

DOE Zero Energy Ready Home

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy



**Indoor airPLUS Builders Joining Forces
with Zero Energy Ready Homes**

Jamie Lyons, P.E.

Newport Partners

Technical Director, DOE ZERH



Specifications: The Easy Lift from Indoor airPLUS

Eligible Building Types

- Same as *ENERGY STAR* Homes



- SFD and SFA dwellings



- MF buildings up to 5 stories;
- Central HVAC and DHW is allowed



- Focus is New Construction; Substantial Rehabs can be qualified;

Stepping up to ZERH...

				Solar Ready
				Eff. Comps. & H ₂ O Distrib.
				Optimized Duct Location
			EPA Indoor Air Package	EPA Indoor Air Package
	HVAC QI with WHV	HVAC QI with WHV	HVAC QI with WHV	HVAC QI with WHV
	Water Management	Water Management	Water Management	Water Management
	Independent Verification	Independent Verification	Independent Verification	Independent Verification
IECC 2012 Enclosure	IECC 2009 Enclosure	IECC 2012 Enclosure	IECC 2009/12 Enclosure	IECC 2012/15 Enclosure
HERS 70-80	HERS 65-75	HERS 55-65	HERS 55-75	HERS 48-55
IECC 2012	ENERGY STAR v3	ENERGY STAR v3.1	Indoor airPLUS	ZERH



DOE ZERH Target Home

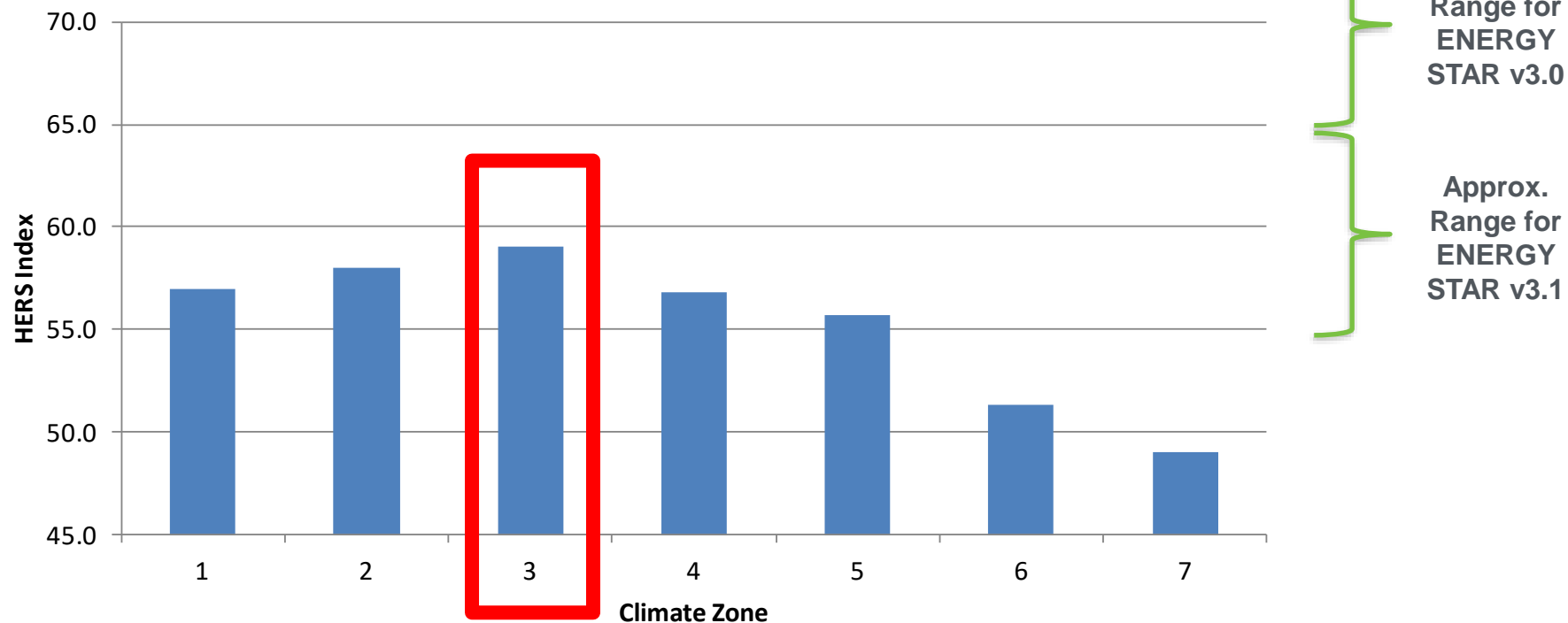
Sets the HERS Value – HVAC Specs

Exhibit 2: DOE Zero Energy Ready Home Target Home ^{7, 20}

HVAC Equipment ²¹			
	Hot Climates (2012 IECC Zones 1,2) ²²	Mixed Climates (2012 IECC Zones 3, 4 except Marine)	Cold Climates (2012 IECC Zones 4 Marine 5,6,7,8)
AFUE	80%	90%	94%
SEER	18	15	13
HSPF	8.2	9	10 ²³
Geothermal Heat Pump	ENERGY STAR EER and COP Criteria		
ASHRAE 62.2 Whole-House Mechanical Ventilation System	1.4 cfm/W; no heat exchange	1.4 cfm/W; no heat exchange	1.2 cfm/W; heat exchange with 60% SRE
Insulation and Infiltration			

DOE ZERH HERS Threshold – Typical Values

Typical DOE ZERH-Compliant HERS Index by Climate Zone



Based on 1800, 2400, and 3600 ft² prototypes on climate-appropriate foundations.

Warm Climate, Affordable HERS 49

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DOE TOUR OF ZERO: VISTA PALM DRIVE BY SOUTHEAST VOLUSIA HABITAT FOR HUMANITY



Cold Climate, Production HERS 3 (low 40s w/o PV)

DOE TOUR OF ZERO: THE HALE PLAN BY NEW TOWN BUILDERS



Hot/Dry Climate, Production HERS 48

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DOE TOUR OF ZERO: VIA DEL CIELO BY PALO DURO HOMES



Performance Path Example - Atlanta CZ3 Prototype - 4 BR, 2400 SF

Specification	Target Home Spec	Design Home
AGW Insulation	R13+5 or R-20 (U 0.060)	R-20 (U 0.060)
Attic Insulation	R38 (U=0.030)	R38 (U=0.030)
Basement Walls	N/A	N/A
Windows	U=0.30; SHGC=0.25	U=0.30; SHGC=0.25
Infiltration	2.5 ACH50	3.0 ACH50
Ducts	Total ≤ 8% cfm25/CFA (192 CFM25) LTO ≤ 4% cfm25/CFA (96 CFM25)	Total: 96 CFM25 LTO: 0 CFM25
AFUE or HSPF	9.0 HSPF	9.0 HSPF
A/C SEER	15	16.5
Whole-House Mech. Vent.	62 cfm; 1.4cfm/W no heat exchange;	62 cfm; 1.4cfm/W, supply ventilation
Water Heater	HPWH (EF 2.0)	Electric Storage Tank (0.95 EF)
Hot Water Dist.	RESNET Reference Home	On-Demand (occ sensor)
Lighting	80% Energy Star	90% Energy Star LEDs
HERS Index	58 (Target)	57 COMPLIES!

