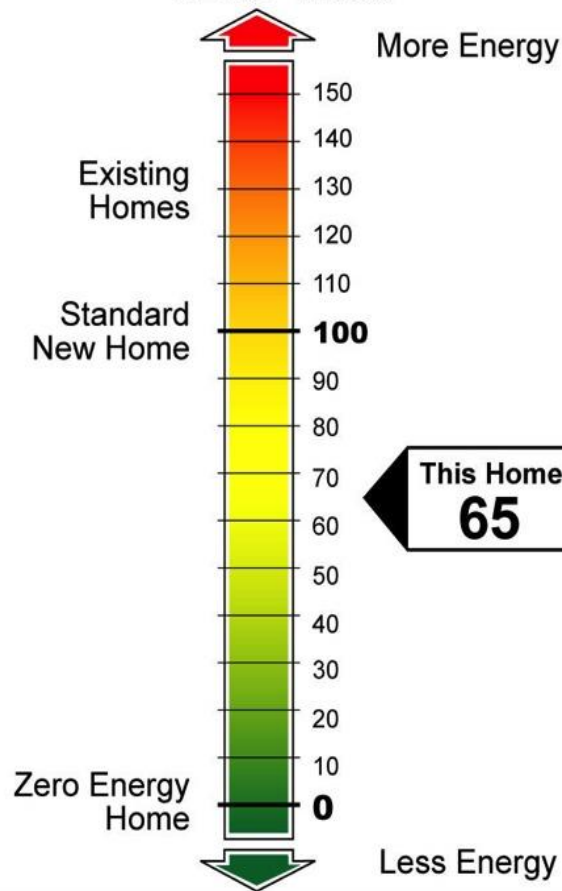
A Lower HERS Index Score Means a More Energy Efficient Home

Where RESNET is headed...

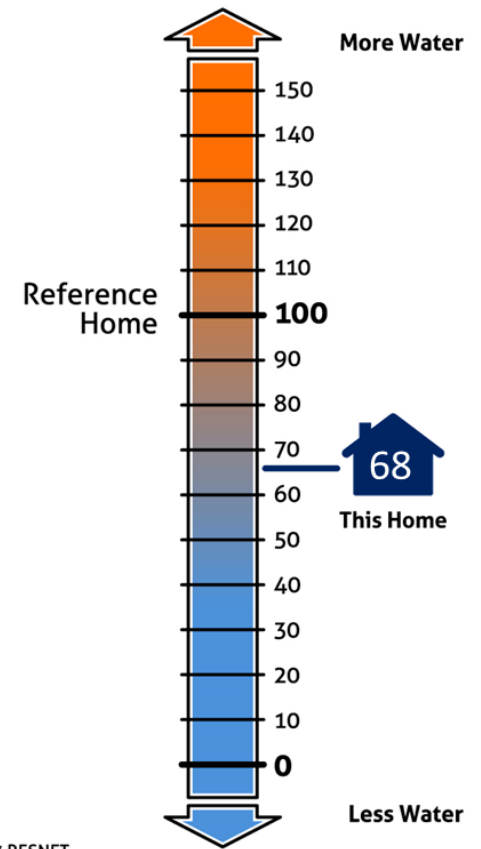
IAQ Index



HERS® Index



RESNET WER® Index



©2017 RESNET

Getting a HERS Index

REM/Rate v 15.3 - Untitled.blg

File Building View Extras Libraries Reports Tools Help

Building Name:

Property Information:

Owner's Name:

Property Address:

City:

State: Zip:

Phone Number:

Builder Information:

Builder's Name:

Builder's Address:

Builder's Email:

Phone Number:

Plan/Model Name:

Community/Development:

Permit Date/Number:

Analysis

Updated:

Design Loads (kBtu/hr)

Heating	0.0
Cooling	0.0

Annual Loads (MMBtu/yr)

Heating	0.0
Cooling	0.0
Water Heating	0.0
WH w/out Ta...	0.0

Annual Consumption (MMBtu/yr)

Heating	0.0
Cooling	0.0
Water Heating	0.0
Lights and App...	0.0
Photovoltaics	0.0
Total	0.0

Annual Energy Costs (\$/yr)

Heating	0.0
Cooling	0.0
Water Heating	0.0
Lights and App...	0.0
Photovoltaics	0.0
Service Charge	0.0
Total	0.0

