



Keys to a High Performance Home: Are You Ready for the DOE Zero Energy Ready Home?

2015 Energy Design Conference Duluth, MN

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KEYS TO A HIGH PERFORMANCE HOME: ARE YOU READY FOR THE DOE ZERO ENERGY READY HOME?

- In accordance with the Department of Labor and Industry's statute 326.0981, Subd. 11,

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KEYS TO A HIGH PERFORMANCE HOME: ARE YOU READY FOR THE DOE ZERO ENERGY READY HOME?

- **Part 1: Defining Total Building Performance**
- **Part 2: Key Components for High-Performance**
- **Part 3: DOE Zero Energy Ready Home**
 - a. Business case
 - b. Technical requirements
- Reflection on where we have been, where we are, and where we need to go!

WHAT IS TOTAL BUILDING PERFORMANCE?

- It is a deliberate integration of building enclosure, mechanical systems, and controls to provide a
 - comfortable, efficient, durable, and healthy home.
- It demands a “systems approach” to the
 - dynamics of climate, site, and occupants
 - interaction of building enclosure, mechanicals, and controls.
- It requires careful planning, teamwork and careful execution in
 - design, construction / installation, and operation.

HOW DO WE MEASURE TOTAL BUILDING PERFORMANCE?

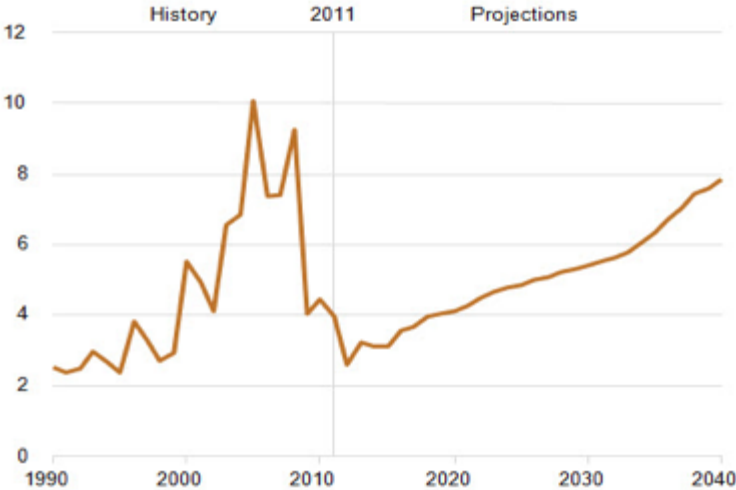
- Energy efficiency
 - overall cost for space conditioning, water heating, refrigeration, lights, and appliances
- Moisture management & durability
 - life of major structural components, systems & products
- Healthy indoor environment
 - quality of pollutant management, filtration, & ventilation
- Environmental impacts
 - “light” footprint and low long-term “costs”

TOTAL BUILDING PERFORMANCE: WHEN SOMETHING IS MISSING

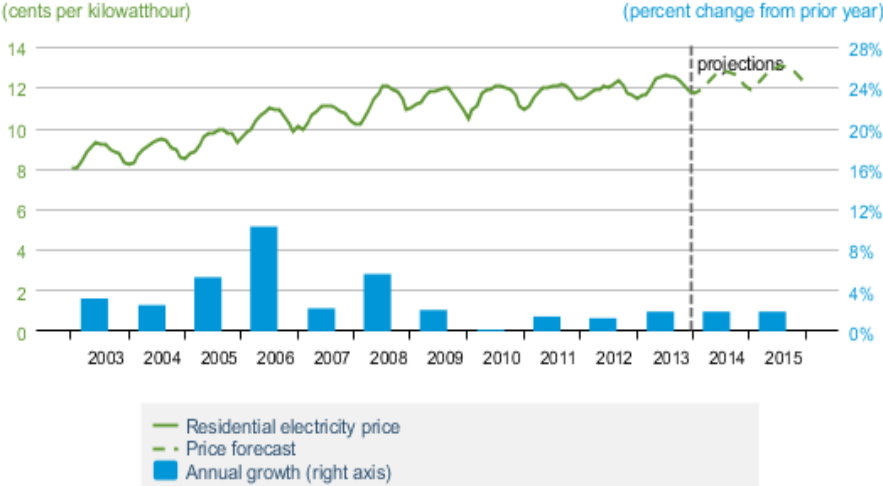
- Some Common Performance Issue's in Today's Homes
 - High energy bills
 - Ice dams
 - Wet foundations
 - Window condensation
 - Structural condensation
 - Water intrusion
 - Poor indoor air quality

HIGH ENERGY BILLS

Figure 86. Annual average Henry Hub spot natural gas prices, 1990-2040 (2011 dollars per million Btu)



U.S. Residential Electricity Price



Source: Short-Term Energy Outlook, January 2014.

ICE DAMS



WET FOUNDATIONS



WINDOW CONDENSATION



STRUCTURAL CONDENSATION



WATER INTRUSION



INDOOR AIR QUALITY



RISKY MECHANICAL SYSTEMS

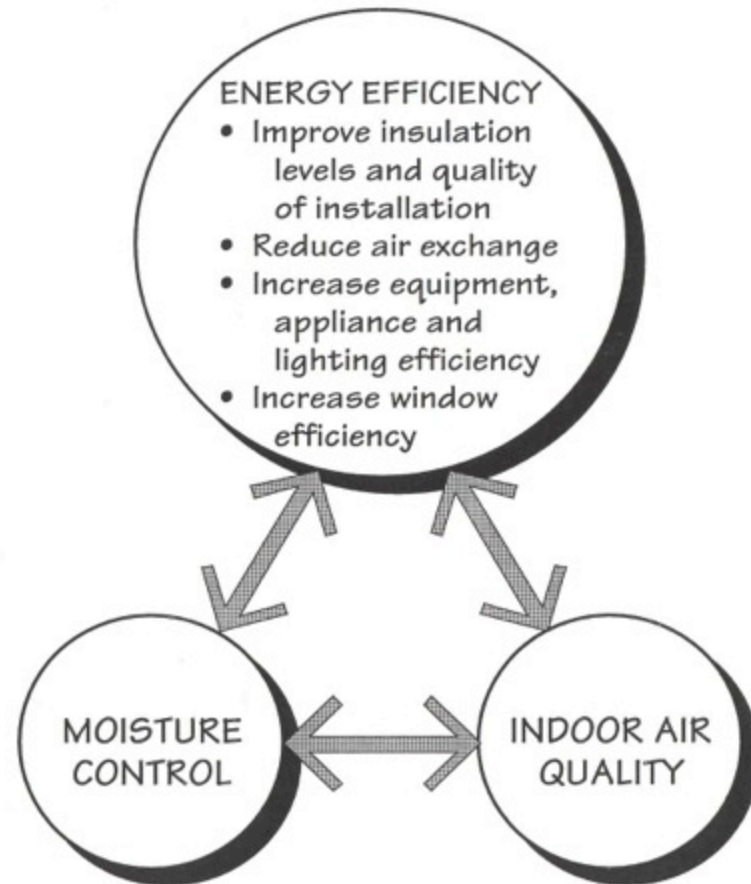


CAN WE PREDICT TOTAL BUILDING PERFORMANCE?

- What's the best predictor of overall building performance?
 - Answer: Air flows and pressures
 - as a group – unplanned, unintentional, and unmanaged airflows are the primary cause of residential performance failures
 - air flow can carry with it a great deal of heat and moisture
 - air pressures can compromise mechanical system performance
 - Air management is critical for comfort, energy efficiency, durability, and indoor air quality!

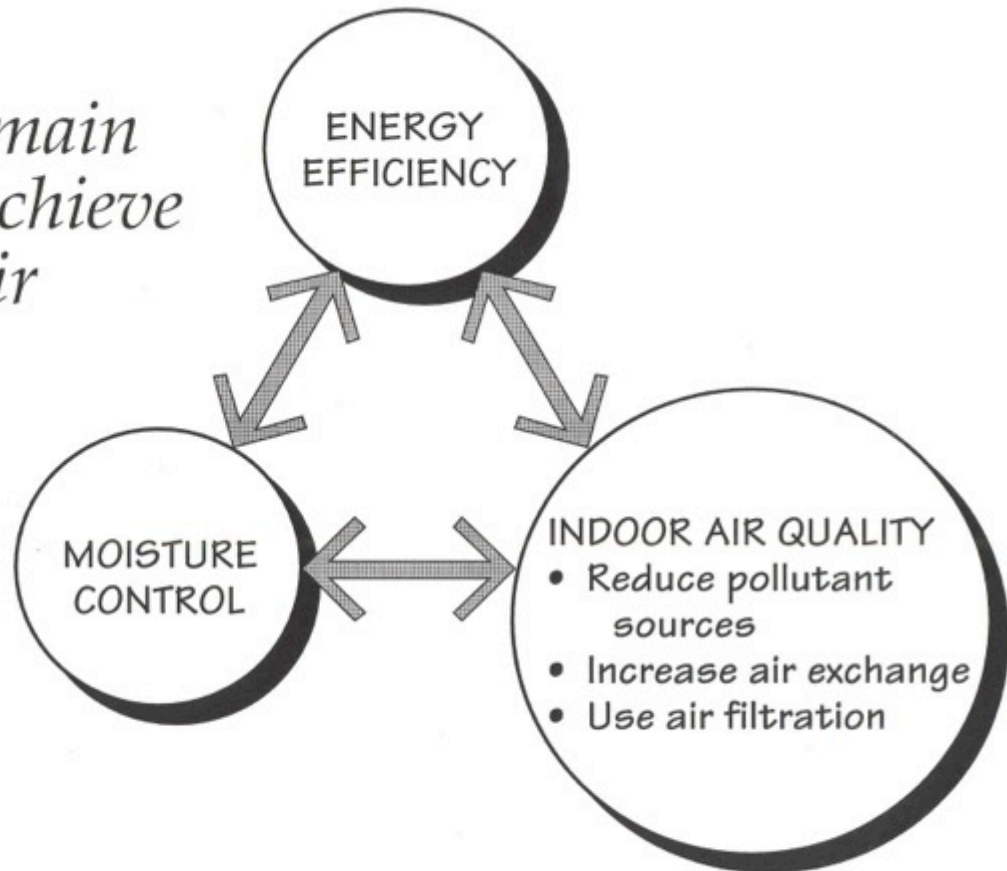
FINDING THE SOLUTION TO TOTAL BUILDING PERFORMANCE

What are the main strategies to achieve energy efficiency?