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IECC 2012	ENERGY STAR v3	ENERGY STAR v3.1	Indoor airPLUS	ZERH



- Compliance with next generation code
- Three Options for Compliance:
 - ✓ Prescriptive
 - ✓ Alternative equivalent U-factor
 - ✓ **Total UA calculation**
 - allow for modest trade-offs of insulation levels from one part of the envelope to others.

	CZ 2	CZ 3
Walls	R-13 (rec. R13+5)	R-20 or R-13+5 (rec. R-13+5)
Ceiling	R-38	
Floor	R-13	R-19
Basement	R-0	R-5/13
Crawl Space	R-0	R-5-13
Slab	R-0 (rec. R-5 slab edge)	

2012 IECC Building UA Compliance

Property
ZERH Reference Home Model
,

Organization

Builder

HERS
Based On Plans
Rater ID:

Weather: Austin, TX
Austin, TX
CZ 2 - 2400 SF Austin, TX.blg

Elements

Insulation Levels

	2012 IECC	As Designed
Shell UA Check		
Ceilings:	36.0	36.4
Above-Grade Walls:	173.5	175.0
Windows and Doors:	160.0	155.6
Slab Floor:	51.1	51.1
Overall UA (Design must be equal or lower):	420.6	418.1

- Run UA compliance report within HERS Rating software
- Design Home UA must be \leq 2012 IECC version of the home

High Performance Windows

ENERGY STAR Window Specs to Apply to DOE Zero Energy Ready Home Projects ¹	Hot Climates IECC CZ 1 2		Mixed Climates IECC CZ 3 4 except Marine		Cold Climates IECC CZ 5 8 and 4 Marine ²	
	U Value	SHGC	U value	SHGC	U Value	SHGC
	0.40	0.25	[CZ 3] 0.30 [CZ 4] 0.30	[CZ 3] 0.25 [CZ 4] 0.40	0.30 0.31 0.32	Any ≥0.35 ≥0.40

1. DOE Zero Energy Ready Home offers multiple compliance paths including area weighting and allowances for passive solar design. See the National Program Requirements, Exhibit 1 with footnotes, for details.

2. These U & SHGC values are based on the ENERGY STAR v5.0 Window Specifications. DOE ZERH will review the feasibility of adopting ENERGY STAR v6.0 Window Specifications, which entail lower U values, periodically. Any program update to require the v6.0 window specs will be announced with a minimum 1-year phase-in.

Stepping up to ZERH...

				Solar Ready	
				Eff. Comps.& H ₂ O Distrib.	
				Optimized Duct Location	←
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IECC 2012	ENERGY STAR v3	ENERGY STAR v3.1	Indoor airPLUS	ZERH	

The Importance of Duct Performance

95% Condensing Furnace

X

60% Efficient Duct
Distribution

57% System Efficiency

80% Furnace

X

90% Efficient Duct
Distribution

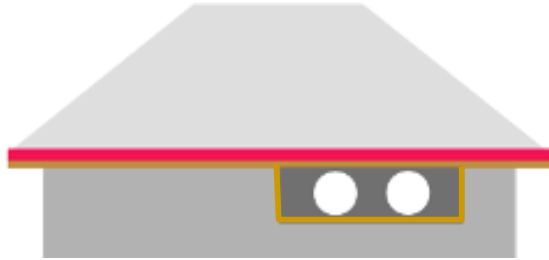
72% System Efficiency

Cooling:

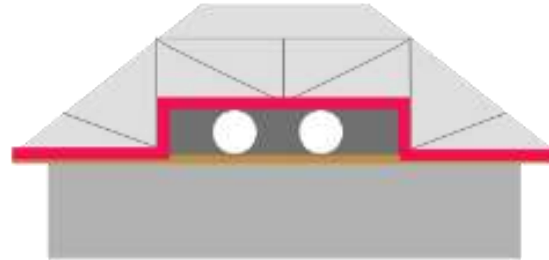
If we're using a SEER 21, variable speed A/C system...

- SEER 21 has **twice** the run time vs a SEER 13 system
- Ducts in conditioned space: SEER 21 offers 40% savings
- Ducts **not** in conditioned space: SEER 21 offers 27% savings

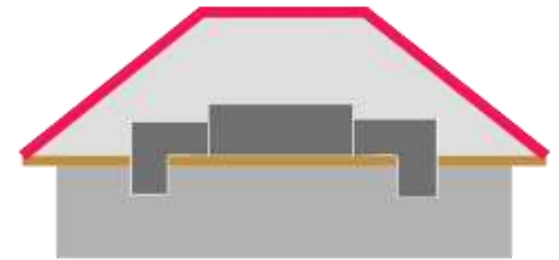
Options for Optimized Duct Location



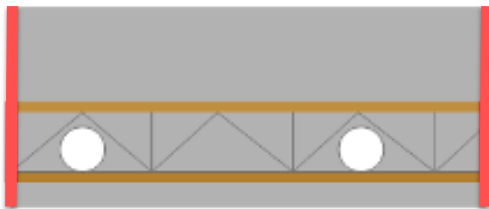
Ducts in Dropped Ceiling



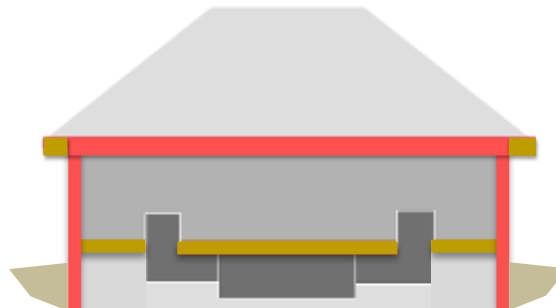
Ducts in modified truss
in attic



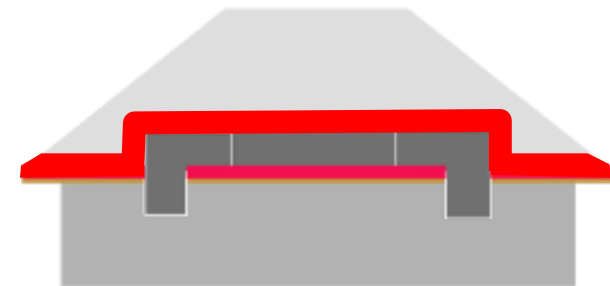
Ducts in Unvented Attic
Ducts in unvented attic