Errors/Warnings

Energy Area Compliance

Undetermined Portland, OR 10/02/1

ekotrope

My Projects TutorialTest

My Projects Component Library

Upload your Photo

Analyze Register with Provider Register with RESNET Reports

Building Designs

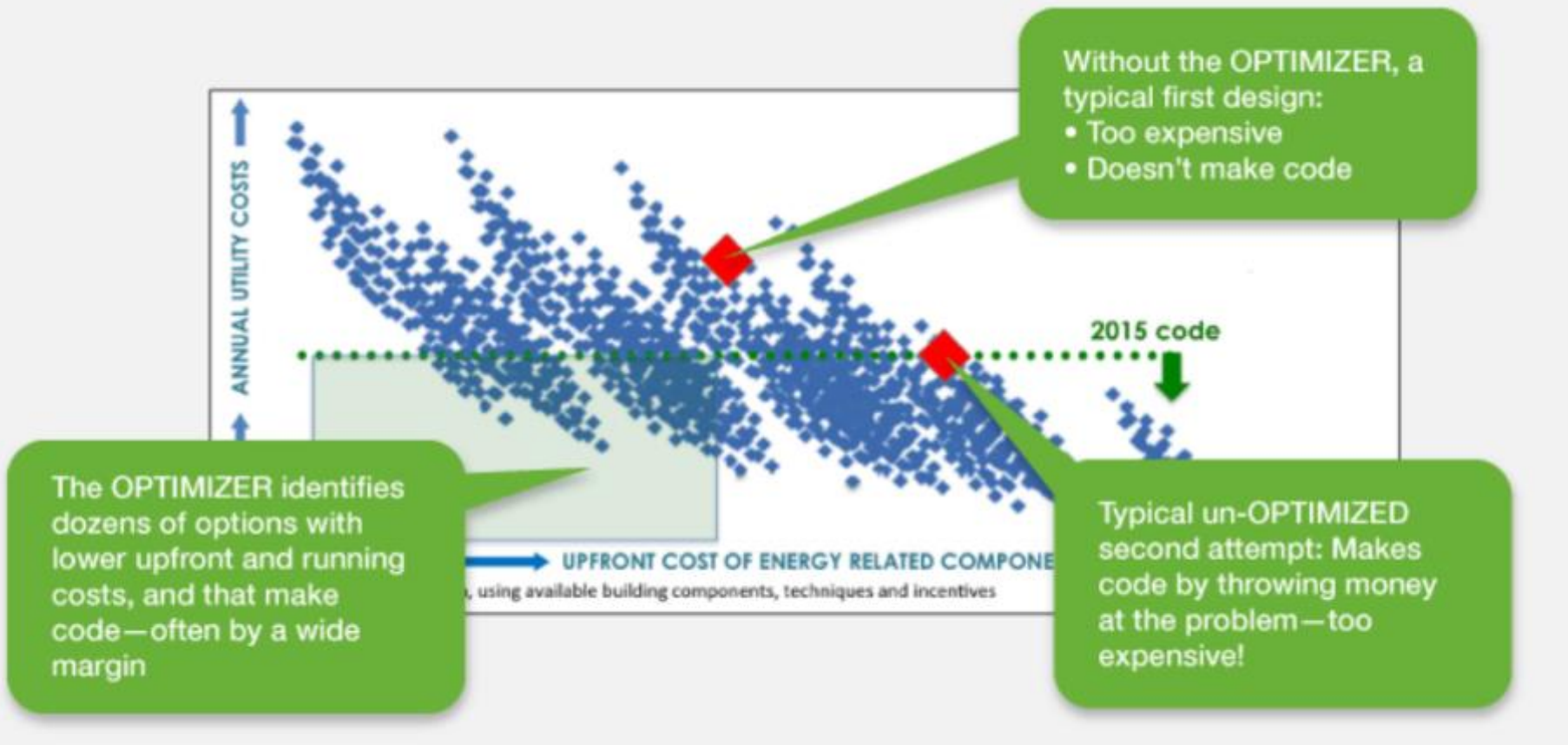
Name	Edit
<input type="checkbox"/> Initial House Design	Edit

Component Library

Walls Windows/Glass Doors Conditioning Equipment

Roof Insulation Solar Generation Slabs

Ekotrope for builders





Websites!

<https://betterbuiltnw.com/>

BetterBuilt^{NW}

PROGRAMS

FIND A PROFESSIONAL

RESOURCES

CASE STUDIES

AXIS Overview for Utilities



Performance Path



269.58 KB
pdf

This resource provides utilities a step-by-step review of the AXIS database workflows associated with home entry, QA, and reporting under the Performance Path. This resource also highlights future workflow and new feature/functionality options.

Download

Share

Utility Performance Path Overview Webinar



Performance Path



This webinar will provide utilities an overview of RTF approved modeling protocols, the BPA reporting requirements, and home entry and reporting with AXIS.

Link

Share

Rater Performance Path Overview Webinar



Performance Path



This webinar will provide Raters an overview of Northwest approved modeling protocols and, home entry and reporting with AXIS.

Link

Share

Utility Performance Path Overview for AXIS Presentation



Performance Path



1.81 MB
pdf

This presentation will provide utilities an overview of home entry and reporting with AXIS.

Download

Share

Rater Performance Path Overview for AXIS Presentation



Performance Path



1.48 MB
pdf

This presentation will provide Raters an overview of home entry and reporting with AXIS.

Download

Share

Rater Performance Path Overview and Modeling Presentation



Performance Path



1.72 MB
pdf

This presentation will provide Raters an overview of Northwest approved modeling protocols.

Download

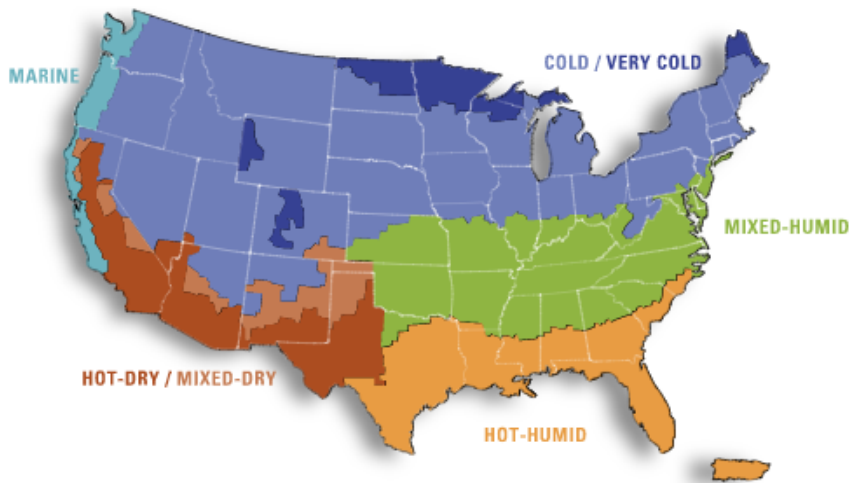
Share

<http://zeroenergyproject.org/>



<https://energy.gov/eere/buildings/doe-tour-zero>

Are you ready for a home that lives, works, and lasts better? The home of the future - a [better home](#) - is available today. Take a virtual tour of homes that are so energy efficient a renewable energy system can offset all or most of their annual energy consumption. These award-winning homes are independently certified to meet DOE Zero Energy Ready Home [guidelines](#) and constructed by a select group of [top builders](#). Zero Energy Ready Home is part of the U.S. Department of Energy's Better Buildings initiative. Better Buildings aims to make commercial, industrial, public, and residential buildings 20 percent more energy efficient over the next decade.



<https://energy.gov/eere/efficiency/homes>

A photograph of two construction workers on a building site. One worker, wearing a white hard hat and a light blue shirt, is pointing towards the wooden framing of a building. The other worker, wearing a dark blue shirt and jeans with a tool belt, is looking in the same direction. The background shows the wooden skeleton of a building under construction against a clear blue sky. In the foreground, there is a concrete floor with some wooden debris. An orange square graphic is positioned to the left of the text box.