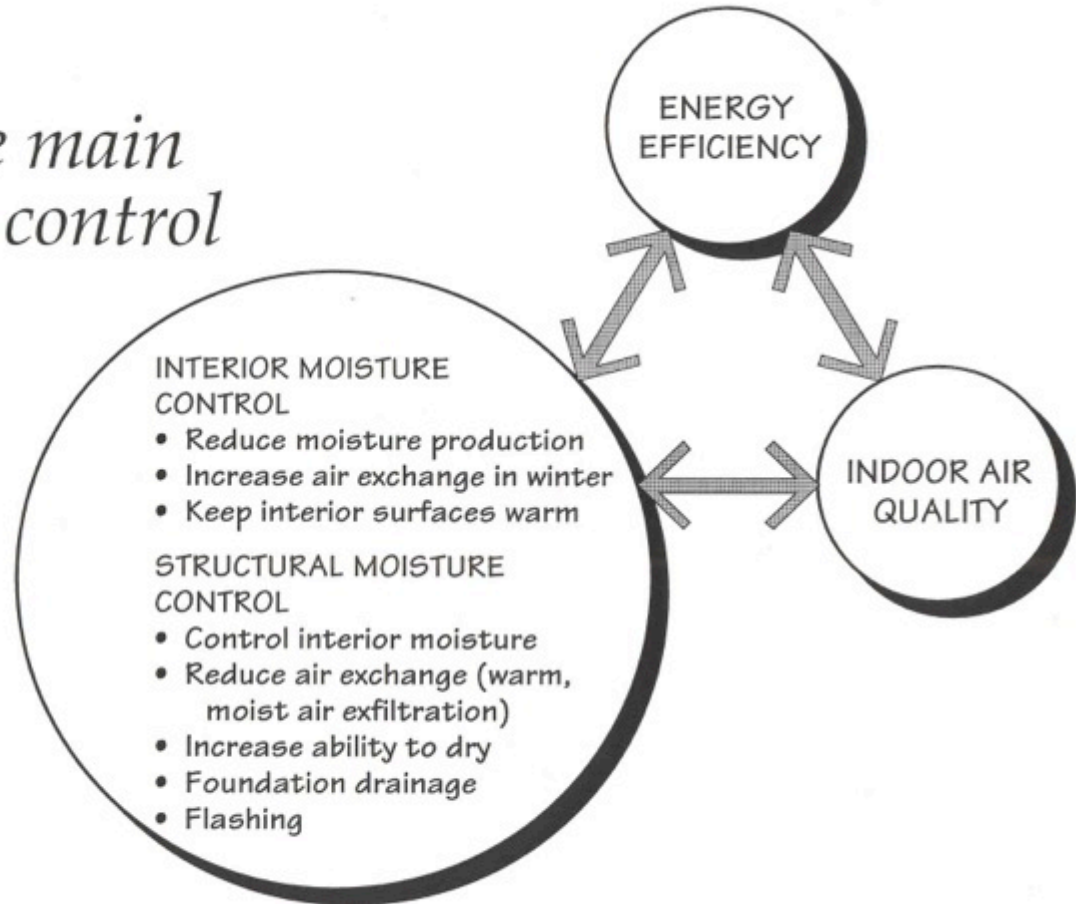
FINDING THE SOLUTION TO TOTAL BUILDING PERFORMANCE

What are the main strategies to achieve good indoor air quality?



FINDING THE SOLUTION TO TOTAL BUILDING PERFORMANCE

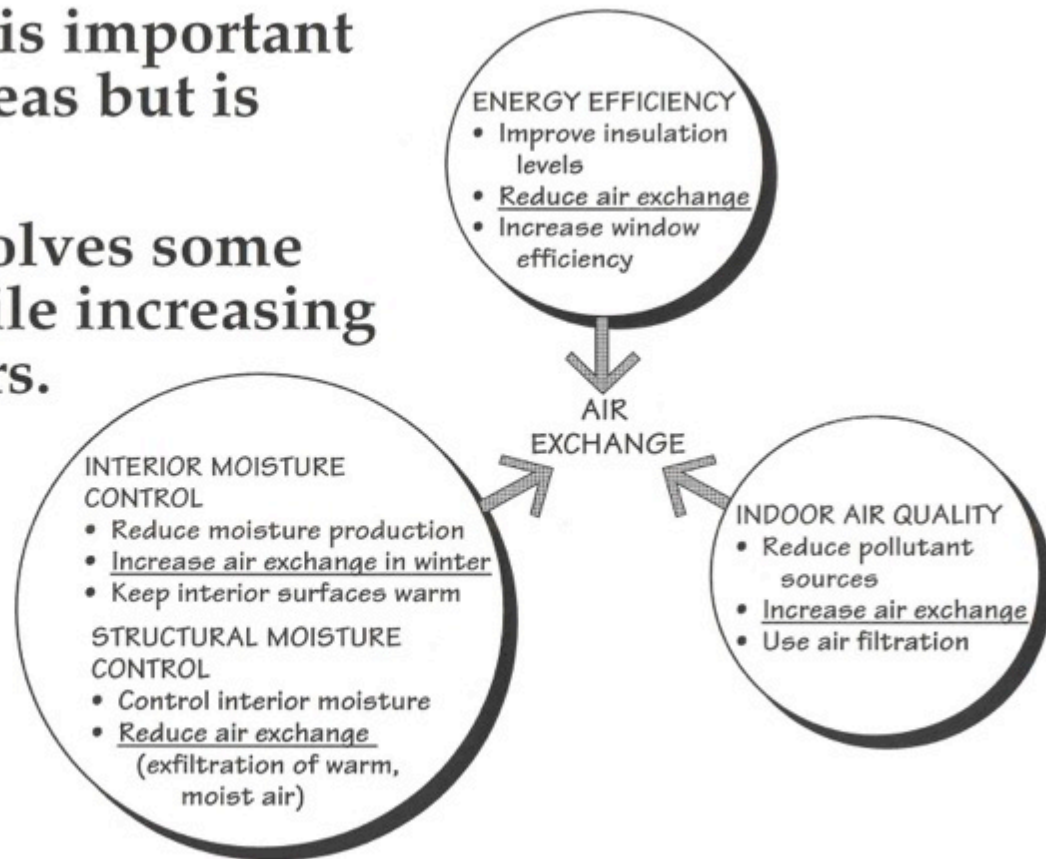
What are the main strategies to control moisture?



FINDING THE SOLUTION TO TOTAL BUILDING PERFORMANCE

Air exchange is important in all three areas but is also complex.

Reducing it solves some problems while increasing it solves others.



TOTAL BUILDING PERFORMANCE: A KEY TO THE GREAT PUZZLE!

- Efficient, durable, and healthy homes require carefully managed airflows;
 - must control both holes and pressures.
- And to some extent, until we get this right we can't move on.

HIGH PERFORMANCE HOUSES

- The “Ten Key Components” that will ensure ...
 - Energy efficiency
 - Moisture control & durability
 - Good indoor air quality
- A formula to have your cake and eat it to!!!

Components

The Ten Key Components

Energy

Moisture

IAQ

1. Full coverage optimal thermal insulation



2. Continuous warm-side air barrier



3. Full-coverage warm-side vapor retarder



4. Continuous exterior-side weather barrier



5. Energy efficient, condensation resistant windows



6. Effective ground moisture / soil gas control



7. Low toxicity materials, finishes, and furnishings



8. Safe, efficient space heating and cooling



9. Managed mechanical ventilation



10. Efficient and safe appliances and lighting



TOTAL BUILDING PERFORMANCE: WHEN IT ALL COMES TOGETHER

- Well-insulated envelope
 - slab, foundation, walls, ceiling
- Highly efficient windows
- Extremely airtight
- High quality mechanicals
 - efficient, sealed combustion furnace and water heater
 - properly sized, high-efficiency air-conditioning
 - well-designed, sealed ductwork
 - dedicated and distributed mechanical ventilation system
 - high-efficiency air filtration
 - proper make-up air for exhausts
 - user-friendly controls



- Very comfortable home
- Durable & low-maintenance
- Healthy indoor environment
- Heating: \$140 - 350 / yr
- Cooling: \$80 - 200 / yr
- Water heating: \$60 - 100 / yr

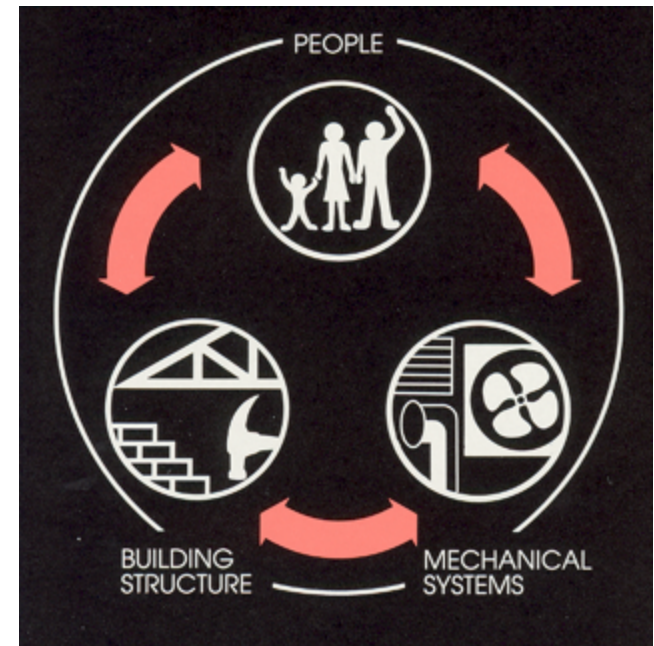
TOTAL BUILDING PERFORMANCE: A SYSTEMS VIEW

- Building a home or remodeling today is
 - not just parts, but practices,
 - not just materials, but methods, and
 - not just products, but process.

- The whole should be more than the sum of the parts.
 - We must move from simple assembly to system integration and ultimately synergy.

TOTAL BUILDING PERFORMANCE: A SYSTEMS VIEW

- Always Keep a Holistic View of How Houses Work
 - Must acknowledge the interaction of ...
 - structure & building envelope
 - mechanical equipment
 - occupants
 - Within the context of the ...
 - climate
 - site



TOTAL BUILDING PERFORMANCE: A SYSTEMS VIEW

- We can and must do better!
 - Controlling airflow is critical to building performance
- Existing technology can get us there!
 - It's not about products; it's about execution
- New technologies will be important
 - But we must be systematic in their evaluation and application

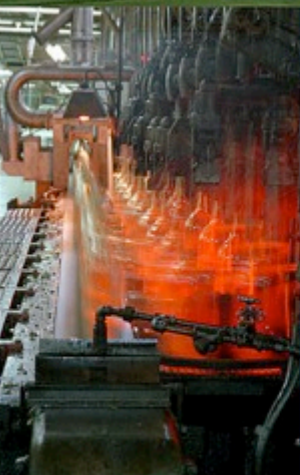
TOTAL BUILDING PERFORMANCE

- Questions

Building Technologies Program

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy



Building America
National Renewable Energy Lab

INTRODUCTION TO BUILDING AMERICA



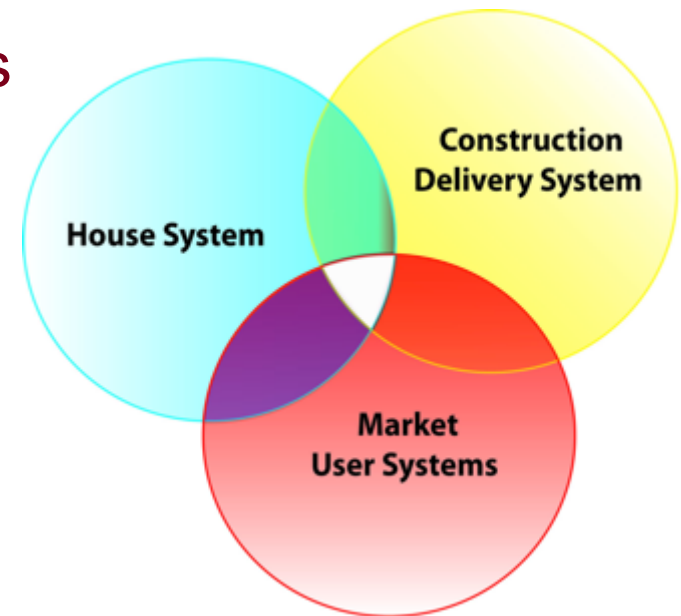
- Focus is to reduce energy use by 50% in new houses and 30% in existing residential buildings.
- Promote building science solutions using a systems engineering and integrated design approach.
- “Do no harm” => we must ensure that safety, health, and durability are maintained or improved.
- Accelerate the adoption of high-performance technology.