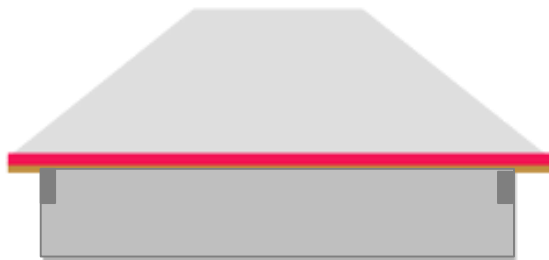
Ducts Between Floors



Ducts in Unvented
Crawl Space/Basement



Ducts in vented attic
Ducts in Vented Attic



Ductless Systems

- Buried & SPF encapsulated (Humid Climates)
- Buried (Dry Climates)
- Buried (2018 IECC)

- **Short Duct Run**

up to 10' of total length is permitted to be outside of the home's thermal and air barrier boundary.

- **Jump Ducts**

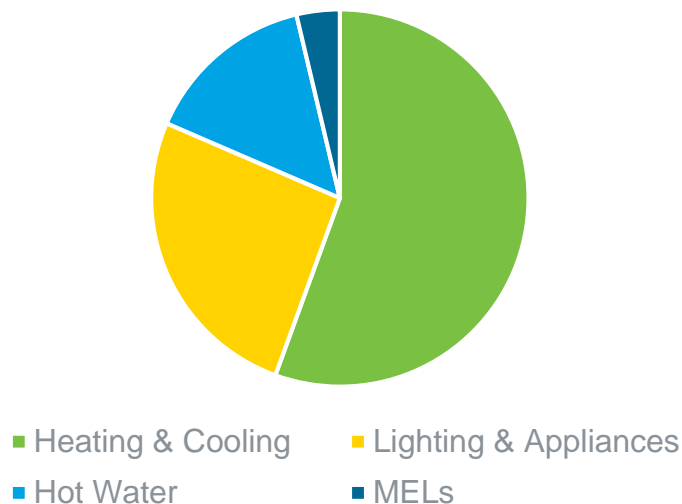
may be located in attics if all joints, including boot-to-drywall, are fully air sealed with mastic

Stepping up to ZERH...

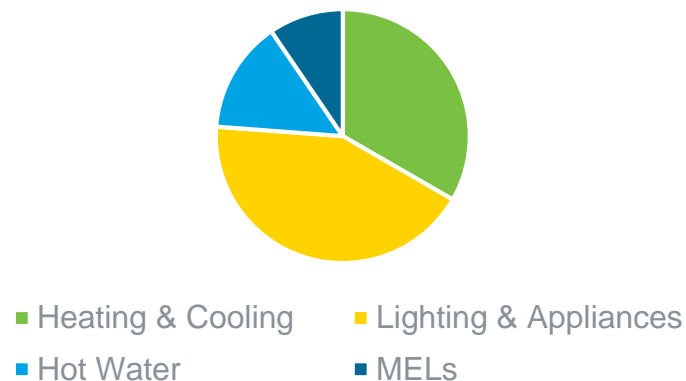
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IECC 2012	ENERGY STAR v3	ENERGY STAR v3.1	Indoor airPLUS	ZERH	

Components and MEL's are increasingly larger part of total energy use in low-load homes (~50%).

Energy Use - Then



Energy Use - Now



Zero Energy Ready Home requires:

- **ENERGY STAR Certified Appliances:***
refrigerators, dishwashers, clothes washers
- **ENERGY STAR Certified Fans*:**
bathroom ventilation, ceiling fans
- **ENERGY STAR Certified Lighting:**
Min. 80% of fixtures or lamps (CFL or LED)
- **WaterSense Hot Water Distribution**

*Only where installed by builder

Built for when water was free and energy was cheap!

Copper L piping:

- 1" = 5.53 ounces/ft
- $\frac{3}{4}$ " = 3.22 ounces/ft
- $\frac{1}{2}$ " = 1.55 ounces/ft

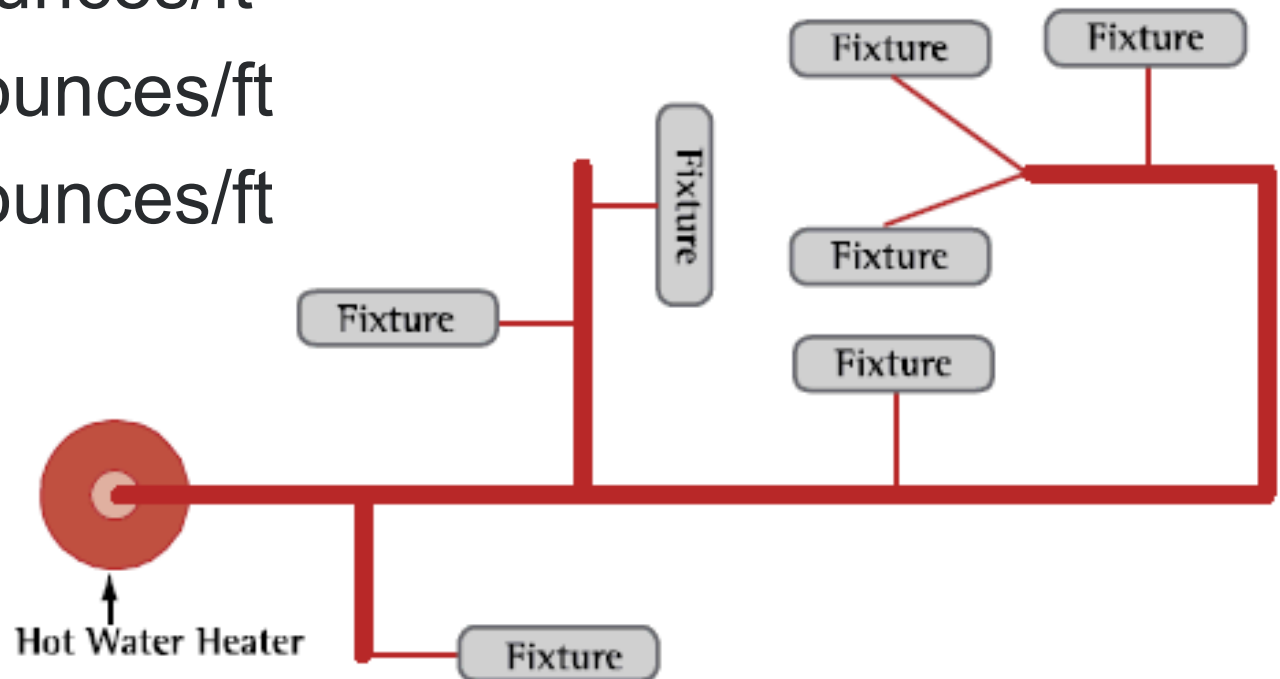
Estimated Volume:

30.6 gallons

10' branch

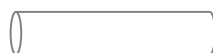
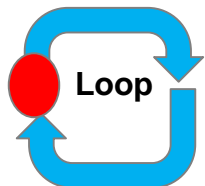
Wait Time: 1 – 1.5

minutes

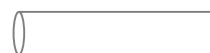


- Based on EPA WaterSense Specifications:

Hot Water
Source



≤ 0.5 gallons of water



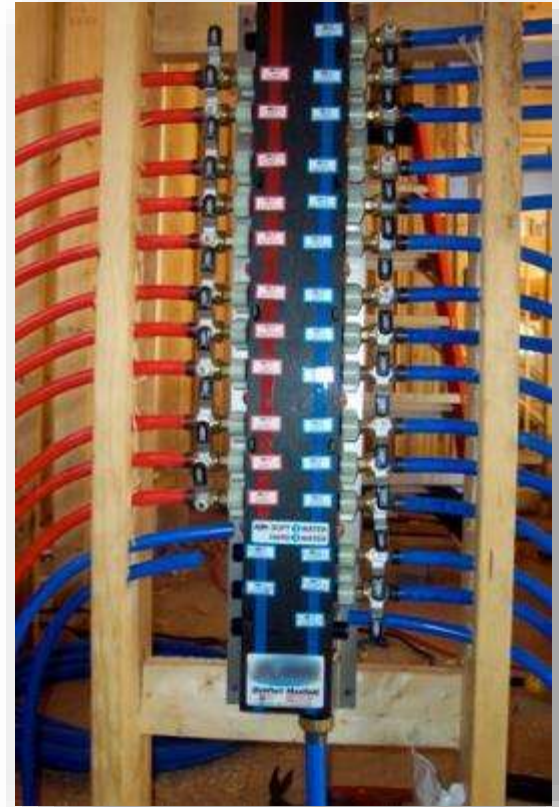
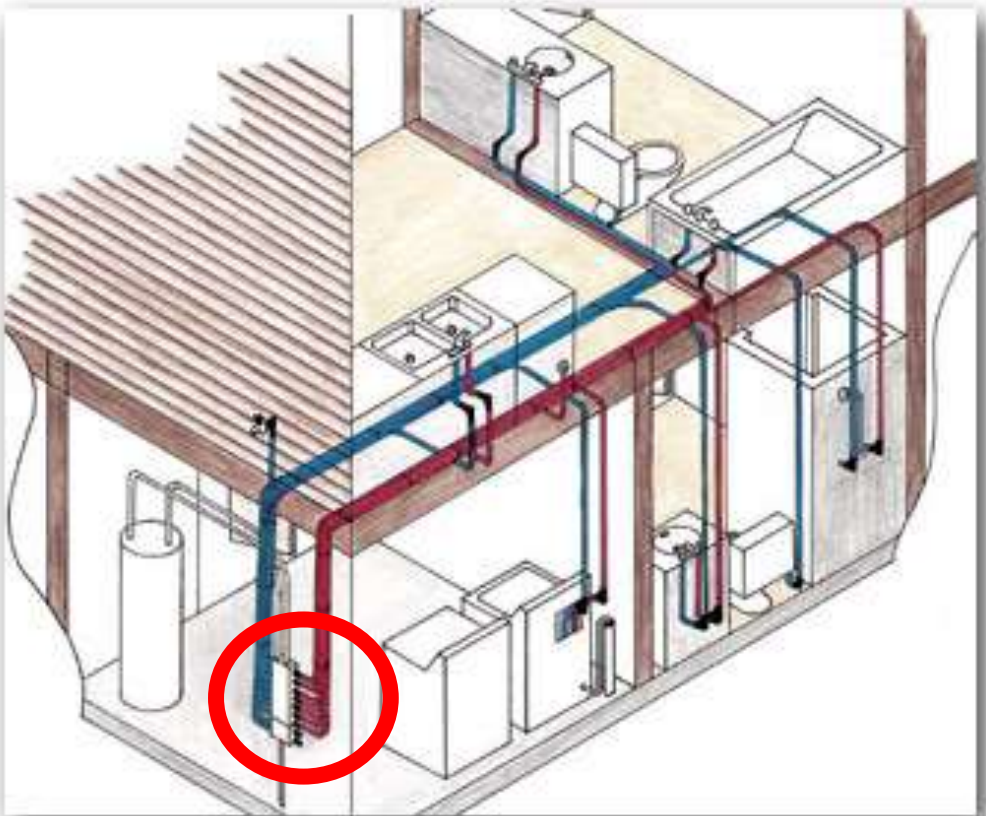
Furthest
Fixture