Building America Solution Center and Building Science Advisor

Home Efficiency Forum 2017

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy



Where's WALDO? (Winning Assets that Lead to Dependable Outcomes)

October 5, 2017

Chrissi Antonopoulos

DOE Zero Energy Ready Home Program,
Pacific NW National Laboratory

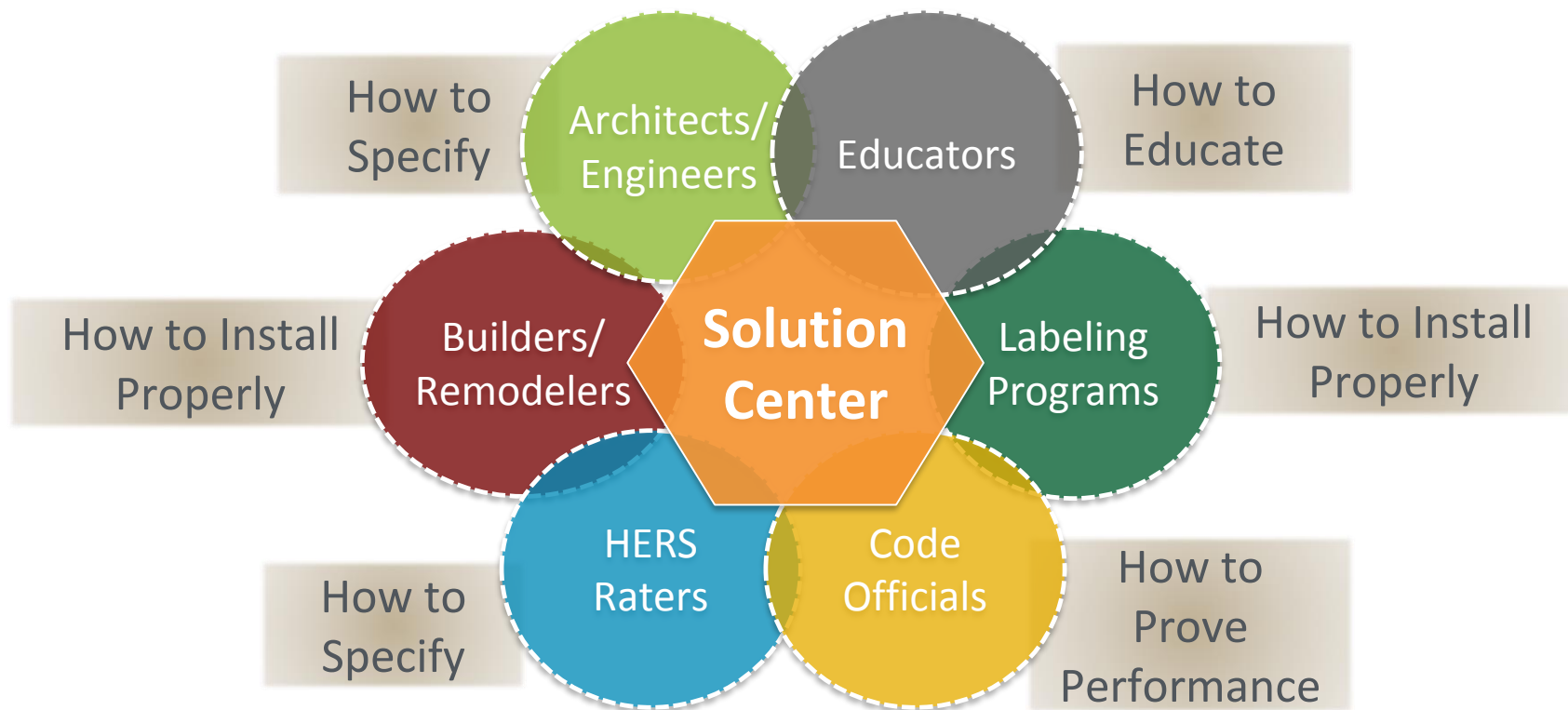
What is the BUILDING AMERICA SOLUTION CENTER?

- An online tool designed to provide building professionals with fast, free and reliable best practices based on leading building science.
- At the heart of the Building America Solution Center are guides – each covering eight critical topics for more than 230 individual best practices (and growing).
- Users can browse to view galleries of content -- such as images, CAD files, case studies, or the reference library – search and filter by keyword.



Content and Audiences

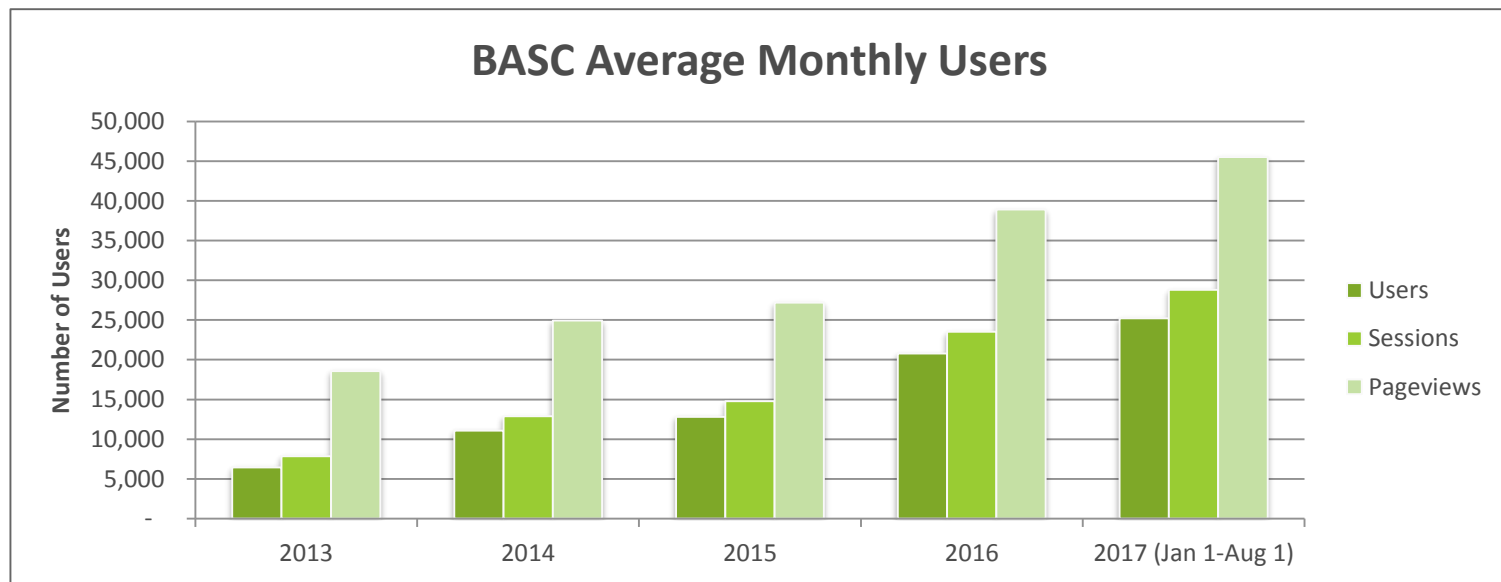
- 230+ Guides
- 1,600+ Images
- 330+ Proven performance case studies
- 115+ CAD drawings
- 900+ Building Science references & resources
- 30+ Code compliance briefs
- 90+ Videos
- 40+ Sales briefs