Industry Research Teams



- Exploring the next generation of high performance homes for cold climates, using
 - building science as our compass
 - research as our guide
- Taking a total systems approach
 - House (physical) system
 - Construction delivery system
 - Market (consumer-user) system



- Research Team Lead: University of Minnesota
 - Cold Climate Housing Program
 - Center for Sustainable Building Research

- Research Team Partners
 - Center for Energy and Environment – David Bohac
 - Building Knowledge, Inc. – Ed VonThoma
 - Energy Center of Wisconsin – Dan Cautley

- Research and deployment of a whole-house, systems engineered, integrated design approach to select the least cost and highest value features including:
 - Climate-specific designs
 - Highly-efficient walls, foundations, roofs
 - Super-efficient windows & doors
 - Passive solar space & water heating
 - State-of-the-art heating & cooling systems
 - Advanced hot water, appliances, lighting
 - Solar thermal and solar electric systems
 - Moisture resistant construction
 - Healthy indoor air



- We must ensure our high-performance houses meet our expectations today and in the future?
- High-performance houses will push the envelope (and mechanical systems and occupants).
 - This will require more robust designs
 - It will demand systems with forgiveness/tolerance
 - We must have a more predictable delivery system
 - The owners/occupants will need to be in the loop

- New Partners
 - Home Energy Raters

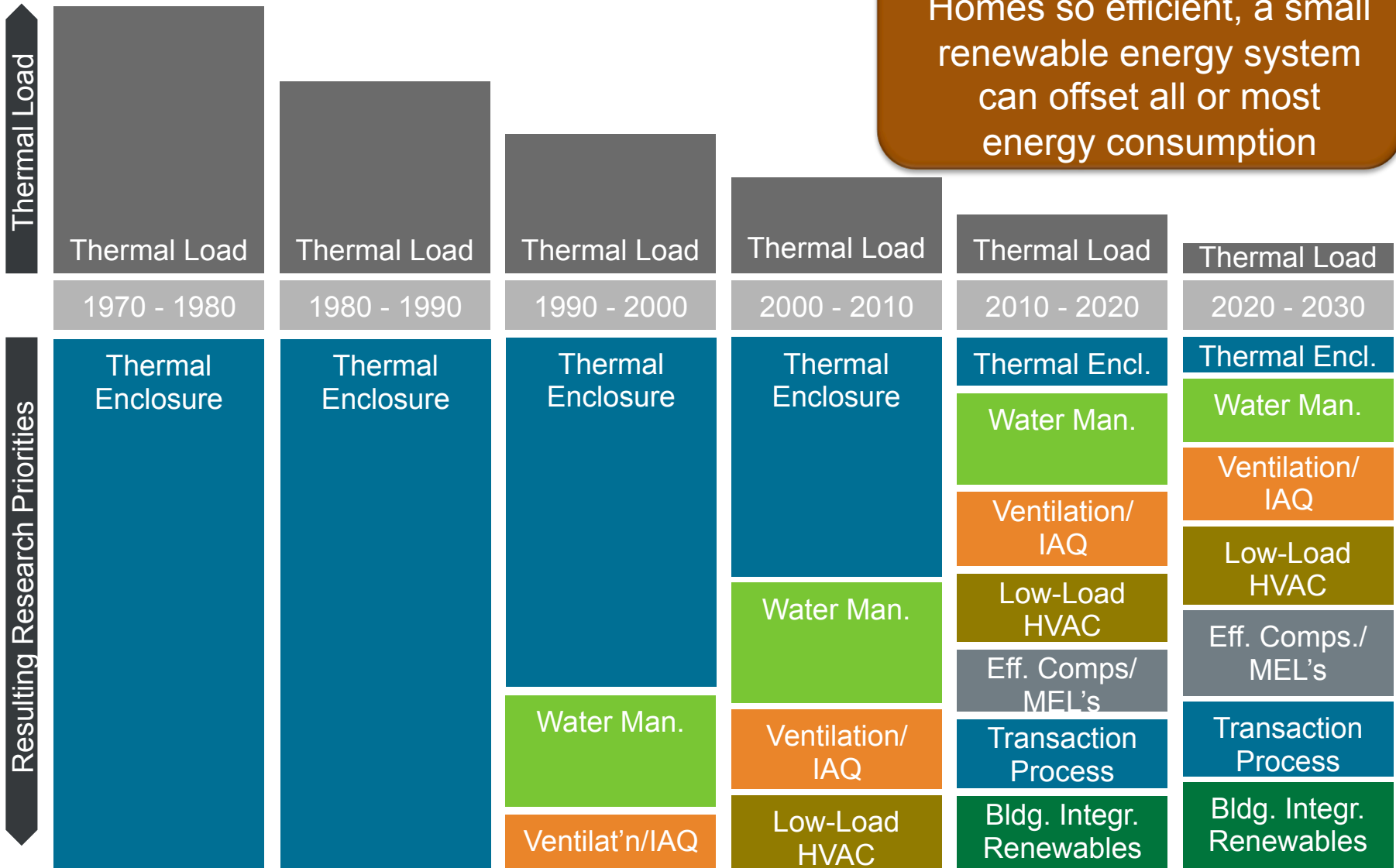
 - Home Performance Consultants

 - Other Resources
 - Building America

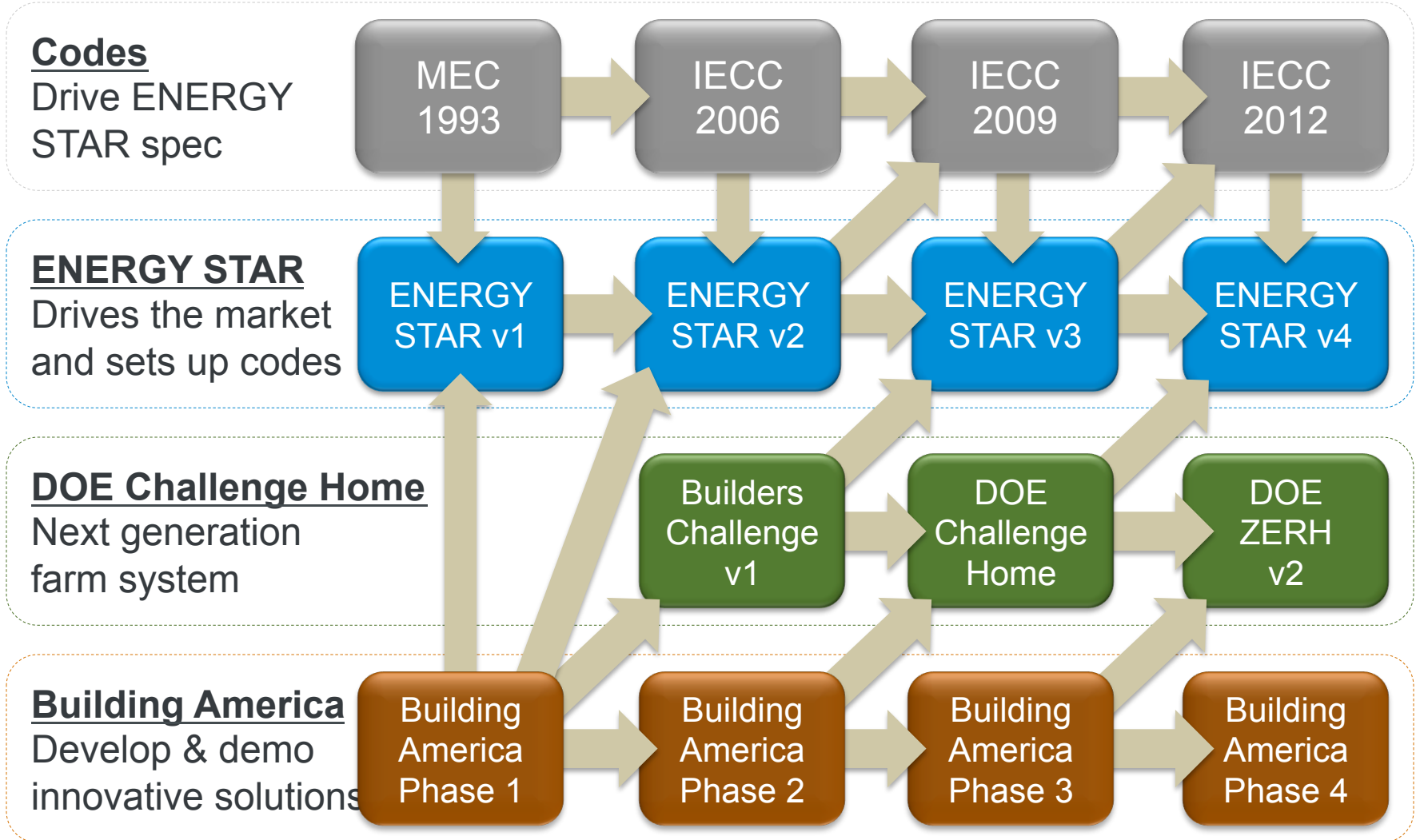
- Building America Resources
 - General Energy Information (EERE)
 - Top Innovations “Hall of Fame”
 - Building America Solution Center
 - DOE Zero Energy Ready Home

Building America Strategy

Goal:
Homes so efficient, a small renewable energy system can offset all or most energy consumption