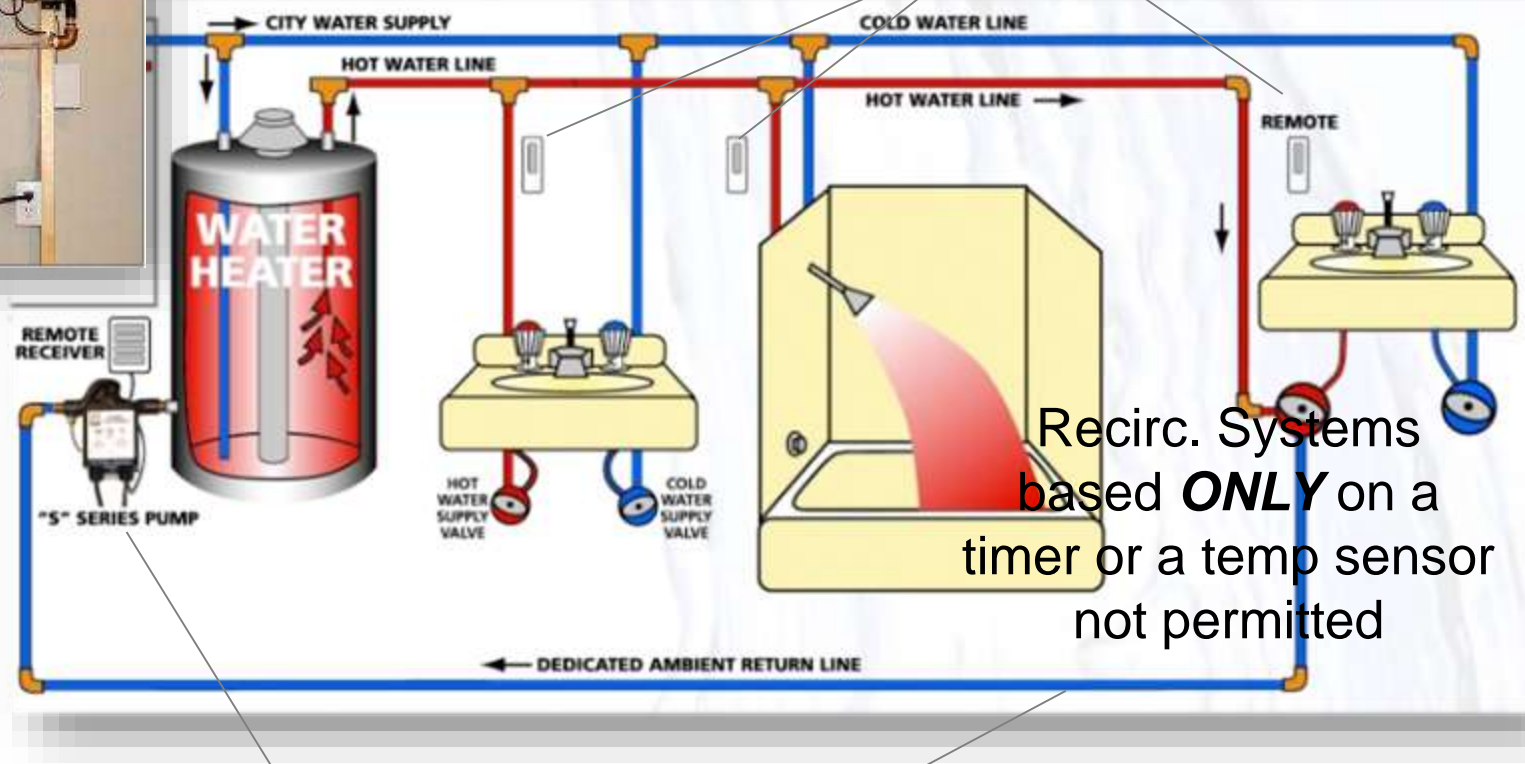
Core Plumbing Layout



Manifold Plumbing System



Demand Pumping System

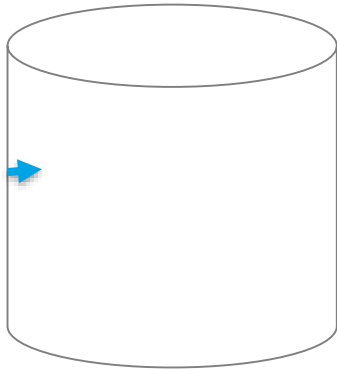


Demand Pump

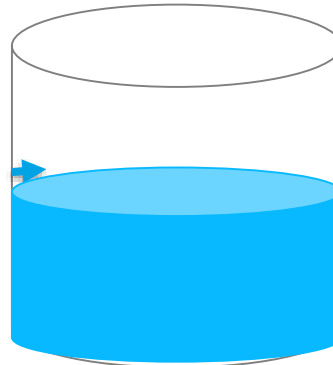
Dedicated Return



0.6 gal →



0.6 gal →



$T_{fin} - T_{init}$
must be at least 10 F

Prime loop (if applicable)

Start flow

Take T_{init} (of flow)

Stop at 0.6 gallons

Take T_{fin} (of flow)

Stepping up to ZERH...

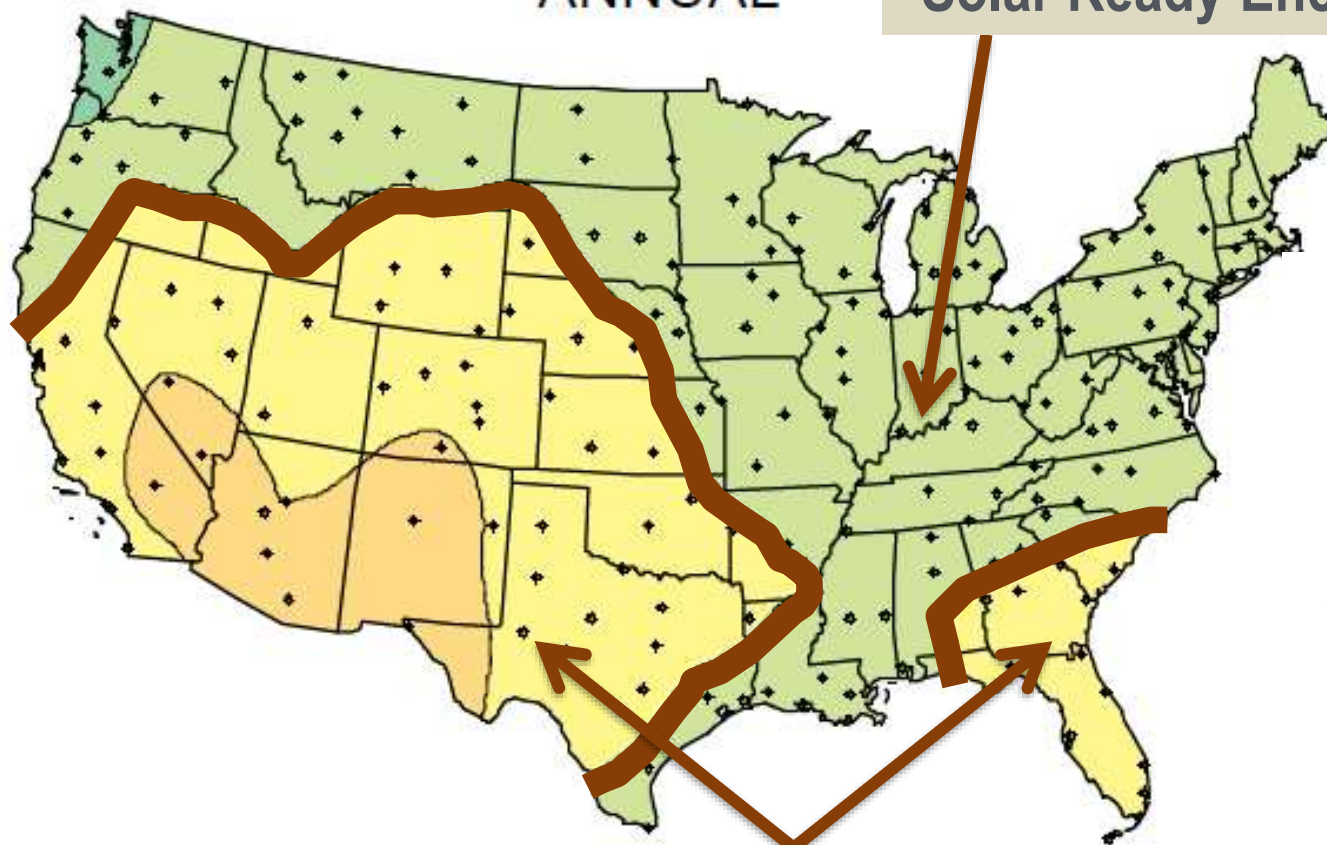
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PV-Ready Checklist Applicability

