Orientation Training ***UPDATE*** – August 2014

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

DOE Zero Energy Ready Home

Better Business for Builders

Jamie Lyons, P.E.
for
DOE Zero Energy Ready Home Program

Congratulations

By constructing DOE Zero Energy Ready Homes, you are:

- in a select group of builders

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

- providing unprecedented value

  Your customers receive immediate energy savings of 40-50% easy to adapt to ***zero net-energy 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, the program provides a path to constructing zero energy ready that none of your competition has.

Orientation Training Purpose

As a condition of partnership, all partners are required to complete an annual online training in order to be listed as a partner

This orientation training should take 1 hour to complete. After this training, you should understand:

- How Zero Energy Ready Homes respond to housing industry trends
- Key changes/updates to DOE Zero Energy Ready Home
- Communicating the value proposition to homebuyers
- Your roles and responsibilities and the benefits of being a DOE Zero Energy Ready Home partner
- The process for qualifying homes
- The technical specifications included in the DOE Zero Energy Ready Home National Program Requirements

Course Overview

Section 1: What's Changed?
Section 2: Visible Future, Value Proposition, & Bus. Case
Section 3: Roles, Responsibilities and Process
Section 4: National Program Requirements

What's Changed?

What's Changed?

DOE Challenge Home is now DOE Zero Energy Ready Home

Leveraging the "Power of Zero" to engage consumers

New Training and Resources

Extensive Training Series

- Live trainings (usually webinar format)
- Recorded online training
- Covering technical and marketing topics

Building America Solutions Center (BASC)

- The ZERH Checklist Manager is now available. BASC offers world-class expert guidance right at your fingertips.
- Basc.pnnl.gov

Technical Specification Changes/Updates

- Full compliance with the **Indoor airPLUS program** (eliminating a lone exception on garage exhaust ventilation which wasn't needed following EPA's latest update of this spec in November 2013)
- Adding eligibility for some **multifamily buildings** four or five stories above grade (consistent with the ENERGY STAR Homes program);
- Adding a **dry climate design option for buried ducts**, to satisfy the ducts In Conditioned space requirement.
- Increased water efficiency through **adaptive scheduling** Hot Water recirculation systems
- Windows are now included in the home's UA calculation

Zero Energy Ready Homes

Definition

ZERH Definition

A DOE Zero Energy Ready Home is a high performance home which is so energy efficient, that a renewable energy system can offset all or most of its annual energy consumption.

The Visible Future

Predicting the Visible Future

"You can predict the future accurately.

All you have to do is leave out the parts you could be wrong about."

"The key… is knowing how to distinguish a ***soft trend*** *from a* ***hard trend****…*

It's knowing how to recognize certainty."

Daniel Burrus, ***"Flash Foresight"***

Predicting the Visible Future

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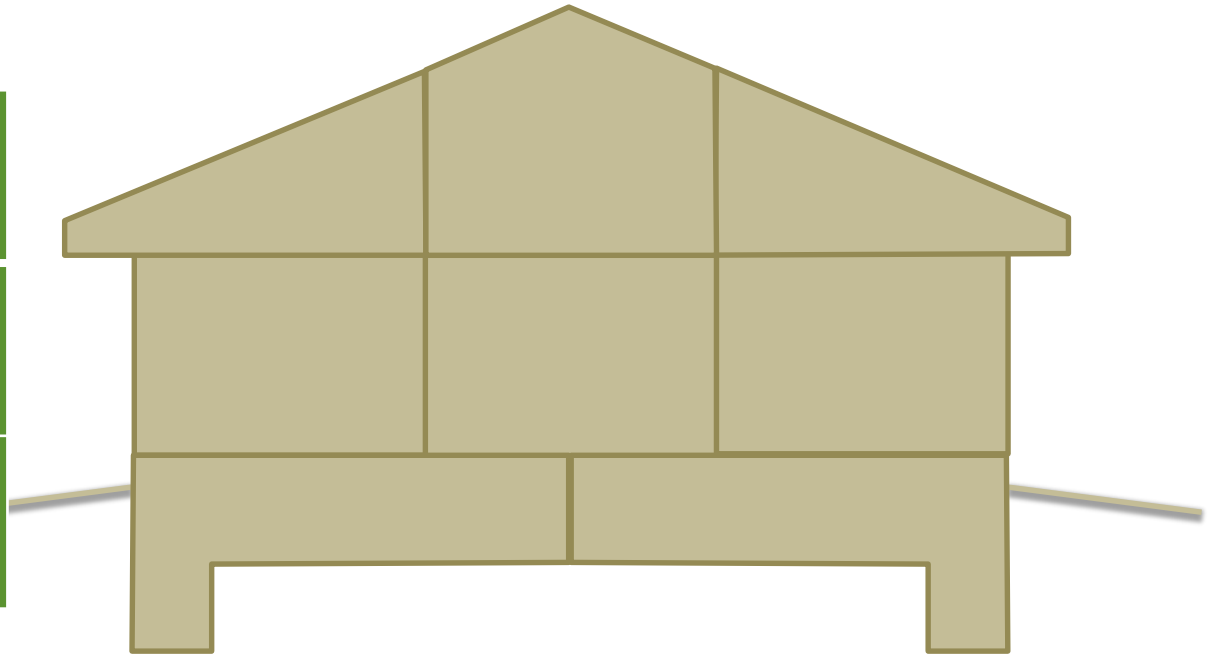
Increasing Energy Efficiency