Why Building America Innovations

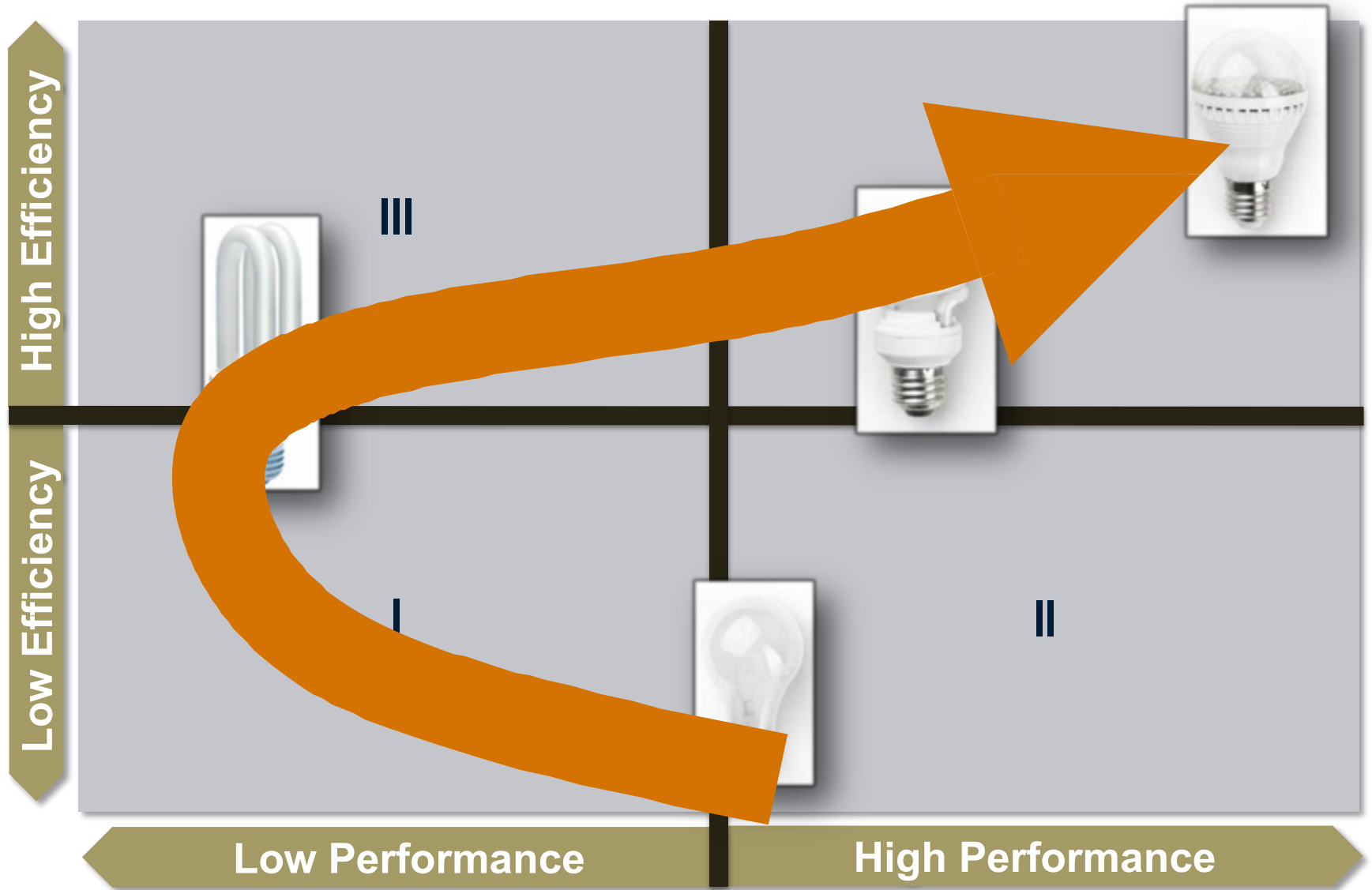


Ultra-High Efficiency + High-Performance

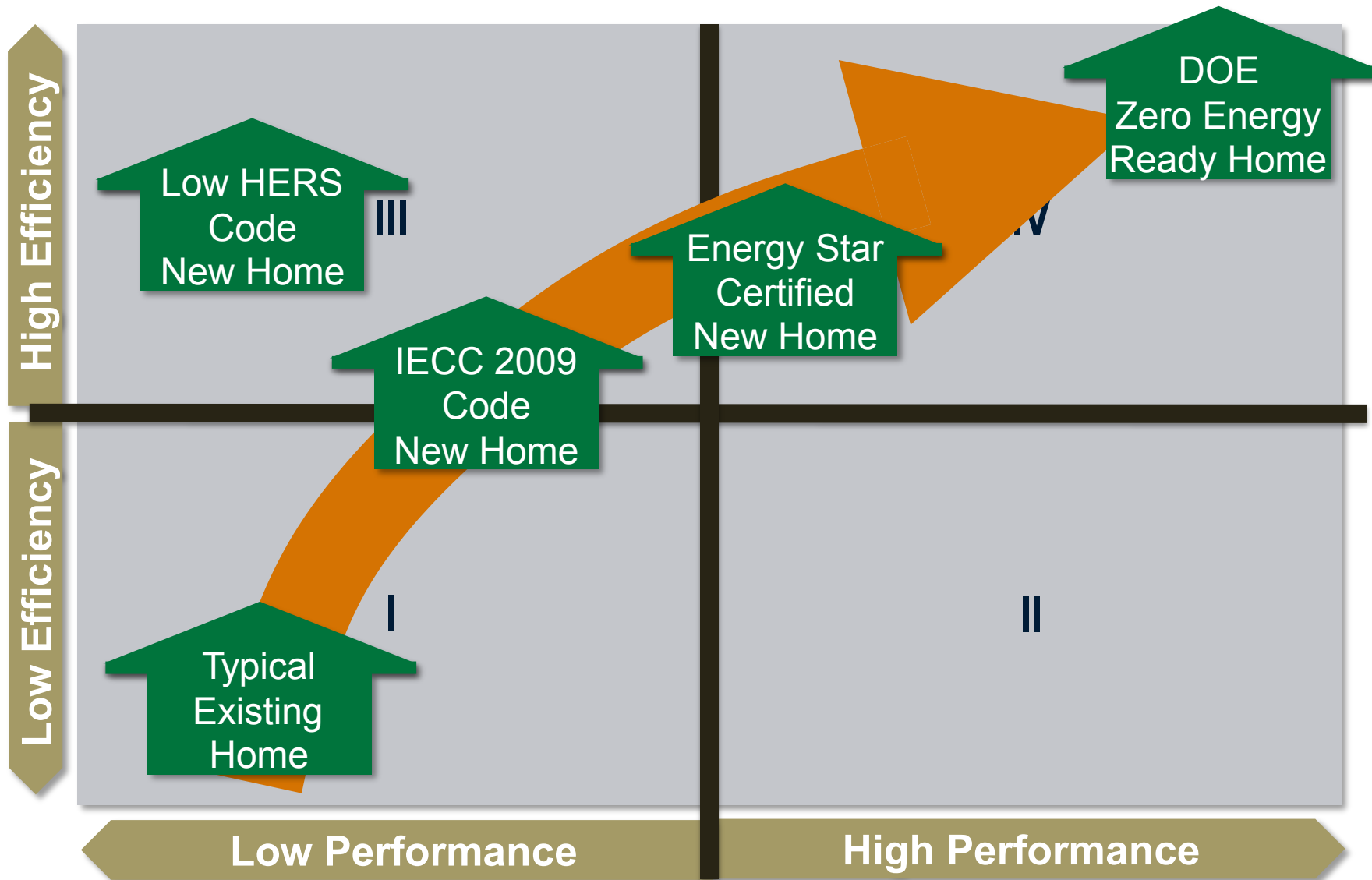
- Enclosure
- Low-Load HVAC
- Components

- Affordable
- Comfort
- Health
- Durability
- Renewable Readiness
- Water Conservation
- Disaster Resistance

Efficiency + Performance Example



DOE Zero Energy Ready Home Path



BA Top Innovations “Hall of Fame”

ADVANCED TECHNOLOGIES



**Building
Science Solutions**

**Energy Efficient
Components**

**Assured Health
and Safety**

HOUSE-AS-A-SYSTEM BUSINESS CASE



**New Homes
with Whole-House
Packages**

**Existing
Homes with Whole-
House Packages**

**Whole-House
Program Support**

EFFECTIVE GUIDANCE AND TOOLS



**High
Performance
Home Solutions**

**High
Performance
Home Metrics**

**Research
Tools**

INFRASTRUCTURE DEVELOPMENT



**Educating
Professionals**

**Recognizing
Value in
Transaction Process**

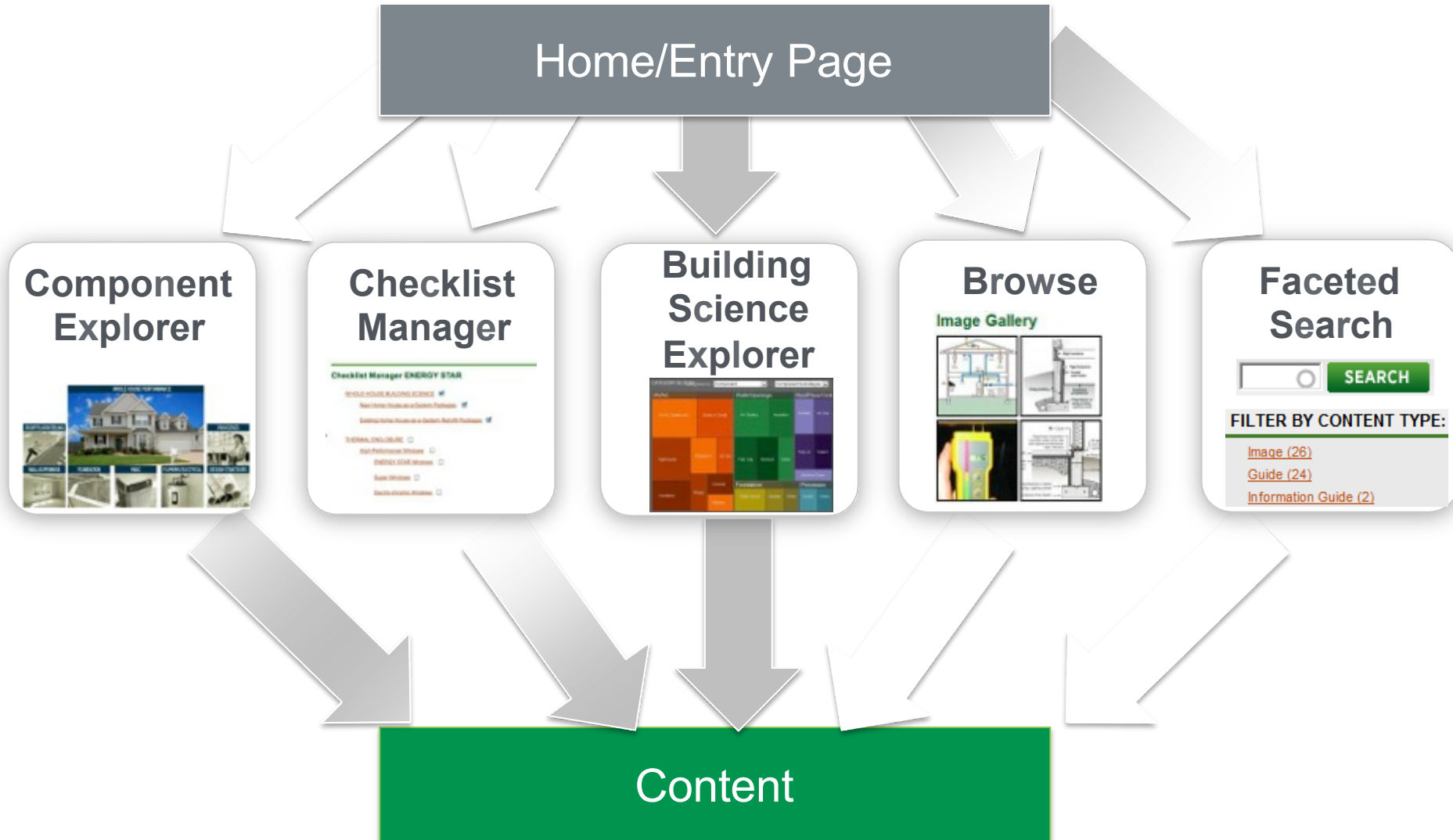
**Informing
Codes and
Standards**

World-Class Research...