Average Daily Solar Radiation Per Month

ANNUAL

Solar Ready Encouraged



kWh/m²/day



Solar Ready Required

Not required in areas lacking access to significant solar resources:

- Tree Shading
- Tall Buildings
- Available South Facing Roof

Multifamily Building Allowances:

- PV-ready features may be provided for the common space instead of at the dwelling level



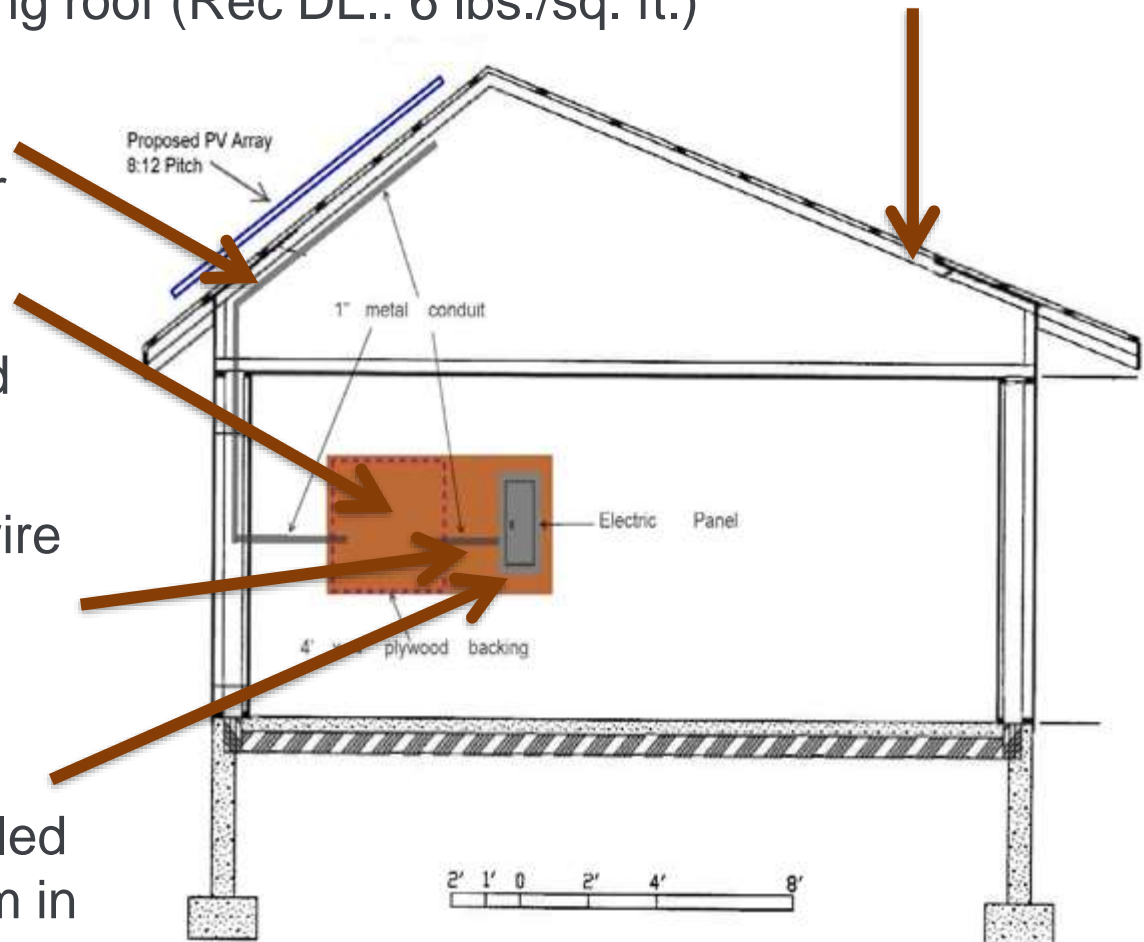
Documentation of the maximum allowable dead load and live load ratings of the existing roof (Rec DL.: 6 lbs./sq. ft.)

Conduit to run DC wire from roof to inverter

Dedicated Area for installing inverter and balance of system

Conduit to run AC wire from inverter location to electric panel

Circuit Breaker designated and/or installed for use by the PV system in the electric panel



Stepping up to ZERH...