User Data Over Time

User Stats Since 2013

- 292% increase in users
- 316% increase in direct users
- Over 52,000 page views in August 2017; over 1.6 million since 2013



Average monthly data allows comparisons of partial years

Homepage – BASC.ENERGY.GOV

Building America Solution Center

Enter your keyword

Solution Center Home

Help

FIND YOUR TOPIC BY:

[Building Components](#)

[Guides A-Z](#)

[ENERGY STAR Certified Homes](#)

[Zero Energy Ready Home](#)

[EPA Indoor airPLUS](#)

FIND RESOURCES:

[Sales Tool](#)

[CAD Files](#)

[Image Gallery](#)

[Case Studies](#)

[Videos](#)

[Optimized Climate Solutions](#)

[Code Briefs](#)

FIND PUBLICATIONS:

[Library](#)

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 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%.



Library

Search a library of Building America publications and supporting resources.



Mobile App

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



RECENTLY ADDED/UPDATED GUIDES

[Whole-Building Delivered Ventilation](#)

Last Updated: January 9, 2017

[Interior Paints and Finishes Certified Low-Emission](#)

Last Updated: August 19, 2016

[Certified Low-Emission Carpet Adhesives and Carpet](#)

Last Updated: July 27, 2016

[More Guides](#)

RECENTLY ADDED CONTENT

[ENERGY STAR HVAC Design Report](#)

Reference Posted: January, 2017

[Deep Energy Retrofits - Over-Time, Phased Guidance](#)

Reference Posted: November, 2016

[Deep Energy Retrofits - Occupant Behavior](#)

Reference Posted: November, 2016

BASC WIDGET

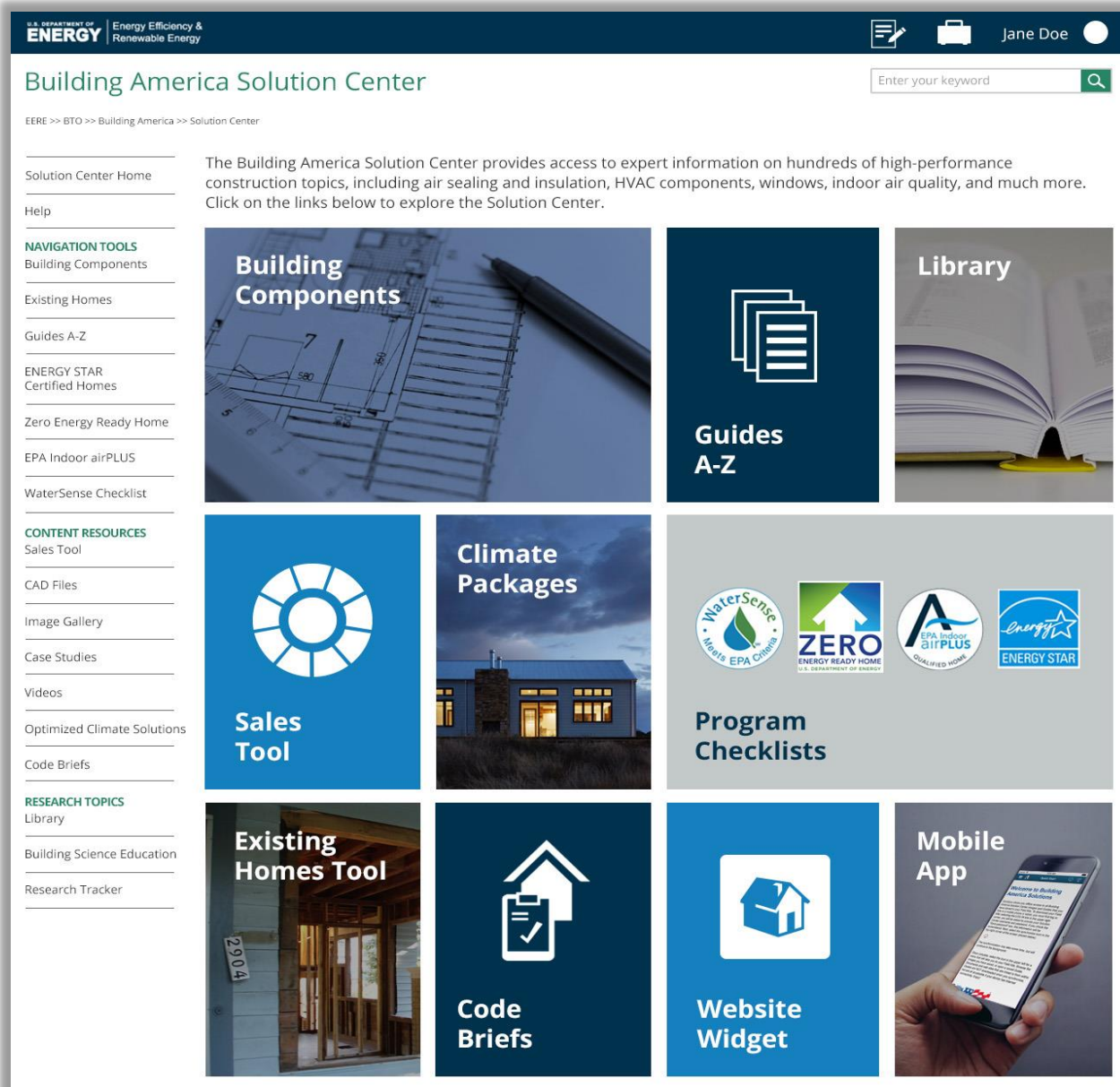


BASC Simple Interface:

- Access DOE/EPA Program information
- Browse guides
- Access sales guidance
- Access climate resources
- Browse library
- Download the mobile app

<h3>Program Checklists</h3> <p>Access guides directly from checklists for Zero Energy Ready Home, ENERGY STAR Certified Home, and Indoor airPLUS</p> 	<h3>Building Components</h3> <p>Access guides for new and existing homes based on building components of interest.</p> 
<h3>Sales Tool</h3> <p>Translate building science technical terms into a new language of value.</p> 	<h3>Climate Packages</h3> <p>Review new home energy efficiency specifications and case studies that exceed 2009 IECC by 30%.</p> 
<h3>Library</h3> <p>Search a library of Building America publications and supporting resources.</p> 	<h3>Mobile App</h3> <p>Join our mobile community to access saved field kits wherever you need them.</p> 

New BASC Homepage – COMING SOON!



- New homepage design highlights BASC navigation options.
- Incorporates new WaterSense checklist and Existing Homes tool.
- Re-organizes topics in the left navigation column.

Access to DOE/EPA Program Specifications

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

ask about



Search library of building science publications from Building America.



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



DOE Zero Energy Ready Home Program

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

Building America Solution Center

[EERE](#) » [BTO](#) » [Building America](#) » [Solution Center](#) » Checklists

Solution Center Home

Help

FIND YOUR TOPIC BY:

- Building Components
- Guides A-Z
- ENERGY STAR Certified Homes
- Zero Energy Ready Home**
- EPA Indoor airPLUS
- EPA WaterSense®


FIND RESOURCES:

- Sales Tool
- CAD Files
- Image Gallery
- Case Studies
- Videos
- Optimized Climate Solutions
- Code Briefs

FIND PUBLICATIONS:

Library

DOE Zero Energy Ready Home



The U.S. Department of Energy (DOE) Zero Energy Ready Home is a program conducted by DOE to recognize homes that achieve exceptional levels of energy savings, comfort, health, and durability. The checklists below provide links to technical guides providing installation instructions for each measure included in the requirements. For more on eligibility, prescriptive and performance path options, and modeling of a target home to qualify via the performance path, please see the [DOE Zero Energy Ready Home National Program Requirements](#) (Rev.06, for homes permitted on or after 7/20/2017). Visit the DOE Zero Energy Ready Home [program website](#) to learn more about training and marketing tools, to find a builder, or to become a partner. The Building America Solution Center is an ever expanding and improving technical resource for builders and installers. Visit often to see the latest guides, resources, and additional content.

▼ Exhibit 1: Mandatory Requirements for All Labeled Homes

▶ 1.0 ENERGY STAR for Homes Baseline

▶ 2.0 Envelope

▶ 3.0 Duct System

▶ 4.0 Water Efficiency

▶ 5.0 Lighting & Appliances

▶ 6.0 Indoor Air Quality

▶ 7.0 Renewable Ready

▶ Exhibit 2: Target Home

▶ Exhibit 3: Benchmark Home Size

[Contact Us](#) | [Web Site Policies](#) | [U.S. Department of Energy](#) | [USA.gov](#)

- BASC includes an automated version of the program checklist
- Use the checklist to find specifications for each requirement
- Each specification is included in a BASC guide
- If you're running a program, BASC is your technical support.

Use Program Navigation to Find BASC Guides

Each Guide contains:

- Scope of work
- Description (how to install)
- Ensuring Success (safety, planning)
- Climate specific info
- Training (images, presentations, videos)
- CAD drawings
- Compliance info (codes/standards/programs)
- Retrofit info for existing homes
- External resources and case studies
- Sales info


Drainage Plane Behind Exterior Wall Cladding

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Scope Description Success Climate Training CAD Compliance Retrofit More Sales

BUILDING SCIENCE-TO-SALES TRANSLATOR

Continuous/Sealed Weather Resistant Barrier = Wall Water Barrier



TECHNICAL DESCRIPTION:

A water barrier and drainage plane directs water that leaks through the part of a wall exposed to the weather, to safely drain down and away from the wall. The water-resistant surface could be house wrap, rigid foam insulation that is taped or sealed at all seams, or a painted-on coating. House wrap should be lapped shingle style over any exterior wall flashings installed around openings, penetrations, or where the walls intersect roofs, foundations, or other transitions. Any holes through the wall, such as for windows, water spigots, exhaust vent outlets, HVAC condensate lines, or light fixtures and receptacles, should be carefully sealed and flashed.

Alternate Terms

- Dry-by-Design Wall Construction
- Wall Water Barrier Technology
- Professionally Installed Wall Water Barrier

Wall Water Barrier Sales Message

Wall water barriers help drain water away from above-grade walls. What this means to you is peace-of-mind knowing your home has a comprehensive set of measures that minimize the risk of water damage in your home. Wouldn't you agree every home should have full water protection?

BASC Code Compliance Briefs

- Designed to address code barriers, such as installation of advanced technologies.
- Detailed references to research findings and codes and tips for plan review and field inspections.
- Consistent expectations resulting in increased compliance and fewer innovations being questioned.
- A shortcut to technical validation, which is critical for code officials to accept innovations.

Code Brief

The intent of Building America's research is to provide code-related information for code officials on how to plan review and conduct field inspections to help provide jurisdictional officials with information for acceptance. Providing the same information to all builders, designers, and others is expected to result in increased compliance and fewer innovations being questioned at the time of plan review and/or field inspection.