Building America Solution Center
BASC.energy.gov



...At Your
Fingertips



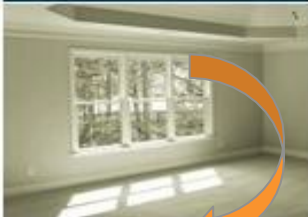
Building America Solution Center Quick Tour: Component Explorer



ROOF/FLOOR/CEILING



WALLS/OPENINGS



FOUNDATION



HVAC



COMPONENTS



QA/QC



DESIGN



Walls/Opening
Water Managed Walls
Minimum Thermal Bridging
Insulation
Air Sealing
Fully Aligned Air Barriers

Fully Aligned Air Barriers
Behind Showers and Tubs
Behind Fireplaces
Attic Knee Walls
Skylight Shaft
Walls Adjoining Porch
Double Walls
Garage Rim/Band Joist

[Solution Center Home](#)

[Component Explorer](#)

[Checklist Manager](#)

[Building Science
Explorer](#)

[Browser](#)

[Guides](#)

[CAD Files](#)

[Case Studies](#)

[Image Gallery](#)

[References](#)

Attic Knee Walls

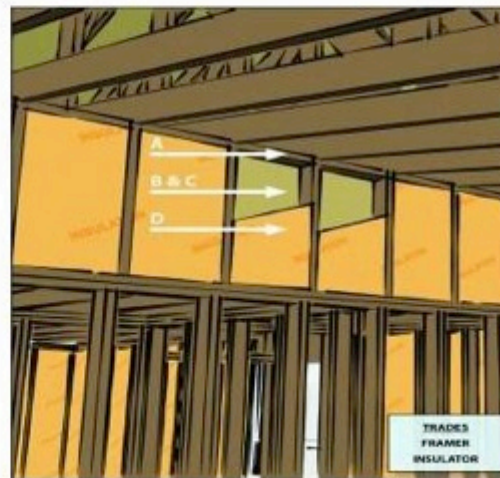
Please [Register](#) or [Login](#) to Provide Feedback.

Scope Description Ensuring Success Climate Training CAD Compliance More Info.

Scope

Fully Aligned Air Barrier

- Install a top and bottom plate or blocking at the top and bottom of all knee wall cavities.
- Back attic knee walls with a rigid air barrier or other supporting material to prevent insulation from sagging and create a continuous thermal barrier*
- Seal all seams, gaps, and holes of the air barrier with caulk or foam.
- Install insulation without misalignments, compressions, gaps, or voids in all knee wall cavities.



* ENERGY STAR recommends using a rigid air barrier, but it is not a requirement.

Notes:

An air barrier is defined as any durable solid material that blocks air flow between conditioned space and unconditioned space, including necessary sealing to block excessive air flow at edges and seams.



MOBILE FIELD KIT

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Scope: Clearly defines and bounds the topic in a way builders and remodelers can contractually obligate their subcontractors.

diameter unless otherwise indicated by the manufacturer. Flexible air barriers shall not be made of kraft

DOE Zero Energy Ready Home

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



Building America

DOE Zero Energy Ready Home

Lots of Recognition Choices...



By constructing DOE Zero Energy Ready Homes, you will be:

- **in a select group of builders**

Only the top one percent of builders in the country meet the extraordinary energy efficiency, comfort, health, safety, durability, and quality levels associated with the DOE Zero Energy Ready Home.

- **providing unprecedented value**

Your customers will receive immediate energy savings of 40-50% and a home that can be easily adapted to net-zero performance with a small renewable energy system.

- **differentiated from the competition**

About 12 in 13 homes sales nationwide are 'used' homes. In addition, the majority of new homes are constructed to minimum code. Based on a foundation of comprehensive home performance, including ENERGY STAR Qualified Home v.3 and the latest proven innovations from DOE Building America, this program provides a path to constructing zero net-energy ready homes that none of your competition has.



Zero Energy Ready Home
Why Build:

The Business Case

Risk Management

Zero Differentiation

Exceed Expectations

Risk Management

Zero Differentiation

Exceed Expectations



More Rigorous Specs:

- Latest Energy Codes
- Low HERS Scores
- Voluntary Labels



Adv. Thermal Enclosure:

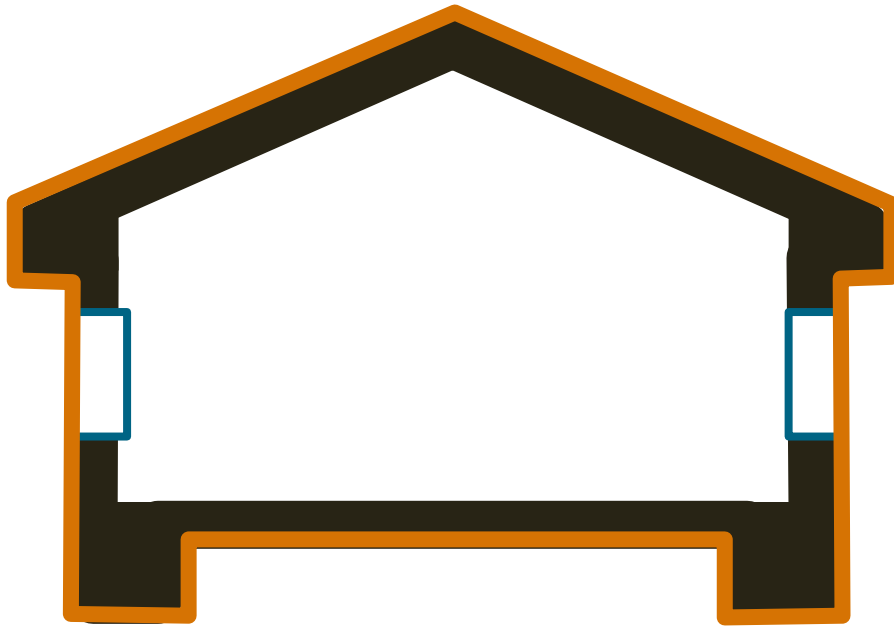
- Adv. Insulation System
 - More Insulation
 - Quality Installation
 - Complete System
- Advanced Windows
- More Air Tightness

Risk 1: Ensured Comfort

Risk Management

Zero Differentiation

Exceed Expectations



Ultra Low HVAC Loads:

- Lower Air Flow/Mixing
- Longer Swing Seasons
- Less Humidity Control



Adv. Thermal Enclosure:

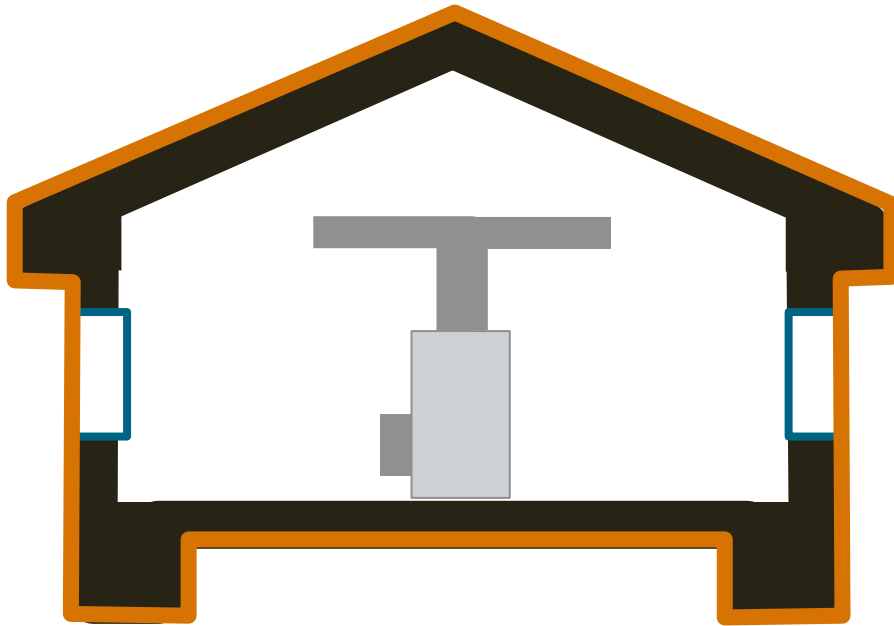
- Adv. Insulation System
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- Advanced Windows
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Risk 1: Ensured Comfort Strategy

Risk Management

Zero Differentiation

Exceed Expectations



Ultra Low HVAC Loads:

- Lower Air Flow/Mixing
- Longer Swing Seasons
- Less Humidity Control



Optimized Low-Load Comfort System

- Right-Sized
- Properly Installed
- Complete (Htg., Clg. + RH)
- Tested

Risk 2: Moisture Man.

Risk Management

Zero Differentiation

Exceed Expectations



More Wetting Risk

- Colder Walls
- Less Drying Potential



Adv. Thermal Enclosure:

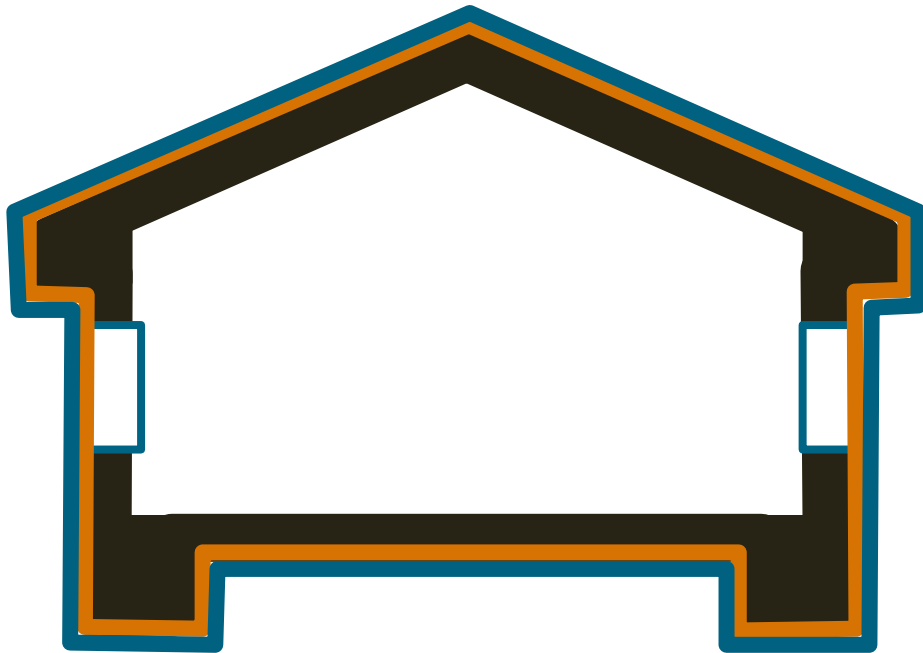
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Risk 2: Moisture Man. Strategy

Risk Management

Zero Differentiation

Exceed Expectations



More Wetting Risk

- Colder Walls
- Less Drying Potential



Comprehensive Water Protection

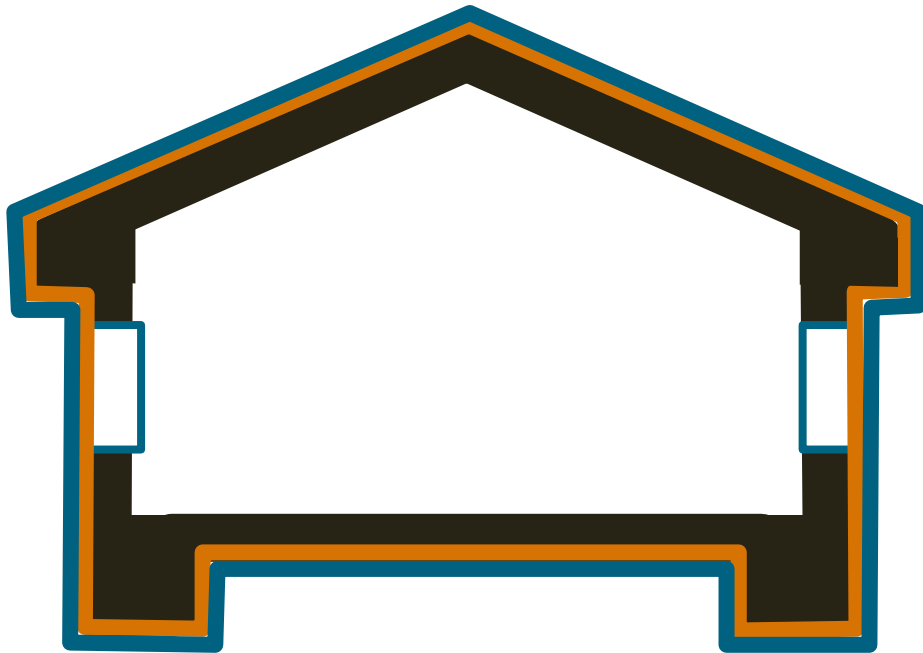
- Roofs
- Walls/Openings
- Site/Foundation
- Materials