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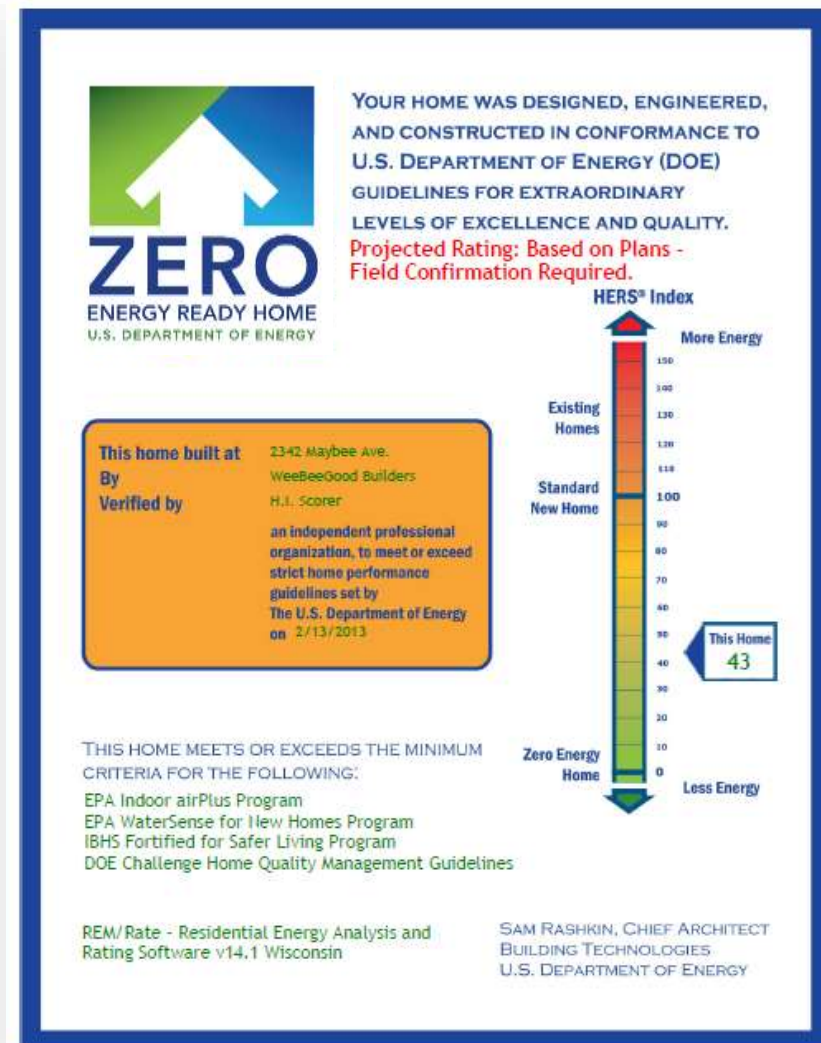
Recognition

Lots of Recognition Choices...



Recognition with Certificate

- **Rater Prints Certificate**
directly from rating software
- **Certificate Includes:**
 - Rating Details
 - Graphic HERS Index
 - Optional Programs





Independent Voice of Authority vs. “Trust me.”

Recognition with 'Brand'

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Recognition with 'Brands'



Links Buyers to Leading Edge Builders:

- Contact Information
- Optional Commitments:
- # Labeled Homes
- Website link



For All Active Partners

DOE Zero Energy Ready Home Partner Locator

Builders across the United States have become DOE Zero Energy Ready Home partners. The interactive map below allows you to view the number of partners by state and organizational type. Search for partners by typing into the text box below. You may also find partners by state, organization type, or commitments.

Ready to Take the Zero Energy Ready Challenge?

Builders interested in learning more about DOE Zero Energy Ready Home can [view the requirements](#) or start the [sign up process](#).

Search Partners:

Search

Or Filter By:

State:

All

Partner Type:

All



DOE Zero Energy Ready Home: Partner Profile

Mandalay Homes



Partner ID:

620

Organization Type:

Builder

Main Contact:

Dave Everson

Address:

2320 E BASELINE RD #148-605

PHOENIX, AZ 85042

Primary Phone Number:

(602) 864-3800

**Certified DOE Zero Energy Ready Homes
(2012 - Present):**

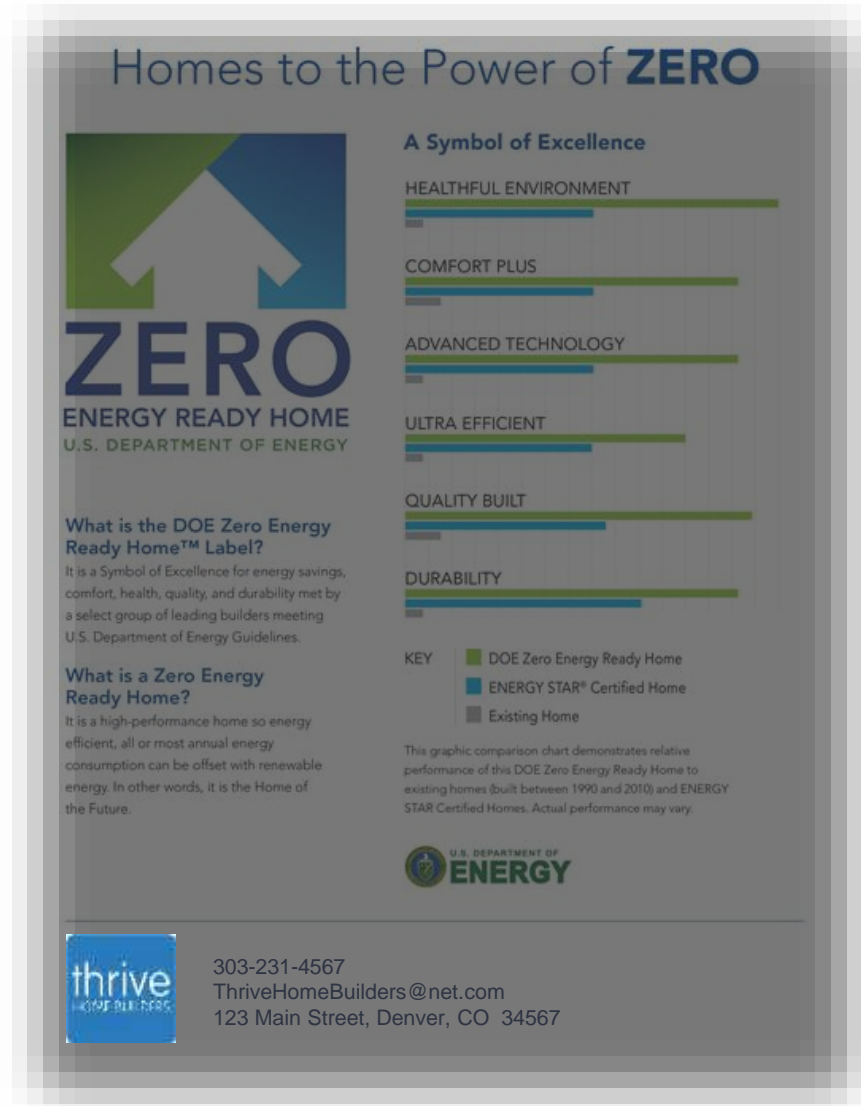
183

**Certified Builders Challenge Homes
(2008 - 2012):**

0

Website:

<http://www.mandalayhomes.com>



Recognition with Brochure

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Front Cover

Inside Spread

Flap

Back Cover

Recognition as a Leader

DOE TOUR OF ZERO

Buildings Home

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Emerging Technologies

Residential Buildings

Building America

Home Energy Score

Home Performance with ENERGY STAR

Better Buildings Residential Network

Home Improvement Catalyst

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Resources

Events

Guidelines for Home Energy Professionals

Commercial Buildings

Appliance & Equipment Standards

Building Energy Codes

Success Stories

Resource Center

Funding Opportunities

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.