[Air Sealing and Insulation](#)
Air sealing and insulation

[Air Sealing and Insulation](#)
Air sealing and insulation

[Publication D](#)
The intent of this brief is to provide code-related information about buried ducts in vented attics to help ensure that the measure will be accepted as being in compliance with the code. Providing notes for code officials on how to plan review and conduct field inspections can help provide jurisdictional officials with information for acceptance. Providing the same information to all builders, designers, and others is expected to result in increased compliance and fewer innovations being questioned at the time of plan review and/or field inspection.

[Air Sealing and Insulation](#)
Air sealing and insulation

[Bathroom Fan](#)
If the bathroom fan is not verified during plan review, it should be verified during field inspection.

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 code-related information about buried ducts in vented attics to help ensure that the measure will be accepted as being in compliance with the code. Providing notes for code officials on how to plan review and conduct field inspections can help provide jurisdictional officials with information for acceptance. Providing the same information to all builders, designers, and others is expected to result in increased compliance and fewer innovations being questioned at the time of plan review and/or field inspection.

Ducts buried in the insulation of vented attics in hot-humid and mixed-humid climates are not addressed in the International Energy Conservation Code (IECC) or International Residential Code (IRC). This measure is an identified code barrier because it is not discouraged or encouraged by the recent model codes (IECC/IRC). This measure has been researched (successfully installed, tested, and monitored) and found to be nearly as effective as requiring that ducts be installed in conditioned spaces (inside the building thermal envelope^[1] or inside the air barrier). This alternative method is endorsed by Building America and has been submitted to the International Code Council (ICC) as a proposed code change for the 2018 IECC/IRC code cycle. The "measure/alternative method" of the study was based on R-8 duct insulation. The proposed code changes require a higher level of duct insulation in hot-humid and mixed-humid climates.

Buried ducts in vented attics, provide a cost-effective, energy-efficient alternative solution to installing ducts inside conditioned space. This is particularly useful for avoiding challenges resulting from many house configurations, including single-story, slab-on-grade, and two-story houses with complicated framing or open floor plans. Adapting house designs with standard interior ducts may require the addition of duct chases, dropped ceilings, soffits, or floors.

[Buried Ducts in Vented Attics in Hot-humid and Mixed-humid Climate Zones - Code Compliance Brief](#)

[Show more](#)

Publication Date: May, 2016

The intent of this brief is to provide code-related information about buried ducts in vented attics to help ensure that the measure will be accepted as being in compliance with the code. Providing notes for code officials on how to plan review and conduct field inspections can help provide jurisdictional officials with information for acceptance. Providing the same information to all builders, designers, and others is expected to result in increased compliance and fewer innovations being questioned at the time of plan review and/or field inspection.

[Continuous Insulation - Cladding/Furring Attachment - Code Compliance Brief](#)

Guidance is needed for code-compliant installations of various cladding materials when installed over thicker foam sheathing also known as insulated sheathing or continuous insulation (c.i.).

[Controlling Moisture in Unvented Attics - Code Compliance Brief](#)

Publication Date: May, 2017

The intent of this brief is to provide code-related information about controlling moisture in unvented attics by installing a vapor diffusion port/vent that would convey water vapor from an unvented attic to the outside when air-permeable insulation

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Sales Tool

The goal of this Building Science-to-Sales Translator is to provide 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.

Use the tool below to navigate through sales themes. When logged into your BASC account, you can create customized Sales Worksheets. You will see the MY SALES WORKSHEETS block on the upper right of your screen. Click Create Sales Worksheet to make a new customized sales list, or View All Sales Worksheets to see all saved Sales Tools. For in-depth instructions for creating sales worksheets, see [this presentation](#).



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.

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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?

Each term has a translation, alternate terms, technical description and consumer sales message.

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User account

Create new account

Log in

Request new password

User information

Username *

Spaces are allowed; punctuation is not allowed except for periods, hyphens, apostrophes, and underscores.

E-mail Address *

A valid e-mail address. All e-mails from the system will be sent to this address. The e-mail address is not made public.

Work Experience

Profession *

- Select a value -

Construction Type *

New and Existing Homes
New Homes
Existing Homes

Location

State *

Alabama
Alaska
Arizona
Arkansas

Climate Zone *

All Climate Zones
Zone 1
Zone 2
Zone 3

San Francisco Zero Energy Ready Home Project #1

Guides



[Cantilevered Floor](#)

Guide describing how to air seal and insulate a cantilevered floor.



[Step and Kick-Out Flashing at Roof-Wall Intersections](#)

Guide describing how to install step and kick-out flashing on roofs.



[Double Walls](#)

This guide describes air barrier and insulation installation, along with air sealing for double walls - h design as an architectural feature that provides a more dimensional appearance.



[Roof Deck Valleys and Penetrations Sealed](#)

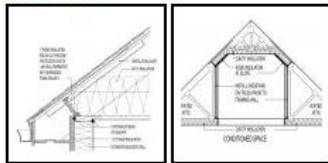
Guide describing how to apply heavy membranes at valley/roof deck penetrations in wet climates to roofing.



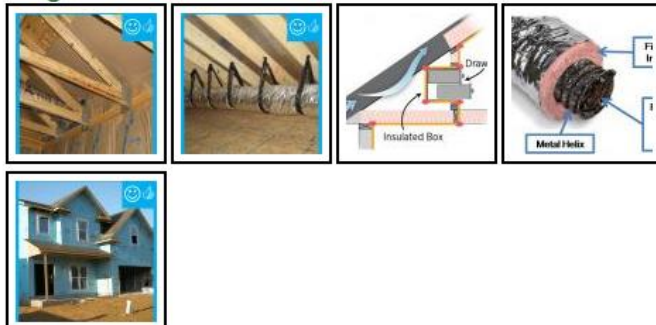
[Bathroom Fan Ratings](#)

Guide describing the bathroom exhaust fan ENERGY STAR rating requirements.