Risk 3: Ensured IAQ

Risk Management

Zero Differentiation

Exceed Expectations



IAQ Risk:

- Less Dilution
- Less Filtration



Adv. Thermal Enclosure:

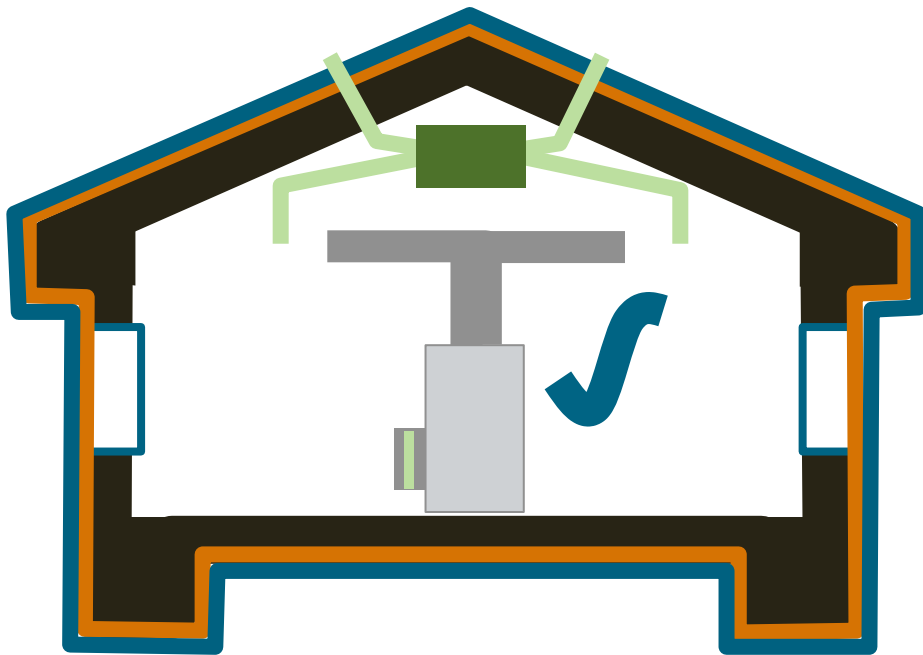
- Adv. Insulation System
 - More Insulation
 - Quality Installation
 - Complete System
- Advanced Windows
- More Air Tightness

Risk 3: Ensured IAQ Strategy

Risk Management

Zero Differentiation

Exceed Expectations



IAQ Risk:

- Less Dilution
- Less Filtration



Comprehensive IAQ System:

- Contaminant Control
- Fresh Air System
- High-Capture Filtration

Zero Strategy 1: Minimize Loads

Risk Management

Zero Differentiation

Exceed Expectations



Ultra Low HVAC Loads:

- Components and MELs 50+% of Energy Use



Adv. Thermal Enclosure:

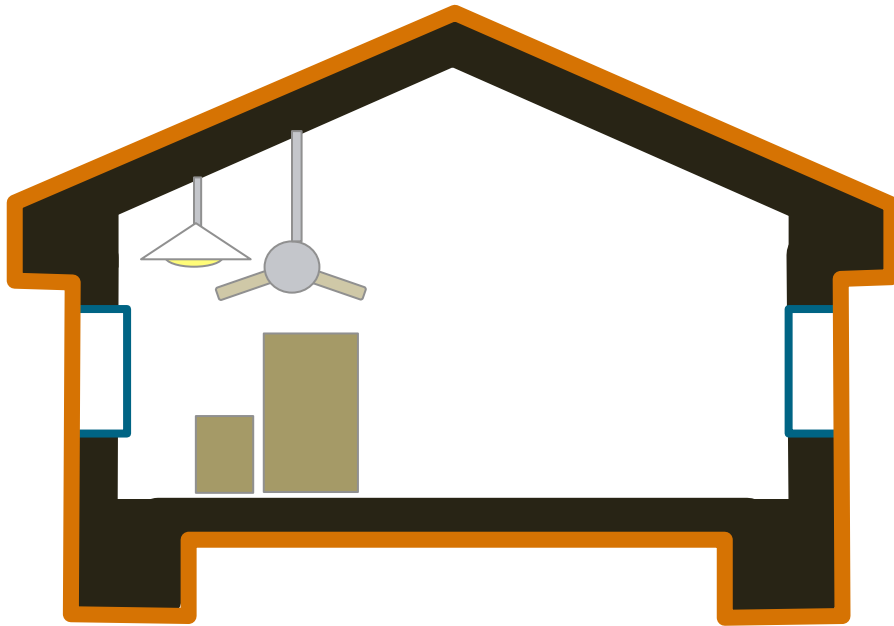
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Zero Strategy 1: Minimize Loads

Risk Management

Zero Differentiation

Exceed Expectations



Ultra Low HVAC Loads:

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Efficient Components:

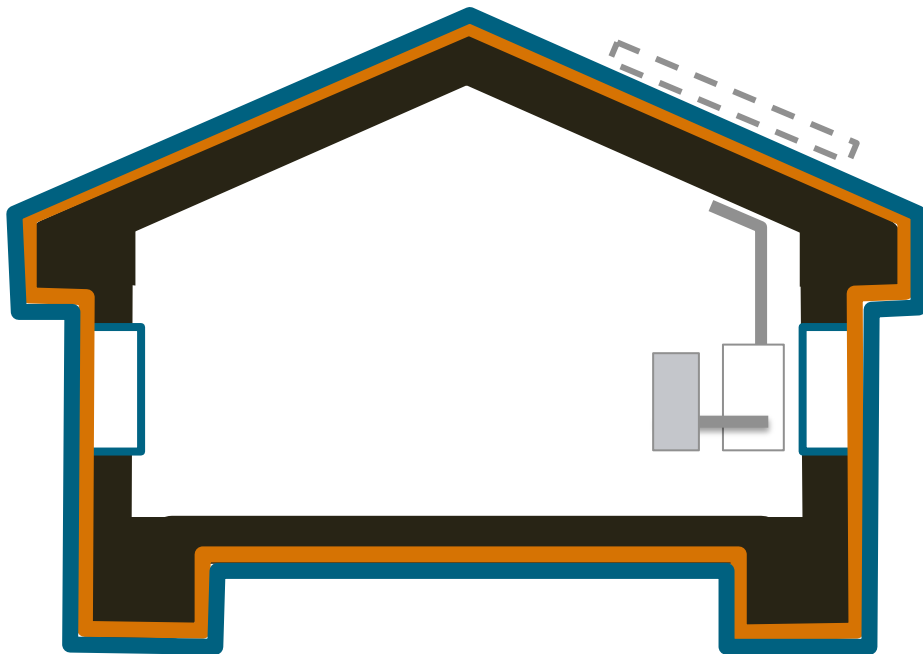
- Space Conditioning
- Water Heating
- Lighting
- Appliances
- Fans

Zero Strategy 2: Solar Ready

Risk Management

Zero Differentiation

Exceed Expectations



Solar Opportunity:

- Energy Loads So Low, All or Most Consumption Can be Offset with Renewable Energy
- Decreasing Solar Cost
- Rising Energy Costs



- Solar Ready Home

Zero Energy Ready Home Spec

Risk Management

Zero Differentiation

Exceed Expectations



Optimized Enclosure



Risk Management:

Optimized Comfort System
Complete Water Protection
Comprehensive IAQ System



Zero Differentiation:

Efficient Components
Solar Ready Construction

Zero Energy Ready Home Defined

Risk Management

Zero Differentiation

Exceed Expectations



High-performance
home, so
energy efficient,
all or most
annual energy
consumption
can be offset by
renewable energy.