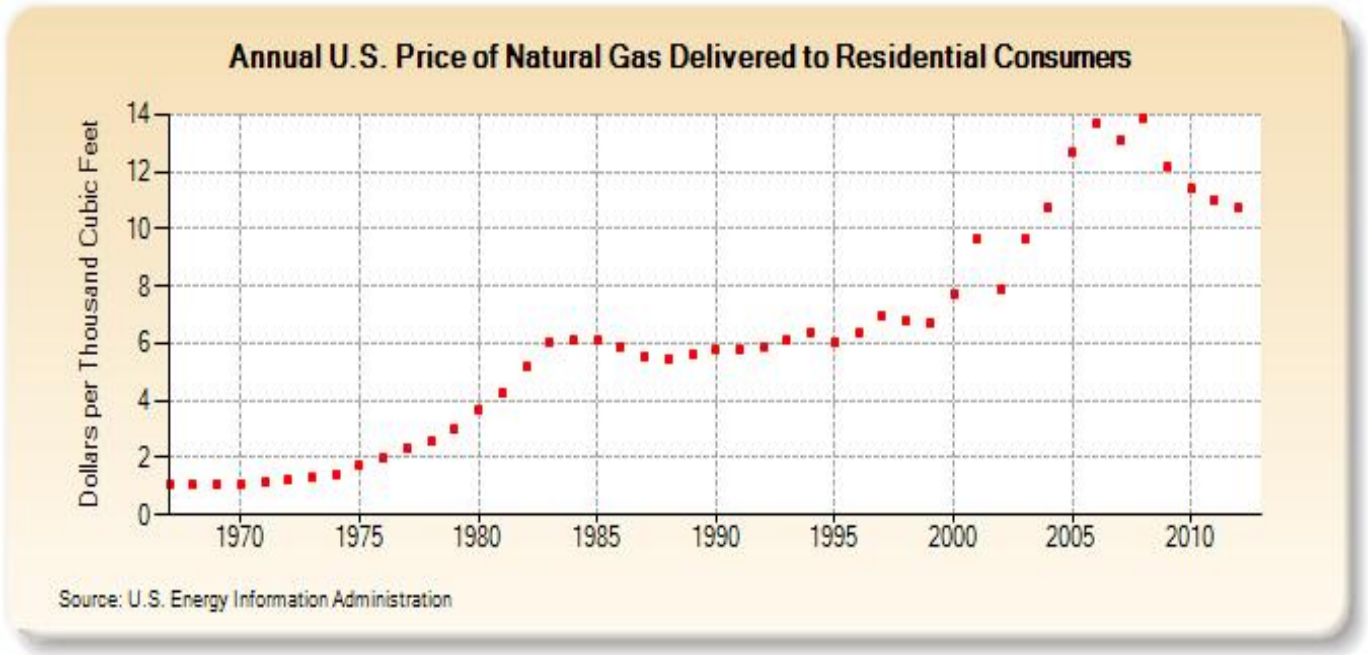
Increasing Performance

Increasing Innovation



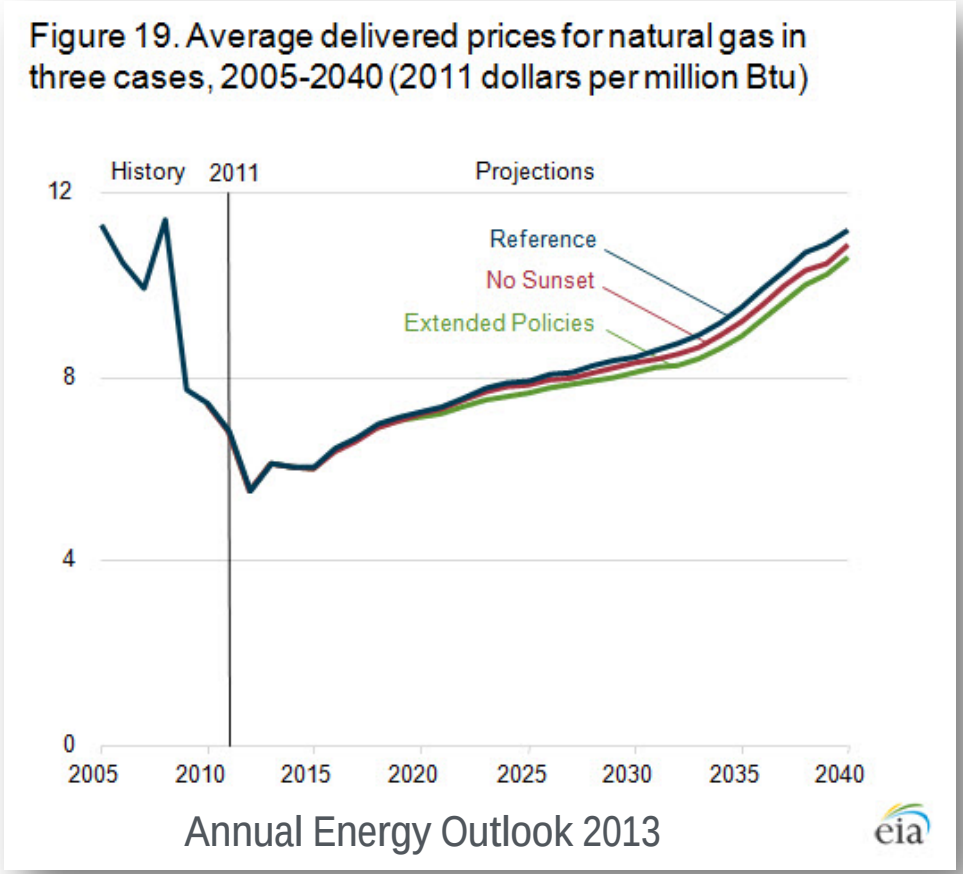
3 Hard Trends → 8 Complete Systems

Increasing Energy Prices: Gas



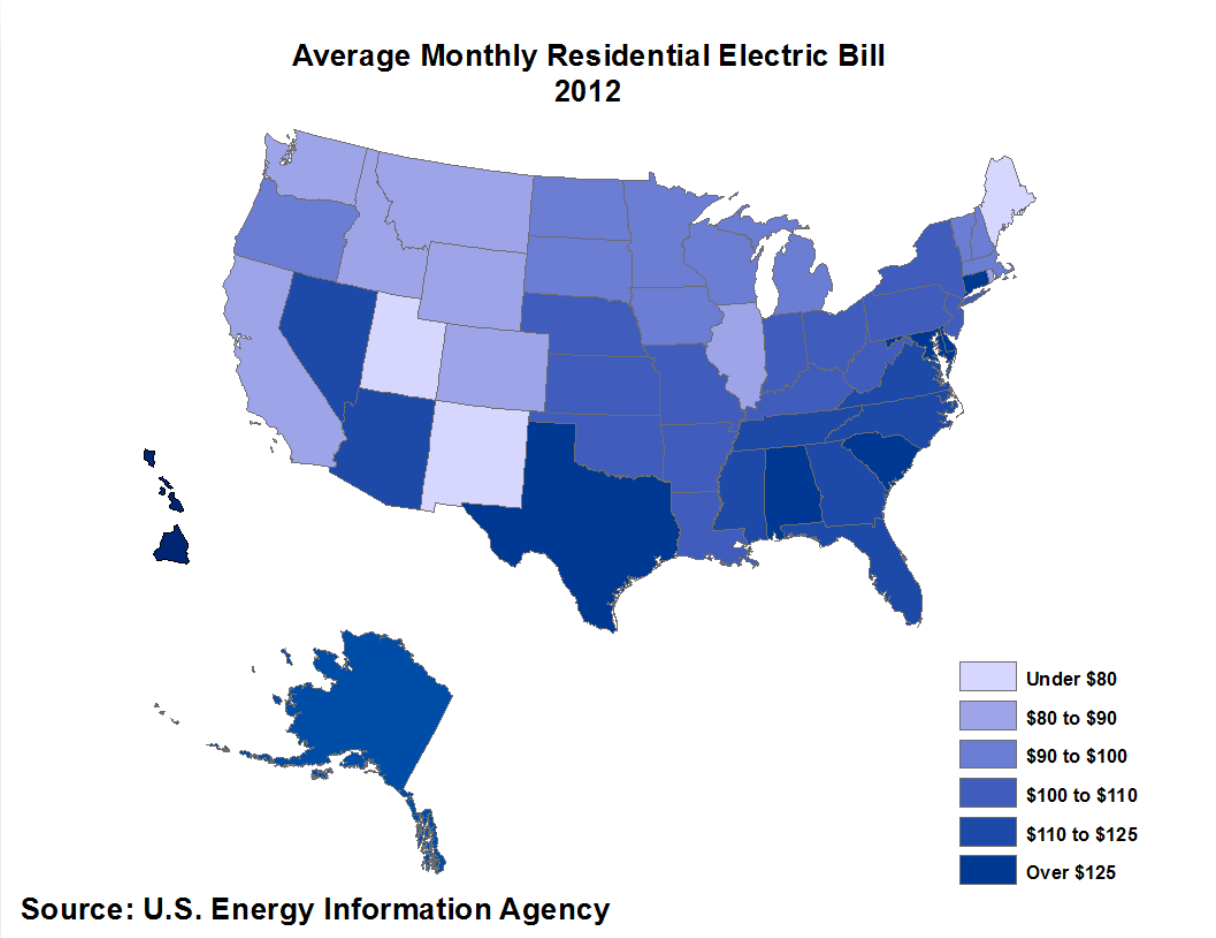
Source: U.S. Energy Information Administration