Click on a climate zone to see homes in that region.



The Home of the Future Today Video (Text Version)

Search:

Showing 1 to 25 of 77 entries

Show entries

TOUR THESE HOMES	BUILDER	LOCATION	HIA WINNER	CLIMATE ZONE
Cobbler Lane	Addicko Homes	Greer, SC	2015	MIXED-HUMID
Fishers Circle	Amaris Homes	Marietta, MI	2015	COLD / VERY COLD
Johns Island Custom	Amaris Homes, LLC	Charleston, SC	2014	HOT-HUMID
Eco-Village Ithaca	AquaZephyr	Ithaca, NY	2014	COLD / VERY COLD
ZED 2	Boulder ZED Design Build	Boulder, CO		COLD / VERY COLD



Drop-In Messaging

As a registered DOE Zero Energy Ready Home partner, enjoy access to the following pre-approved messages for insertion into your promotional materials. Simply insert your company name and use the message as it appears below.

- According to the U.S. Department of Energy, **<Partner Name>** is in a select group of top builders in the nation who have certified one or more homes that meet or exceed Zero Energy Ready Home guidelines for excellence in performance and energy efficiency.
- As a committed DOE partner who provides certified Zero Energy Ready Homes, **<Partner name>** is in the top one percent of builders in the country meeting the extraordinary levels of excellence in energy and performance specified in the national program requirements.
- As a Zero Energy Ready Home Partner, **<Partner Name>** offers high performance homes that are so energy efficient, all or most of their annual energy consumption can be offset with renewable energy.
- **<Partner name>** builds homes certified to rigorous DOE Zero Energy Ready Home National Guidelines that are at least 40%-50% more energy efficient than a typical new home.
- **Healthful environment:**
According to the U.S. Department of Energy (DOE), every certified Zero Energy Ready Home has a comprehensive package of measures to help minimize dangerous pollutants, provide continuous fresh air, and effectively filter the air you breathe.
- **Comfort Plus:**
According to the U.S. Department of Energy (DOE), every certified Zero Energy Ready Home features high-efficiency insulation, windows, air sealing and space conditioning systems that help surround you with even temperatures, low-humidity, and quiet in every room on every floor.
- **Advanced Technology:**
According to the U.S. Department of Energy (DOE), every certified Zero Energy Ready Home features advanced technologies and practices recommended by leading housing experts from DOE's world-class research program, Building America.

- **Ultra efficient:**
According to the U.S. Department of Energy (DOE), every certified Zero Energy Ready Home is so energy efficient a small solar electric system can easily offset most, or all, of its annual energy consumption. This is why it is called as Zero Energy Ready Home.
- **Quality Built:**
According to the U.S. Department of Energy (DOE), every certified Zero Energy Ready Home features high-efficiency appliances and equipment that are often associated with better quality construction. In addition, overall quality is enhanced with rigorous inspections, diagnostics, and checklists enforced by independent verifiers.
- **Durability:**
According to the U.S. Department of Energy (DOE), every certified Zero Energy Ready Home features advanced levels of energy savings, comfort, health, durability, quality and future performance that can be expected to stand the test of time and help enhance future value.
- Samuel Rashkin, Chief Architect for DOE Building Technologies Office, said "Zero Energy Ready Homes like those constructed by **<Partner Name>** are the home of the future because they live, work, and last better with incredibly low or no energy costs. And what's exciting for American homebuyers, they are available today thanks to leading builders across the country."
- "Housing Innovation Award winners such as **<Partner Name who has won HIA>** are leading a major housing industry transformation to zero energy ready homes. This level of performance is the home of the future because it improves the way Americans live by substantially reducing or eliminating utility bills, ensuring engineered comfort way beyond traditional homes, protecting health with a comprehensive package of indoor air quality measures, and helping maximize the largest investment of a lifetime," said Sam Rashkin, Chief Architect at the U.S. Department of Energy's Building Technologies Office.



Homes that do more.

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New Home

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Efficient
Living

Colorado's
Builder

Design
Studio

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Warranty

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"Zero Energy Ready Homes are the future of U.S. housing, and innovators like New Town Builders are leading the way for the entire industry. Zero Energy Ready Homes can provide a vastly superior homeowner experience at a lower ownership cost – an experience all Americans should want in their next home."

Sam Rashkin, Chief Architect for U.S. Department of Energy Building Technologies Office

Recognition After-Sale

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Your Zero Energy Ready Home Story



— BROUGHT TO YOU BY —

Thrive Home Builders

303-231-4567

ThriveHomeBuilders@net.com

123 Main Street, Denver, CO 34567



Welcome to Your Zero Energy Ready Home

THIS IS YOUR STORY.

The story of your Zero Energy Ready Home and how it leverages advanced technology for a better homeowner experience.

IN THIS BROCHURE

you will learn about the following seven complete systems and why they make your home so special.



High-Performance Thermal Enclosure



Whole-House Water Protection



High-Performance Comfort System



High-Efficiency Components



Whole-House Health Protection



Solar-Ready Construction



Enhanced Quality Assurance

Recognition with Awards



Housing Innovation
Award

Recognition with Awards

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Home

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Michigan's Most Respected Builder

CONTACT US



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MAP

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Recognition with Awards





Zero Energy Ready Home Getting Started

ENERGY STAR, IAP, & DOE ZERH

- Same rater network
- Same modeling software (at least 3 different options)
- Same plan review & site inspection protocol



Process:

- Become a Builder or Rater partner (online)
- No need to pre-register projects; no program fees
- Recommend integrated design process (MEPs)
- Rater: plan review & site inspections
- Project Certification
 - Rater sends compliance report (generated by modeling software) to DOE or RESNET Registry
- Builder credited with certified home on DOE website

Thank You!

Resources & Next Steps

www.buildings.energy.gov/zero/

- Become a Partner
- Program Specs
- DOE Tour of Zero
- 24+ Recorded Webinars
- Marketing Took Kit