'Green' vs. Zero Energy Ready

Risk Management


Zero Differentiation

Exceed Expectations

What's Missing in
Green Definition



Complete Systems that Ensure
Bankable **Value Propositions**



What's Included in
Zero Energy Ready Definition

Why Build: The Value

Risk Management

Zero Differentiation

Exceed Expectations

**Lives
Better**

Engineered
Comfort

Healthier
Living

Exclusivity

**Works
Better**

Ultra-Low
Utility Bills

Advanced
Technology

Visionary

**Lasts
Better**

Quality
Construction

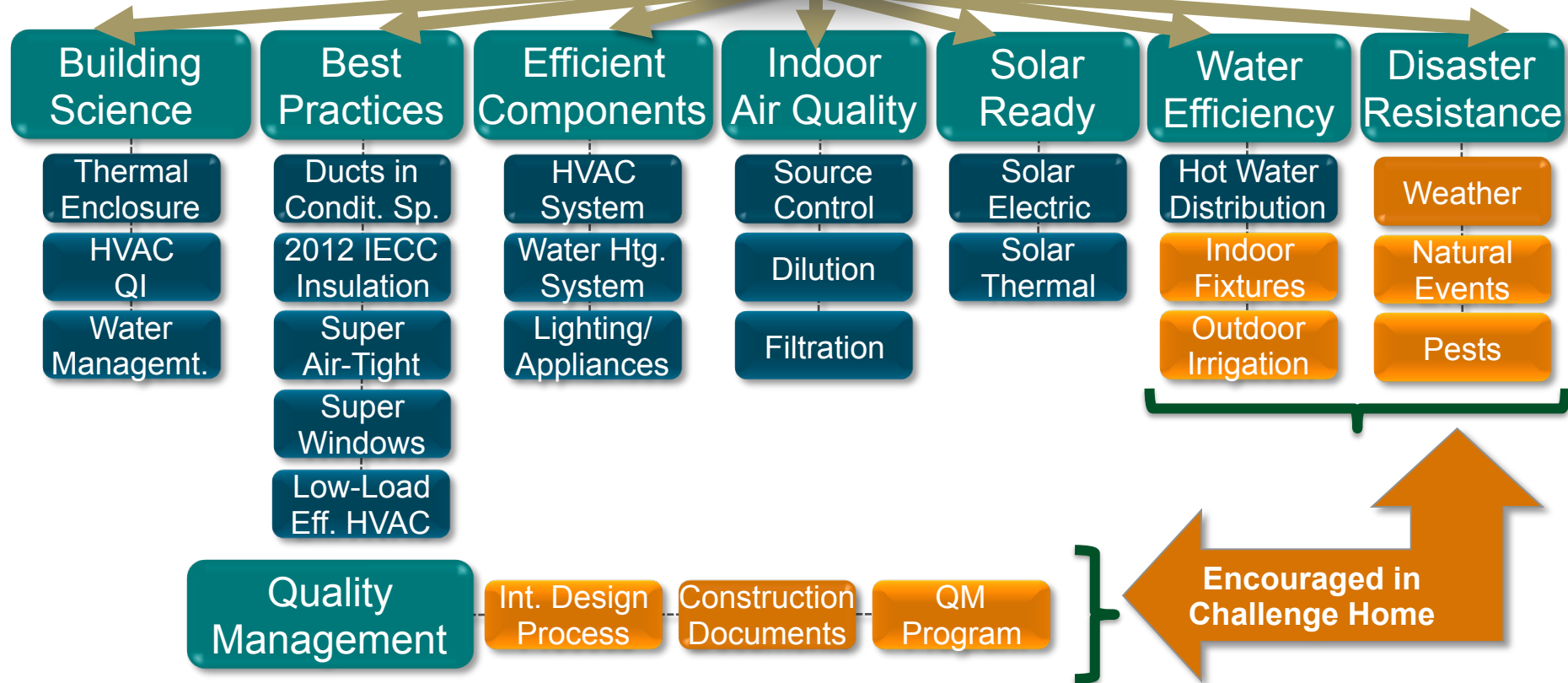
More
Durability

Smart



Zero Energy Ready Homes **Made Simple**

Zero Energy Ready Home Systems





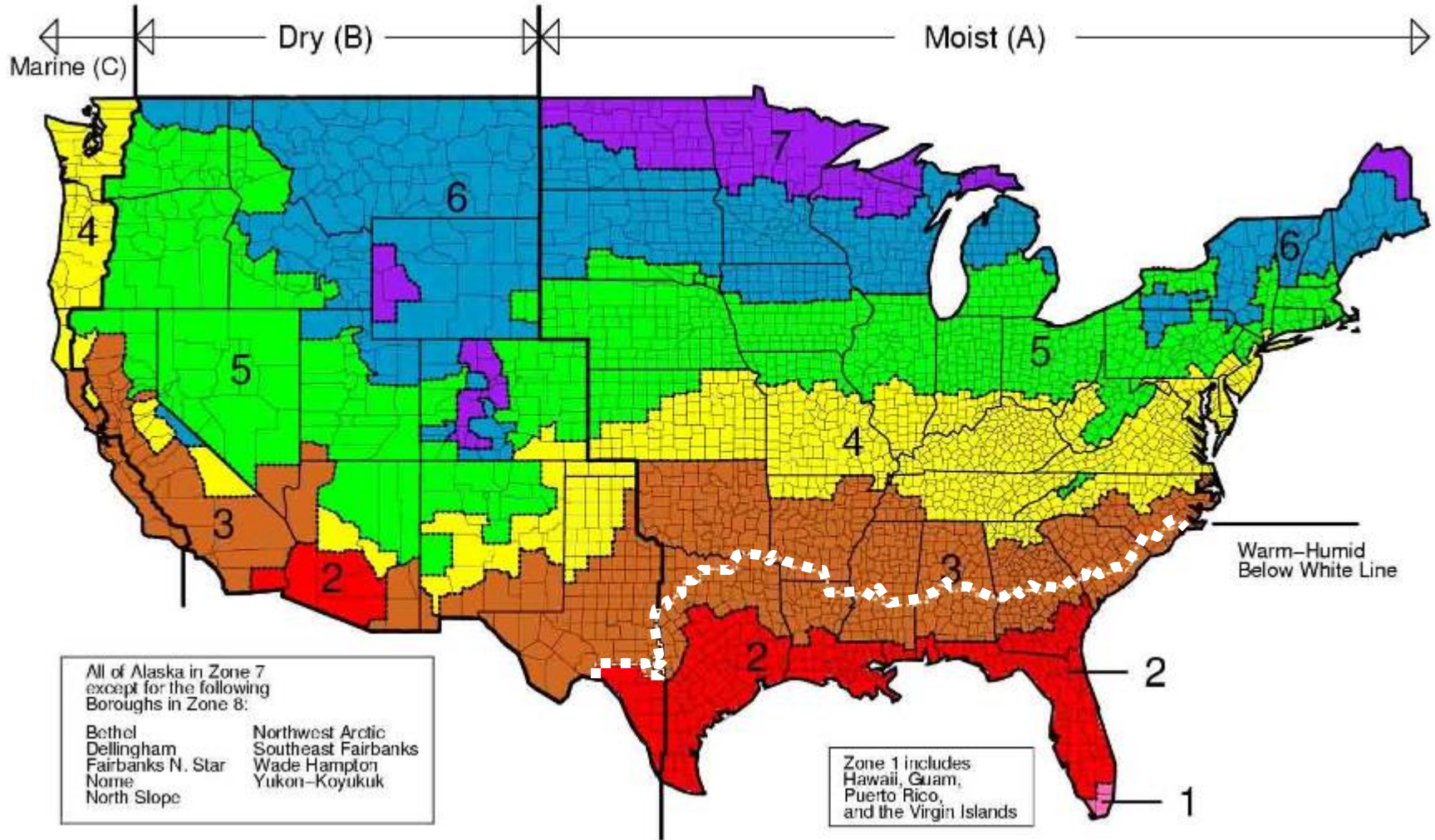
Zero Energy Ready Home

Technical Specifications: Putting It All Together

- ENERGY STAR Certified Homes v3
- Advanced Windows
- Air-Tight Construction
- 2012 IECC Insulation
- Energy Efficient Components
- Efficient Hot Water Distribution
- Indoor Air Quality
- Renewable Ready Construction



IECC Climate Zones



Align with ENERGY STAR for Homes v3:

- Comprehensive Building-Science System
- Variable vs. Fixed HERS Index Score
- House Size Adjustment to HERS Score



Exhibit 1: DOE Challenge 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 Version 3 ²
2. Envelope ³	<input type="checkbox"/> Fenestration shall meet or exceed latest ENERGY STAR requirements ^{7,8} <input type="checkbox"/> Ceiling, wall, floor, and slab insulation shall meet or exceed 2012 IECC levels ⁹
3. Duct System	<input type="checkbox"/> Ducts located within the home's thermal and air barrier boundary ¹⁰
4. Water Efficiency	<input type="checkbox"/> Hot water delivery systems shall meet efficient design requirements ¹¹
5. Lighting & Appliances ¹²	<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"/> EPA Indoor airPLUS Verification Checklist and Construction Specifications ¹³
7. Renewable Ready ¹⁴	<input type="checkbox"/> EPA Renewable Energy Ready Home Solar Electric Checklist and Specifications ¹⁵ <input type="checkbox"/> EPA Renewable Energy Ready Home Solar Thermal Checklist and Specifications ¹⁶

Mandatory Reqts.

Must Comply

Exhibit 2: DOE Challenge Home Target Home^{3, 17}

HVAC Equipment ¹⁸	Hot Climates (2012 IECC Zones 1,2) ¹⁹	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 ²⁰
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% SMC
Insulation and Infiltration			
<ul style="list-style-type: none"> Insulation levels shall meet the 2012 IECC and achieve Grade 1 installation, per RESNET standards. Infiltration²¹ (ACH50): 3 in CZ's 1-2 2.5 in CZ's 3-4 2 in CZ's 5-7 1.5 in CZ 8 			
Windows^{22, 23, 24}			
	Hot Climates (2012 IECC Zones 1,2)	Mixed Climates (2012 IECC Zones 3, 4 except Marine)	Cold Climates (2012 IECC Zones 4 Marine 5,6,7,8)
SHGC	0.25	0.27	any
U-Value	0.4	0.3	0.27
Homes qualifying through the Prescriptive Path with a total window-to-floor area greater than 15% shall have adjusted U-values or SHGCs. ²⁵			
Water Heater			
ENERGY STAR minimum; for heating of water heaters use EF = 0.60			

Effective for Homes: Revised 07/01/2012 Page 2 of 8
Revised: 07/01/2012

'Target Home' Specs

Trade-Off Flexibility

Exhibit 3: Benchmark Home Size²⁶

Bedrooms in Home to be Built	1	2	3	4	5	6	7	8
Conditioned Floor Area ²⁷ Benchmark Home	1,000	1,600	2,200	2,800	3,400	4,000	4,600	5,200

Size Adjust. Factor

Identical to Energy Star



Zero Energy Ready Home

Technical Specifications Mandatory Requirements:

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Encouraged:

- WaterSense Label (indoor and outdoor)
- Disaster Resistance (IBHS Fortified Home)
- Quality Management



Zero Energy Ready Home

Technical Specifications
Mandatory Requirements:
ENERGY STAR for Homes
Version 3 Baseline

Climate Zone 6:

Walls: R-20+5 or R-13+10

Ceiling: R-49

Floor: R-30

Basement: R-15/19

Crawl Space: R-15/19

Slab: R-10 for 4 ft. depth

Climate Zone 7:

Walls: R-20+5 or R-13+10

Ceiling: R-49

Floor: R-38

Basement: R-15/19

Crawl Space: R-15/19

Slab: R-10 for 4 ft. depth



Zero Energy Ready Home **Performance Threshold**

'Target Home' vs. Energy Star Spec

Exhibit 2: DOE Challenge Home Target Home 3-17

HVAC Equipment			
	Hot Climates (2012 IECC Zones 1,2) ¹⁸	Mixed Climates (2012 IECC Zones 3,4)	Cold Climates (2012 IECC Zones 5,6,7,8)
AFUE	80%	90%	94%
SEER	18	15	13
HSPF	8.2	9	10 ¹⁹
Geothermal Heat Pump	ENERGY STAR EER and COP Criteria		
ASHRAE 62.2 Whole-House MV System Performance	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			
<ul style="list-style-type: none"> Insulation levels shall meet the 2012 IECC and achieve Grade 1 installation, per RESNET standards. Infiltration²⁰ (ACH50): 3 in CZ's 1-2 2.5 in CZ's 3-4 2 in CZ's 5-7 1.5 in CZ 8 			
Windows ^{21, 22, 23}			
	Hot Climates (2012 IECC Zones 1,2,)	Mixed Climates (2012 IECC Zones 3,4)	Cold Climates (2012 IECC Zones 5,6,7,8)
SHGC	0.25	0.27	any
U-Value	0.4	0.3	0.27
Homes qualifying through the Prescriptive Path with a total window-to-floor area greater than 15% shall have adjusted U-values or SHGCs. ²⁴			
Water Heater			
ENERGY STAR minimum			
Thermostat ²⁵ & Ductwork			
<ul style="list-style-type: none"> Programmable thermostat (except for zones with radiant heat) 			
Lighting & Appliances			
<ul style="list-style-type: none"> For purposes of calculating the DOE Challenge Home Target Home HERS Index, homes shall be modeled with an ENERGY STAR dishwasher, ENERGY STAR refrigerator, ENERGY STAR ceiling fans, and ENERGY STAR lamps (bulbs) in 80% of sockets or 80% of lighting fixtures are ENERGY STAR Qualified. 			

Higher Eff.
HVAC
Equip.