Increasing Energy Prices: Gas



Increasing Energy Prices

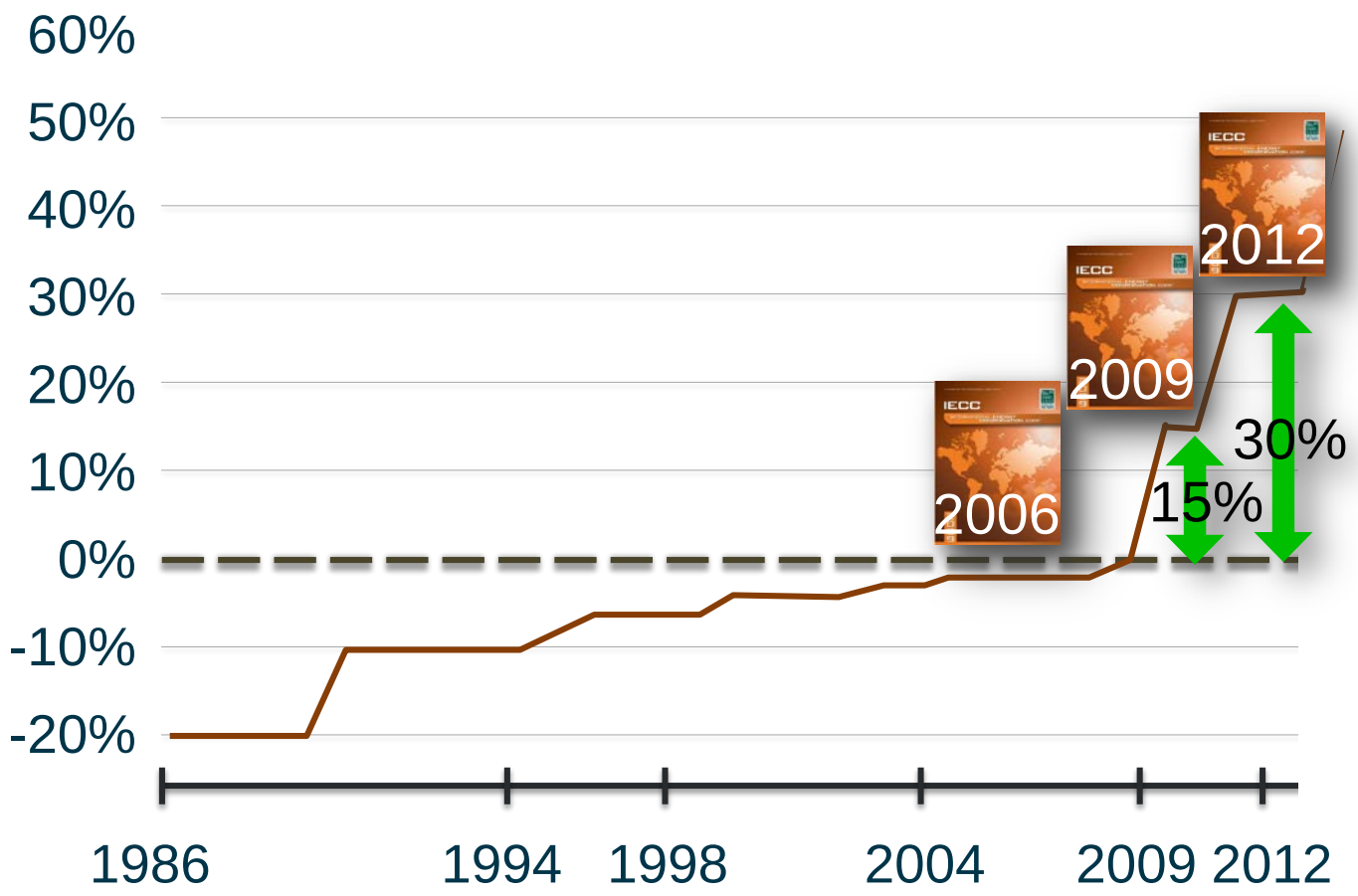
National average electric bill has increased nearly 80% over the last ten years.