CAD Files



Images



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Sales Binder: Zero Energy Ready Home Project Specs

Sales Messages

[High-R Window](#)

High-efficiency ENERGY STAR-rated windows perform at least 15% better than a standard window. Ultra-efficient windows perform at least 50% better. On average, high-efficiency windows save homeowners 7% to 15% on utility bills. These windows use a combination of insulating frames and other features to reduce heat loss. They consist of two or three glass panes separated by insulating spacers. The space between the glass layers is filled with a nontoxic gas like argon or krypton that insulates better than air and the glass panes are coated with a nearly invisible low-emissivity coating that reflects heat to keep warm air in during the winter and hot sun out in summer. The coatings also help to block ultraviolet rays, minimizing fading of curtains and furniture.



[High-R Insulation](#)

High-performance insulation systems include properly installed insulation in amounts that meets or exceeds the insulation levels required by the 2012 International Energy Conservation Code (IECC), which is ~15% more efficient than the 2009 IECC. Ultra-efficient insulation levels exceed the 2009 IECC levels by 50% or more. By using high-efficiency and ultra-efficient insulation, that is carefully installed to avoid gaps and compression, home builders create well-insulated conditioned spaces that require very little effort to heat and cool, provide even comfort throughout the house, and help occupants reduce costs.



[Fully Aligned Air Barriers](#)

A whole-house draft barrier is a continuously connected layer of solid or air-tight materials that block air leaks. This barrier can also function as part of a water barrier, thermal barrier, and vapor barrier, if the location and materials are compatible. For example, rigid foam insulation can provide a combined function. Rigid foam sheets can be used to block air flow when seams are sealed with tape, caulks or adhesives, or liquid applied sealants. An example of an interior air barrier may be the drywall on the home's walls and ceilings, when the seams are taped and mudded, and caulk, spray foam, or gaskets are used to seal around wiring, plumbing, and other penetrations. Insulation should be in full contact with the air barrier layer.



[Exterior Insulation Sheathing](#)

A continuous thermal blanket of rigid foam can be installed on the exterior of the walls, either over the plywood or OSB sheathing or in place of the wood sheathing. Adding sheets of rigid foam insulation to the outside of wall framing has many advantages. The rigid foam covers the entire surface of the wall or roof, which blocks the transfer of heat through the studs. When only cavity insulation is used, the studs form a bridge that heat can follow between inside the house and the exterior. As a form of insulation, rigid foam is a great addition to the thermal barrier, but it can also help block air leaks, water leaks, and vapor leaks.



Sales Tool Customized Worksheet: ZERH Value Propositions



Download one of six worksheets based on ZERH value propositions:

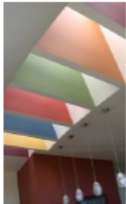
- Advanced Technology
- Engineered Comfort
- Enhanced Durability
- Healthful Environment
- Quality Built
- Ultra Efficient

Customized Sales Tool Worksheets



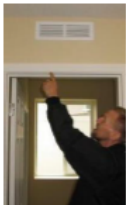
The U.S. Department of Energy's (DOE) Building America program has been a source of [innovations](#) in residential building energy performance, durability, quality, affordability, and comfort for 20 years. This world-class research program partners with industry (including many of the top U.S. home builders) to bring cutting-edge innovations and resources to market.

BUILDING AMERICA: BUILDING AMERICA LIST NUMBER 2



Certified Low/No VOC Finishes

Certified low/no VOC finishes help control one of the most significant health risks where we live. What this means to you is your family can breathe better every day knowing your home was built to help manage a critical respiratory contaminant. Wouldn't you agree protecting health is too important to ignore in new homes?



Comfort Vent

Comfort vents at each bedroom ensure a continuous flow of heating and cooling even when the doors are closed. What this means to you is that you will not have to compromise comfort for bedroom privacy. Wouldn't you agree bedroom doors shouldn't have to be kept open to maintain comfort?



Earthquake Resistant Home

Earthquake resistant homes are designed and constructed to provide enhanced protection from locally prevalent seismic activity. What this means to you is better protection from harm and damage due to one of the most likely acts of mother nature in your location. Wouldn't you agree it's important to protect your family's safety and financial investment in a home?

- Access all Sales Tool messages and build your own customized worksheets
- Add builder logo, contact info and descriptions
- Save worksheets to your Field Kits, or download PDF files.

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Ducts Buried in Attic Insulation and Encapsulated

[Feedback](#)

Belongs to 0 Field Kits

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Scope Description Success Climate Training CAD Compliance More Sales

Scope

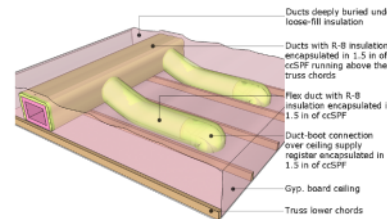
Buried and encapsulated ducts are installed in unconditioned attics. Ducts are installed in contact with the ceiling and/or truss lower cords. Ducts are then encapsulated with 1.5 in of closed-cell spray polyurethane foam (ccSPF), which increases the R-value of the duct insulation, mitigates condensation issues, and reduces air leakage. Finally, loose-fill insulation is installed at the ceiling plane, covering the ductwork. This insulation serves as ceiling insulation and additional insulation for the ductwork.

Figure 1 provides a diagram of a finished buried & encapsulated duct installation. Buried & encapsulated ducts can be installed in all climate zones, including moist and marine climate zones.

- Install ductwork in direct contact with the ceiling and/or truss lower cords.
- Mastic-seal all duct connections.
- Test total duct leakage.
- Apply at least 1.5 in of ccSPF to all ducts.
- Install loose-fill ceiling insulation.

To view these approaches as separate measures, see: [Ducts Buried in Attic Insulation](#), and [Encapsulated Ducts](#).

Last Updated: 05/12/2014



Add or remove this item in your Field Kits.