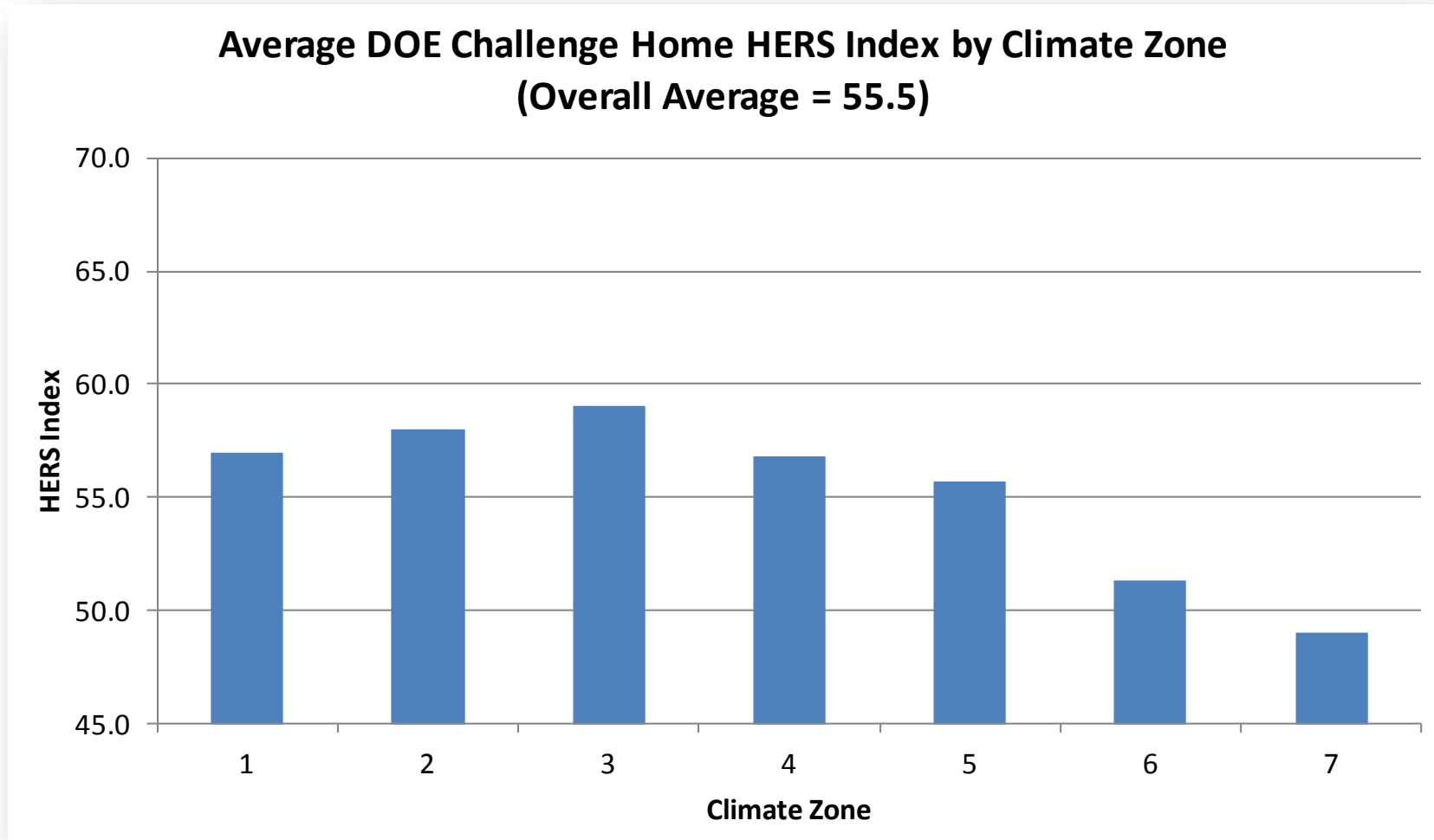
2012 vs.
2009 IECC
Insul.

More Eff.
Windows

Half ACH50

ENERGY
STAR Water
Htg.

Target Home Avg. HERS Scores



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

Size Adjustment Factor

Exhibit 3: Benchmark Home Size²⁸

Bedrooms in Home to be Built	1	2	3	4	5	6	7	8
Conditioned Floor Area <small>Benchmark Home</small>	1,000	1,600	2,200	2,800	3,400	4,000	4,600	5,200

Note: Renewable energy systems may not be used to qualify for the Zero Energy Ready Home HERS Index Target Score, but may be used for the incremental HERS Index points needed for the Size Adjustment Factor.

Homes larger than the benchmark home size must use the size adjustment factor to determine the target HERS index

Exhibit 3: Benchmark Home Size²⁸

Bedrooms in Home to be Built	1	2	3	4	5	6	7	8
Conditioned Floor Area <small>Benchmark Home</small>	1,000	1,600	2,200	2,800	3,400	4,000	4,600	5,200

Note: Renewable energy systems may not be used to qualify for the Zero Energy Ready Home HERS Index Target Score, but may be used for the incremental HERS Index points needed for the Size Adjustment Factor.

$$\text{Size Mod. Factor} = \left[\frac{\text{CFA}_{\text{Benchmark Home}}}{\text{CFA}_{\text{Home to Be Built}}} \right]^{0.25}$$

[Not to Exceed 1.0]



Recognition with **DOE Zero Energy Ready Home**

Registration and training – builders and raters register as partners and take orientation training to learn requirements.

Plan Evaluation – rater evaluates plans and pinpoints improvements to meet the DOE Challenge Home requirements.

Construction – builder constructs home to meet all DOE Challenge Home National Program Requirements

Field Verification – rater conducts independent inspections and testing required to earn the label.

Certification – rater submits verification information to HERS Provider; rater/provider submits rating to National Building Registry; and rater prints certificate and label for Builder

A critical element of partnering with DOE Challenge Home as a builder is working with a Home Energy Rating System (HERS) Rater.

- **Review**

- Technical Guidelines
- Partnership Agreement Terms

- **Register**

- Electronically Sign Agreement

- **Choose Optional Commitments:**



100% of homes meet DOE Challenge Home Guidelines



Homes meet EPA's WaterSense Guidelines



Homes meet IBHS's Fortified Home Guidelines



Meet DOE Challenge Home Quality Management Program

- **Resources**

- Customizable Homebuyer Brochures
- Case Studies
- Branding [Logos, Home Certificates and Labels]
- Electronic Newsletter [updates, policy changes, new innovations]

- **Technical Support**

- Building America Solution Center**
- Building America Stakeholder Meetings
- Building America Research Studies

- **Recognition**

- DOE Housing Innovation Awards
- DOE Challenge Home Web Site Locator Tool

- **Attract Buyers**
DOE maintains a Partner Locator tool that homebuyers can use to find DOE Challenge Home builders in their area.

- **Builder Listings**
All active partners are listed on the Partner Locator. Builder partners can differentiate their company listing on the Partner Locator through the optional commitments



DOE Challenge Home Partner Locator

Find out who is taking the challenge. Locate DOE Challenge Home partners near you! First choose a partner type and select a state. You can also enter a company name and find DOE Challenge Home partners that match your search.


Please note: Partners began registering for the new DOE CHALLENGE HOME on April 2, 2012. The locator will not produce large results of partners in the program for several weeks. Please check back to watch our progress.

Organization Type: Choose a State: [See Results](#)



- **Number of Homes that Meet the Challenge**
The number of homes displayed on the Partner Locator come from the RESNET National Registry.
- **Website link**
A link to your website.

Homes to the Power of **ZERO**



ZERO
ENERGY READY HOME
U.S. DEPARTMENT OF ENERGY

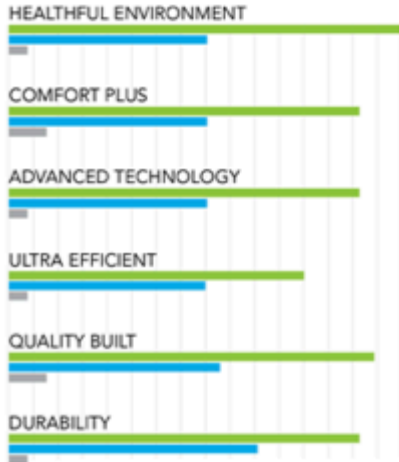
What is the DOE Zero Energy Ready Home™ Label?

It is a Symbol of Excellence for energy savings, comfort, health, quality, and durability met by a select group of leading builders meeting U.S. Department of Energy Guidelines.

What is a Zero Energy Ready Home?

It is a high-performance home so energy efficient, all or most annual energy consumption can be offset with renewable energy. In other words, it is the Home of the Future.

A Symbol of Excellence




Category	DOE Zero Energy Ready Home	ENERGY STAR® Certified Home	Existing Home
HEALTHFUL ENVIRONMENT	High	Medium	Low
COMFORT PLUS	High	Medium	Low
ADVANCED TECHNOLOGY	High	Medium	Low
ULTRA EFFICIENT	High	Medium	Low
QUALITY BUILT	High	Medium	Low
DURABILITY	High	Medium	Low

KEY

- DOE Zero Energy Ready Home
- ENERGY STAR® Certified Home
- Existing Home

This graphic comparison chart demonstrates relative performance of this DOE Zero Energy Ready Home to existing homes (built between 1990 and 2010) and ENERGY STAR Certified Homes. Actual performance may vary.



NEW TOWN BUILDERS

303-231-4567
NewTown@net.com
123 Main Street, Denver, CO 34567

Translating ZERH Value with Clarity



Front Cover

Lives Better

HEALTHFUL ENVIRONMENT

Every DOE Zero Energy Ready Home has a comprehensive package of measures to minimize dangerous pollutants, provide continuous fresh air, and effectively filter the air you breathe.

COMFORT PLUS

Superior insulation, windows, air sealing and space conditioning systems included in every DOE Zero Energy Ready Home surround you with even temperatures, low-humidity, and quiet in every room on every floor.

KEY

- DOE Zero Energy Ready Home
- ENERGY STAR Certified Home
- Existing Home

Works Better

ADVANCED TECHNOLOGY

Every DOE Zero Energy Ready Home begins with solid building science specified by ENERGY STAR for Homes, and then adds advanced technologies and practices from DOE's world-class research program, Building America.

ULTRA EFFICIENT

Compared to a typical home, an ultra efficient Zero Energy Ready Home is inexpensive to own. In fact, every DOE Zero Energy Ready Home is so energy efficient, a small solar electric system can easily offset most, or all, of your annual energy consumption. We call this Zero Net-Energy Ready.

Lasts Better

QUALITY BUILT

Advanced construction practices and technologies are specified for every DOE Zero Energy Ready Home. Then they are enforced by independent verifiers with detailed checklists and prescribed diagnostics.

DURABILITY

The advanced levels of energy savings, comfort, health, durability, quality and future performance in every DOE Zero Energy Ready Home provide value that will stand the test of time, and will meet and exceed forthcoming code requirements.

LEARN MORE AT: buildings.energy.gov/zero

Inside Spread

The Future of Housing—Today

Only a select group of the top builders in the country meet the extraordinary levels of excellence and quality specified by U.S. Department of Energy guidelines.

A Symbol of Excellence

HEALTHFUL ENVIRONMENT

COMFORT PLUS

ADVANCED TECHNOLOGY

ULTRA EFFICIENT

QUALITY BUILT

DURABILITY

KEY

- DOE Zero Energy Ready Home
- ENERGY STAR Certified Home
- Existing Home

This label indicates relative performance of this DOE Zero Energy Ready Home to existing homes (built between 1990 and 2000) and ENERGY STAR Certified Homes. Actual performance may vary.

LEARN MORE AT:
buildings.energy.gov/zero

U.S. DEPARTMENT OF
ENERGY

Flap

Back Cover



For More Information:

www.buildings.energy.gov/zero/

e-mail Contact:

zero@newportpartnersllc.com



- Questions & Discussion

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