Hard Trend:
Increasing Rigor of Energy Codes

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

> Energy Eff. | **> Performance** | **> Innovation**



Hard Trend:
Increasing Builder Risk

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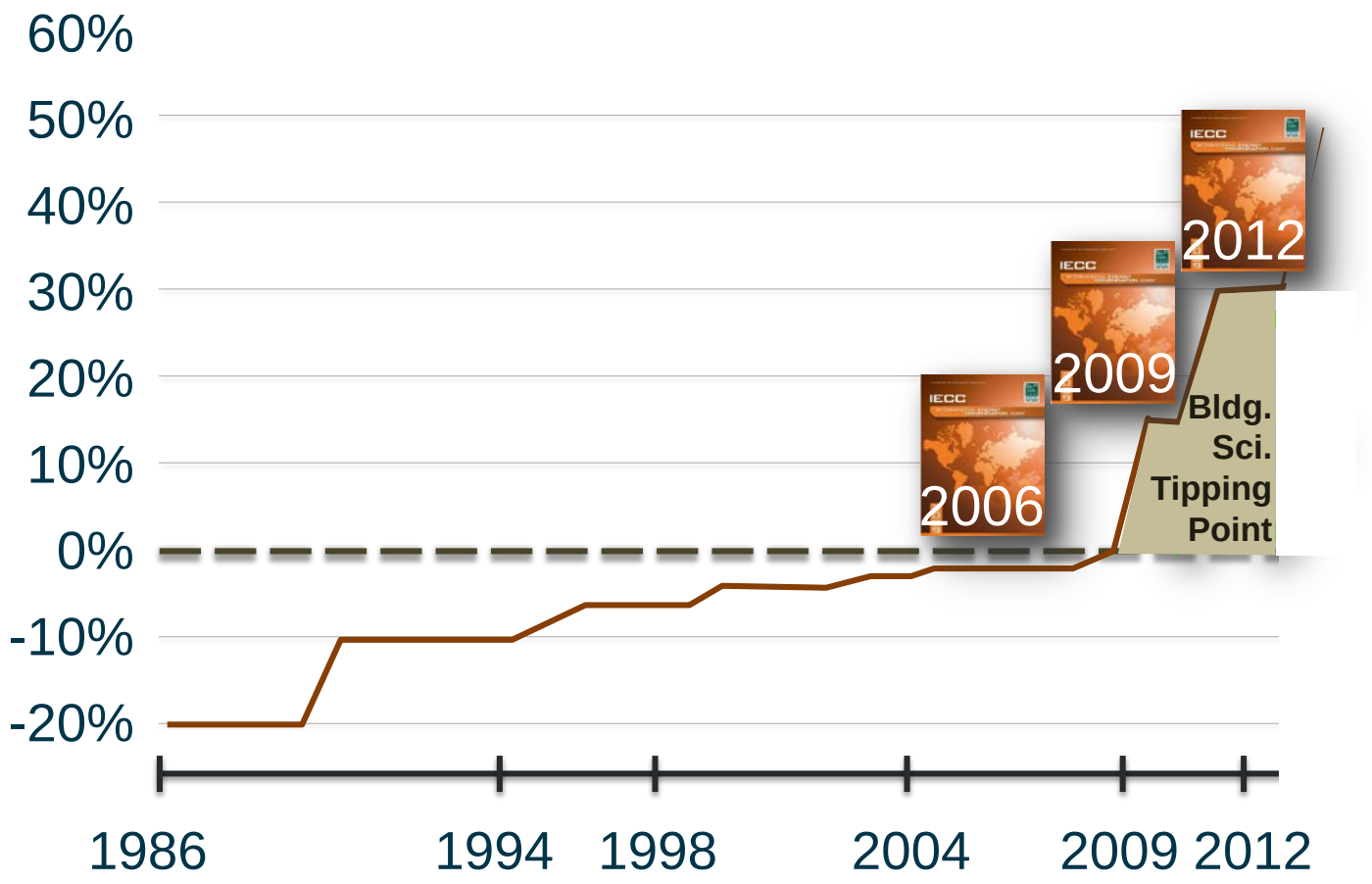
> Energy Eff. | **> Performance** | **> Innovation**



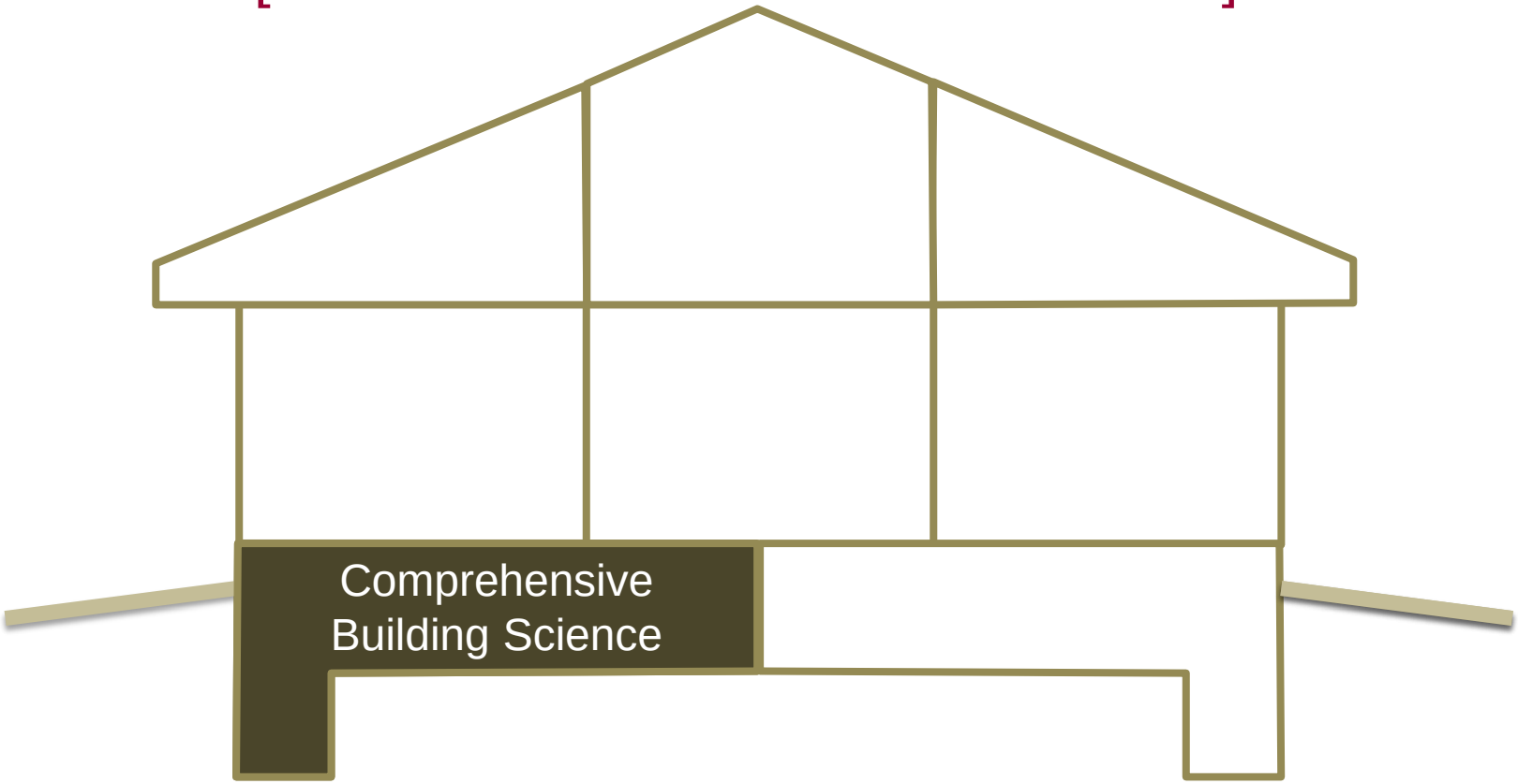
Building Science Tipping Point:

- Homes No Longer Can Dry if They Get Wet
- Homes More Likely to Get Wet with Colder Condensing Surfaces
- Homes No Longer Ensure Fresh Air
- Greater Combustion Safety Risks