- Zero Energy Ready Home Project #1
22 items
- New Construction Specs
6 items
- Portland Oregon Renovation
4 items
- Indoor airPLUS
3 items
- Sales Binder: Zero Energy Ready Home Project Specs
20 items

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Last Updated: February 22, 2017

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[Ultra Efficient List](#)

Last Updated: September 23, 2015

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[New Construction Specs](#)

6 items

[Portland Oregon Renovation](#)

4 items

[Indoor airPLUS](#)

3 items

[Sales Binder: Zero Energy Ready Home Project](#)

Specs

20 items

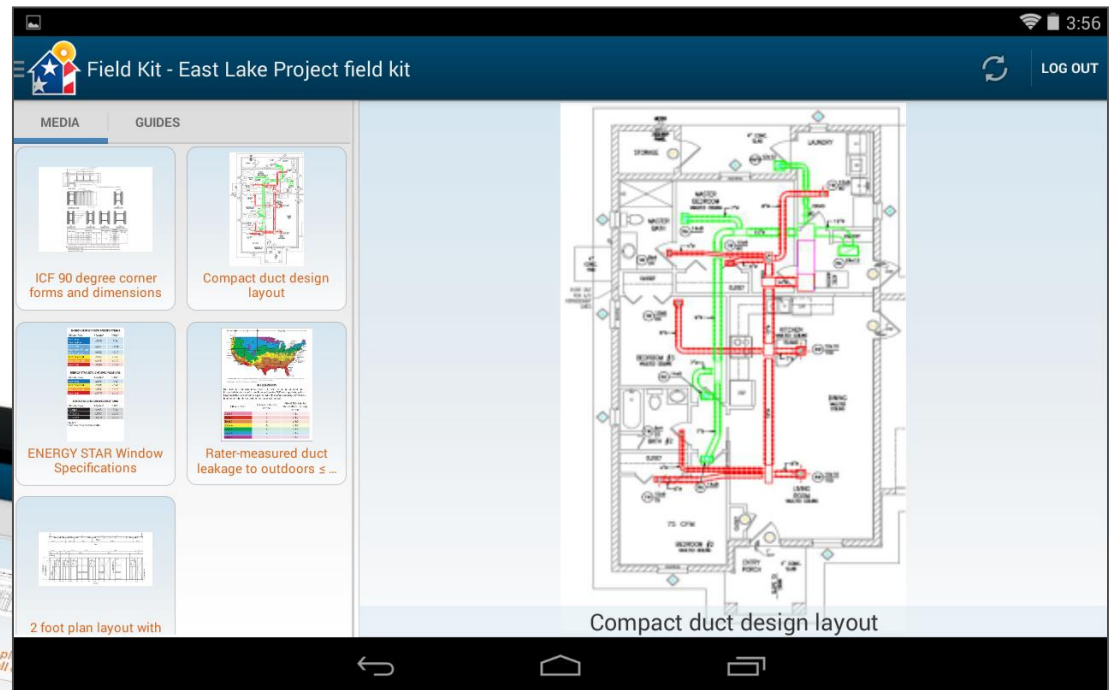
New Field Kit

BASC Mobile Access



Access your Building America Field Kits remotely using the new “Solutions” mobile application for Android and iOS. Access the iOS app through the Apple store, and use the link below for the Android app.

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- Access Field Kits for specific construction projects



<https://basc.energy.gov/solutions>

Field kits can also be accessed from computers

**World Class Guidance
for High-Performance Homes...
... at Your Finger Tips**



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**Contacts:
BASC@pnnl.gov
Chrissi Antonopoulos@pnnl.gov**

- Developed by the US Department of Energy and Oak Ridge National Laboratory.
- The tool (BETA version released) is designed to help users determine moisture risks in wall structure designs.
- The tool works by gathering information about climate zone and wall components:
 - Cladding
 - Structure
 - Insulation
 - Vapor barriers
 - Air sealing
 - Sheathing
 - Other materials
- The output will inform the user about the moisture risks associated with the wall.

Building Science Advisor Wall Suggestions

Climate

Cladding

Structure

Insulation

Decision

More Suggested Walls

SELECTIONS

Map Location	Portland, OR
Exterior Cladding	Treated Wood Clapboard
Continuous Insulation	Expanded Polystyrene (EPS)
Structure	2 x 4 16" o.c.
Cavity Insulation	High Performance Fiberglass (R-15/R-21)
Insulation Thickness	1 in

SUGGESTIONS

	Suggested wall 1	Suggested wall 2	Suggested wall 3
Air Space	None	None	None
Water/Air Barrier	Housewrap	Insulated Sheathing	Insulated Sheathing
Exterior Sheathing	Oriented Strand Board	Mineral Fiber Board	None
Vapor Retarder	None	Kraft Paper	Smart Vapor Retarder
Interior Finish	Latex Paint	Vapor Barrier Paint	Vapor Barrier Paint
Air Tightness	5 ACH50	5 ACH50	5 ACH50

Building Science Advisor Advanced Output Example

Back/Decision

Air Gap

Water/Air Barrier

Sheathing

Vapor Retarder

Interior Finish

Air Tightness

Results

Map Location

Portland, OR

Exterior Cladding

Treated Wood Clapboard

Structure

2 x 4 16" o.c.

Cavity Insulation

High Performance Fiberglass (R-15/F)

Continuous Insulation

Expanded Polystyrene (EPS)

Insulation Thickness

Air Space

None

Water/Air Barrier

Housewrap

Exterior Sheathing

None

Vapor Retarder

None

Interior Finish

Vapor Barrier Paint

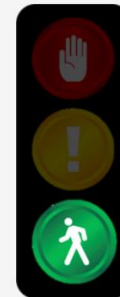
Air Tightness

3 ACH50

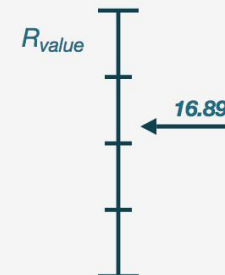
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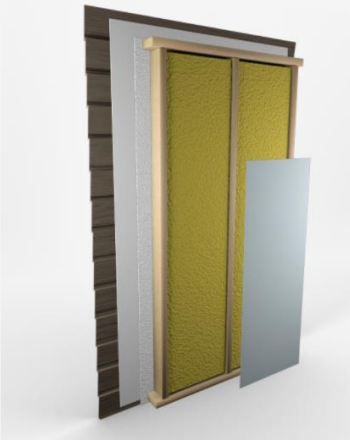
Moisture Durability Performance



Thermal Performance



Email a question about this wall.



Moisture Performance

This wall assembly has sufficient drying capacity and should perform adequately in the selected climate zone.



Thank You

Dan Wildenhaus

info@betterbuiltinw.com

Chrissi Antonopoulos

BASC@pnnl.gov