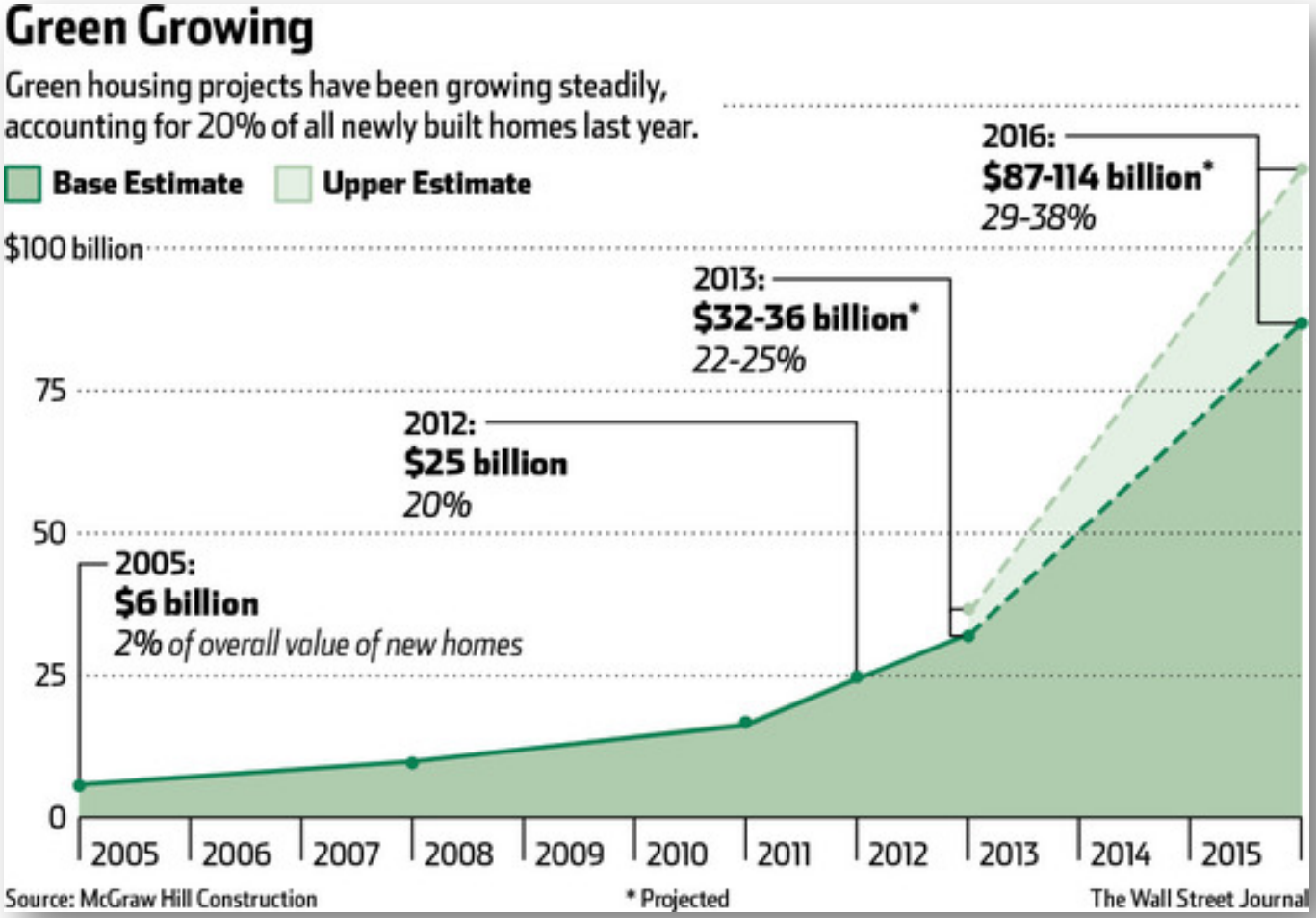
Comprehensive Building Science:

Control Air, Thermal and Moisture Flow.

[ENERGY STAR Certified Homes v3]



Increasing Energy Eff. Homes



2013

- ~220,000 HERS Ratings
- Average Score 64

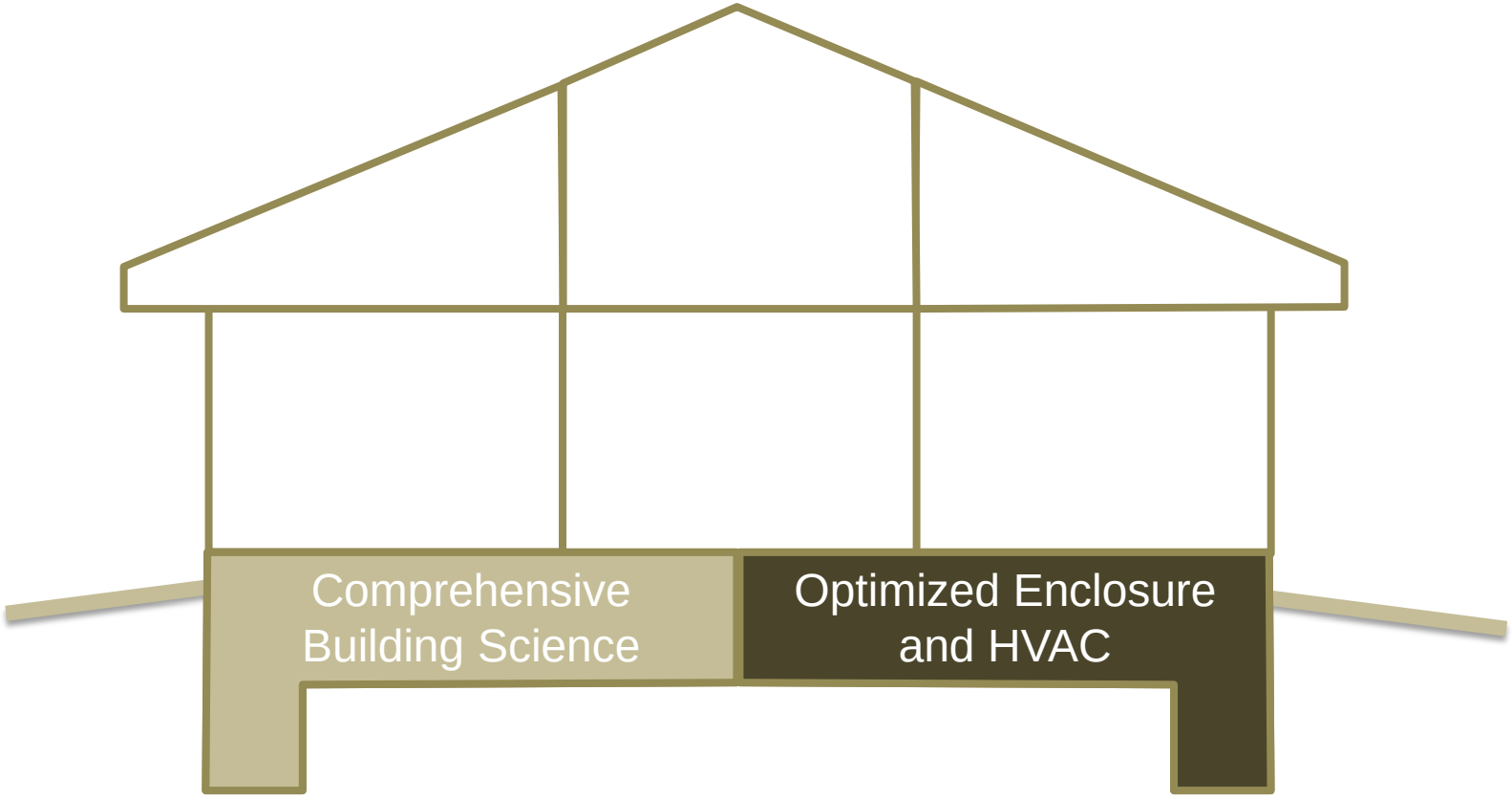
Visible Future: System #2

> Energy Eff. | **> Performance** | **> Innovation**

Optimized Enclosure and HVAC:

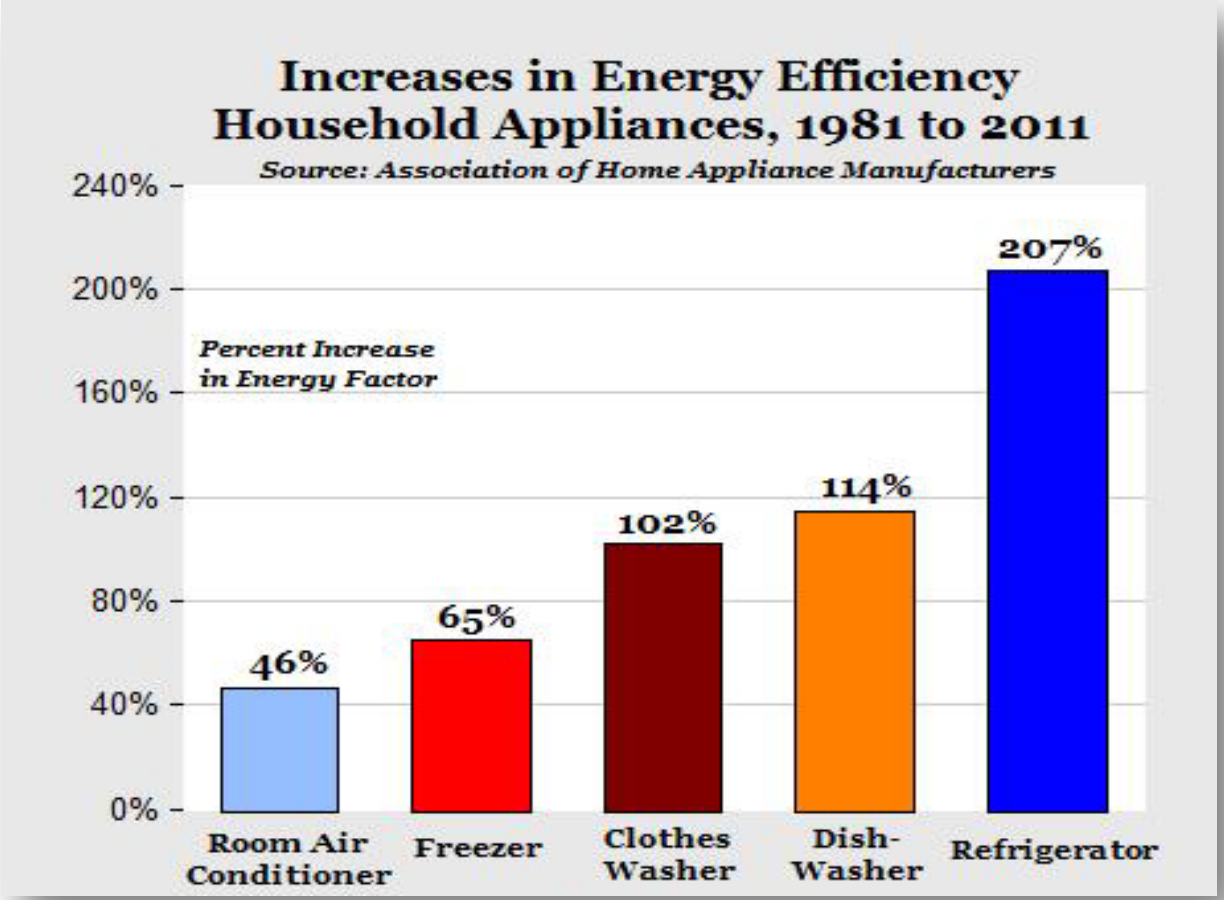
Proven Technologies and Best Practices

[DOE's Building America Program Innovations]



Increasing Energy Eff. Components

> Energy Eff. | **> Performance** | **> Innovation**



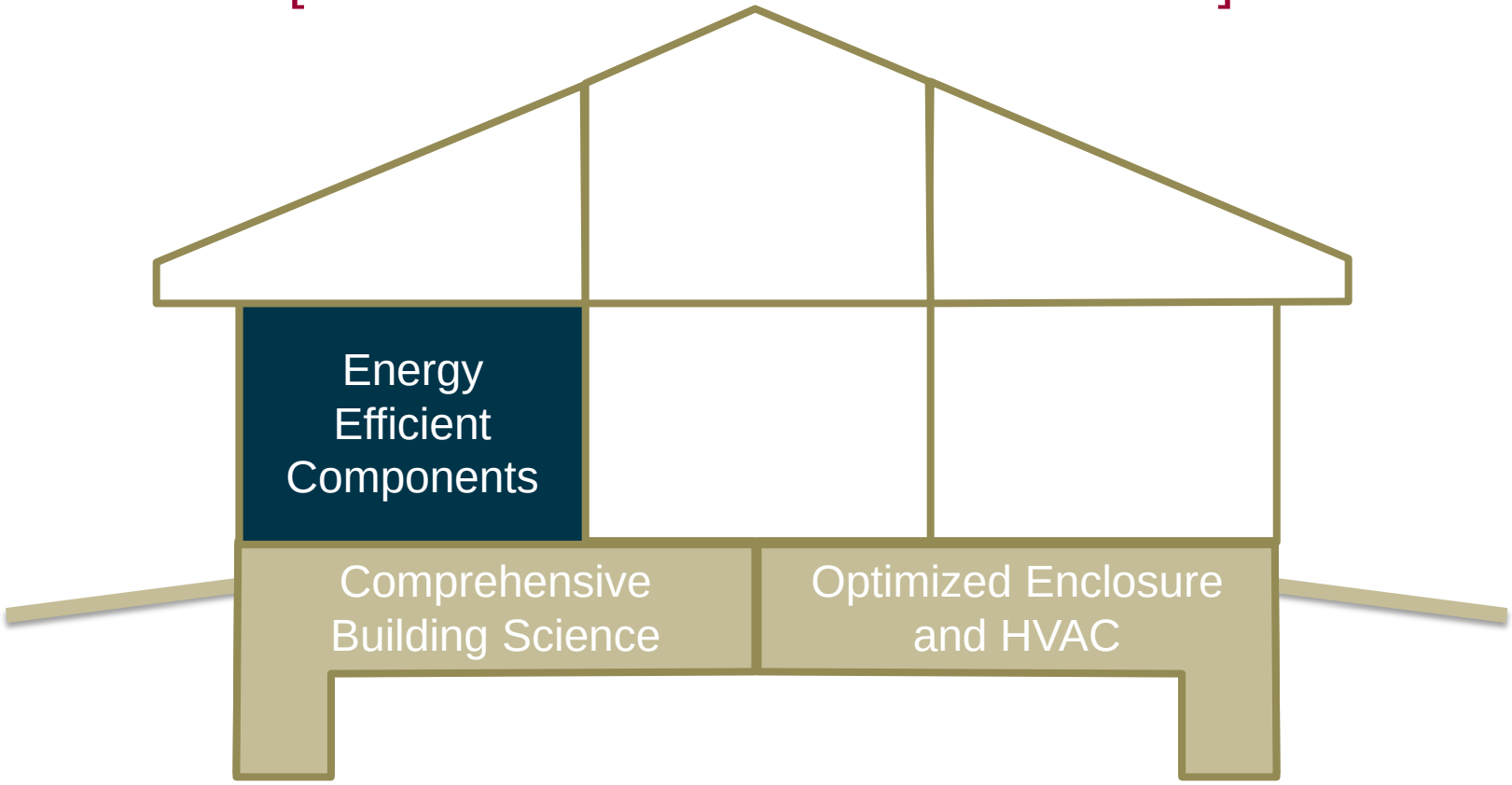
Visible Future: System #3

> Energy Eff. | > Performance | > Innovation

Energy Efficient Components:

High-Efficiency Appliances, Lighting, Fans

[ENERGY STAR Certified Products]



Increasing Health Concerns

$40 Billion

$20 Billion

Indoor vs. Outdoor Air Pollutants:

On average **2-5 times greater**

Up to **100 times greater**

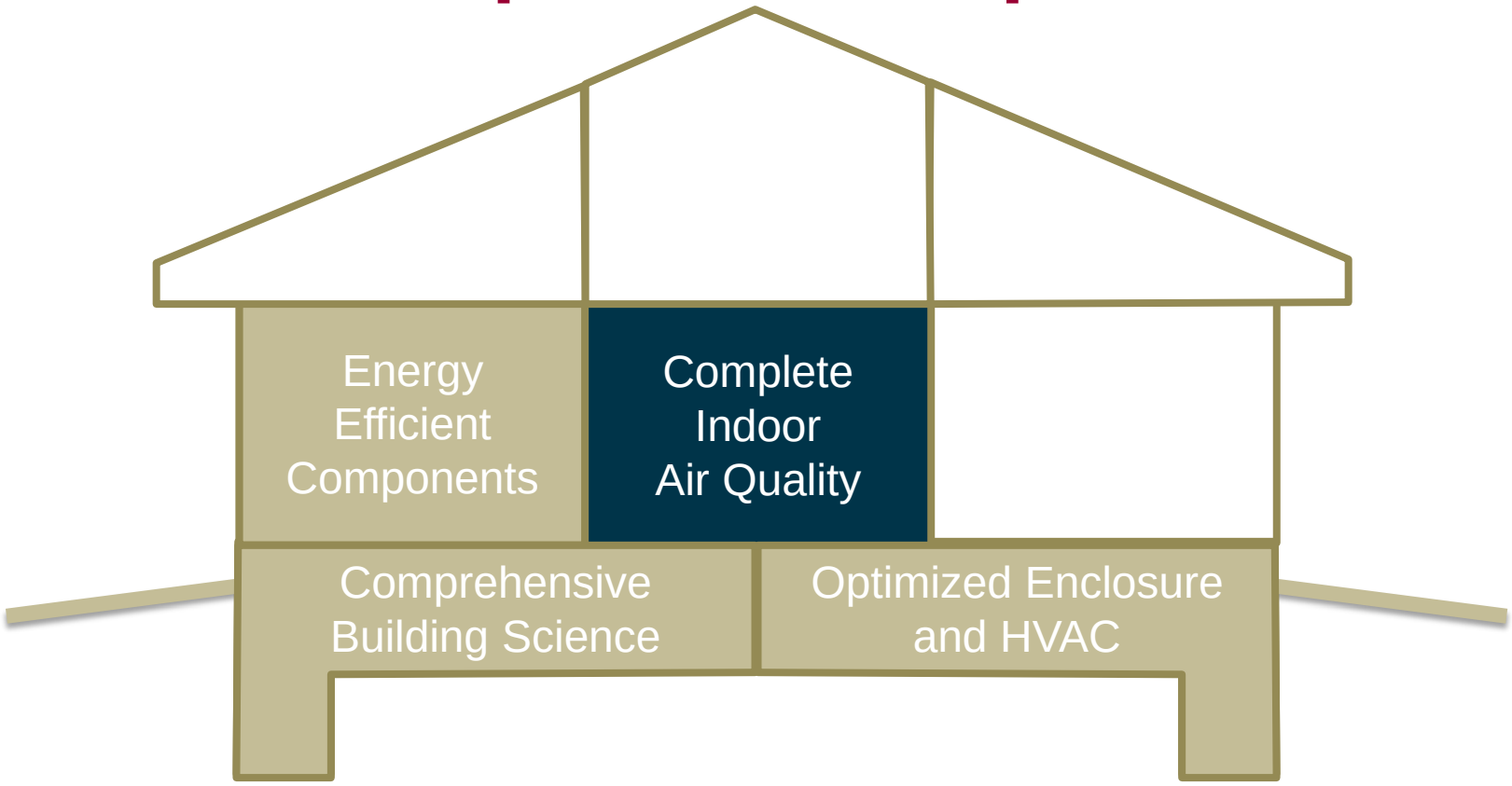
While Americans Spend

90% of time indoors

Comprehensive Indoor Air Quality:

Source Control, Dilution, and Filtration

[EPA Indoor airPlus]



Hard Trend:
Decreasing Renewable Cost

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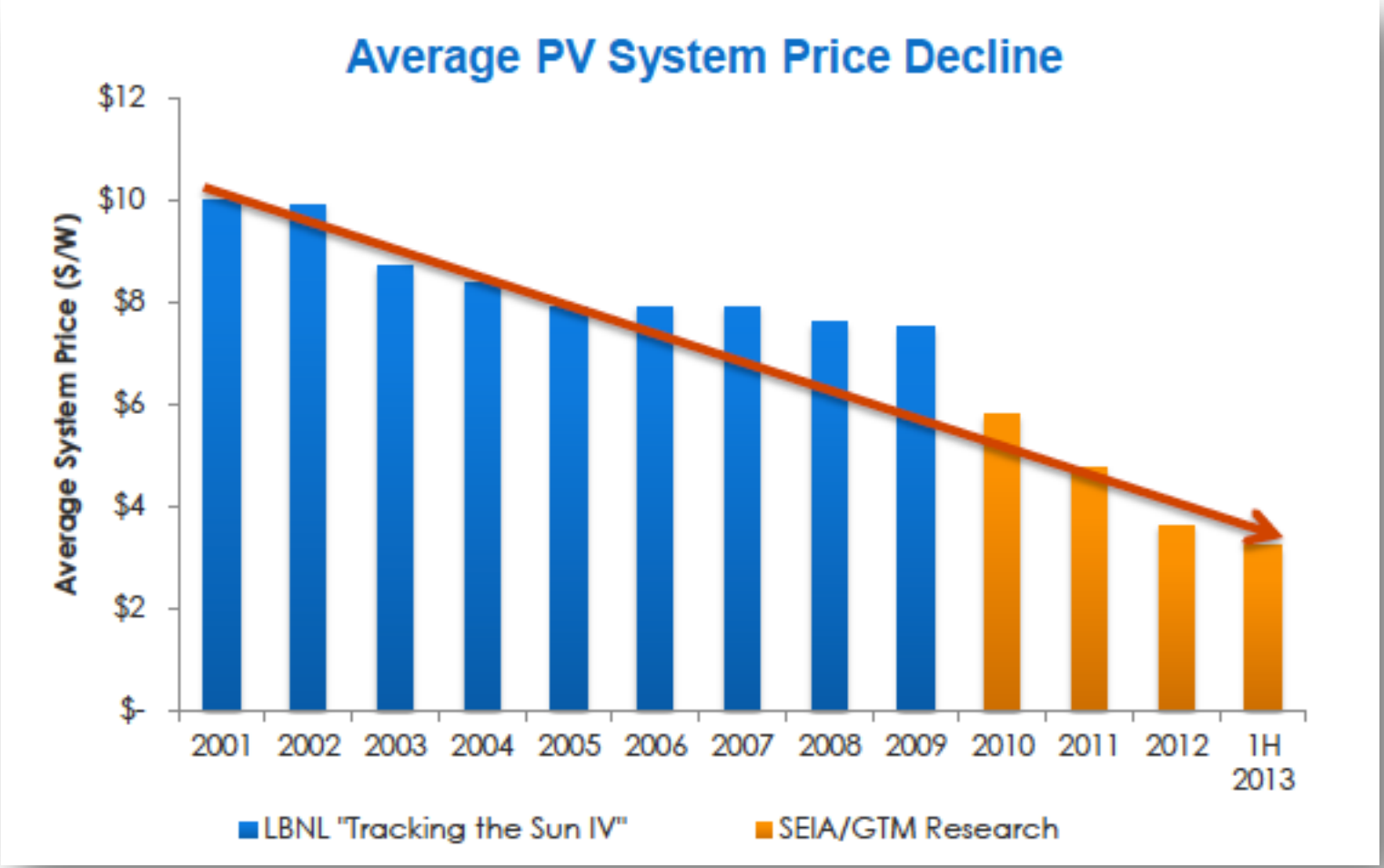
> Energy Eff. | **> Performance** | **> Innovation**



Visible Future: System #5

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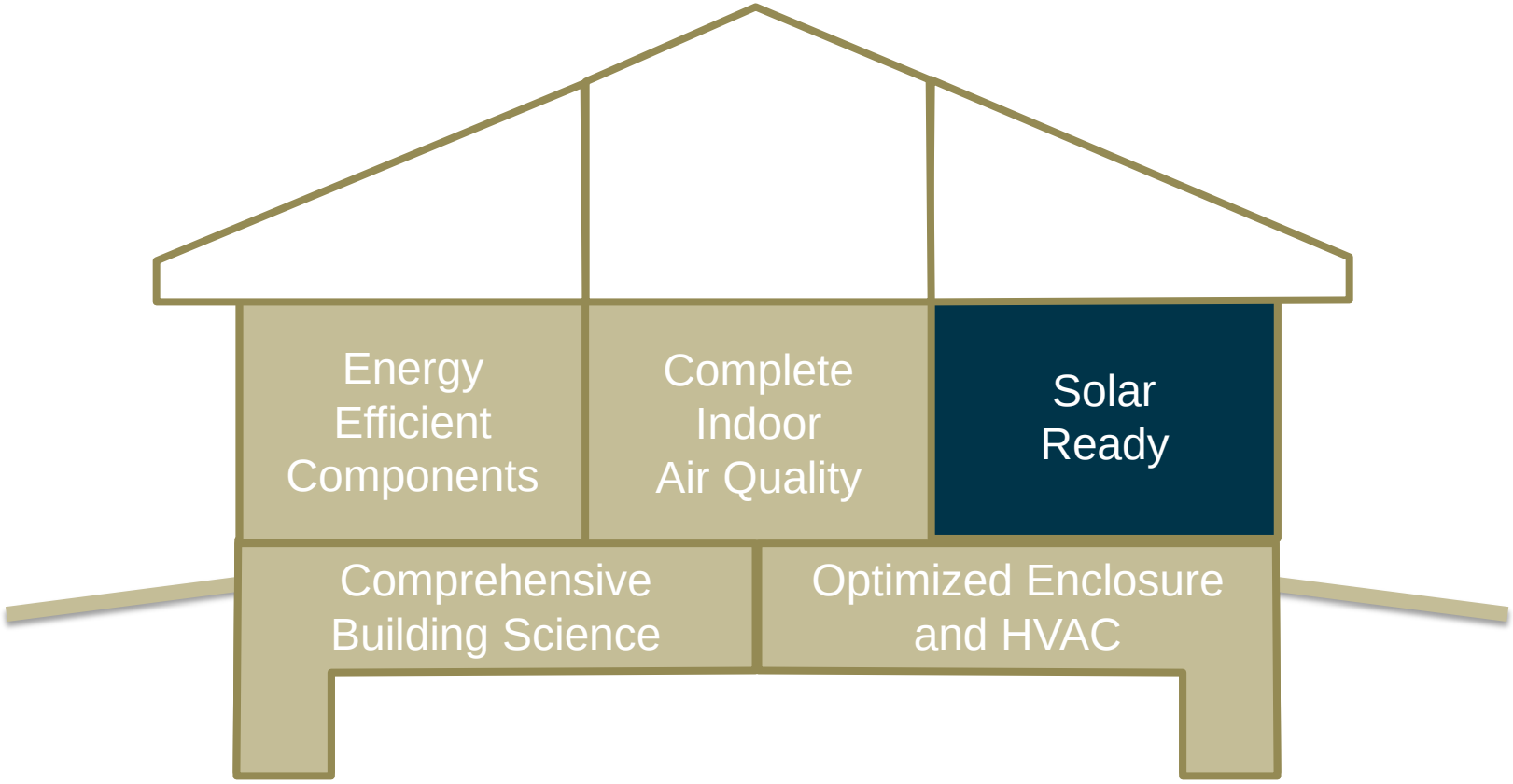
> Energy Eff. | > Performance | > Innovation

Solar Ready Package:

Low/No-Cost Details Can Save $1,000's in Future

[EPA Renewable Ready checklist]



Increasing Water Crisis

1950 – 2000:

U.S. Population Doubled

Public Supply Water Demand More than Tripled

Since 2011:

> Half the U.S. Some Level of Drought.

Hard Trend:
Increasing Water Crisis

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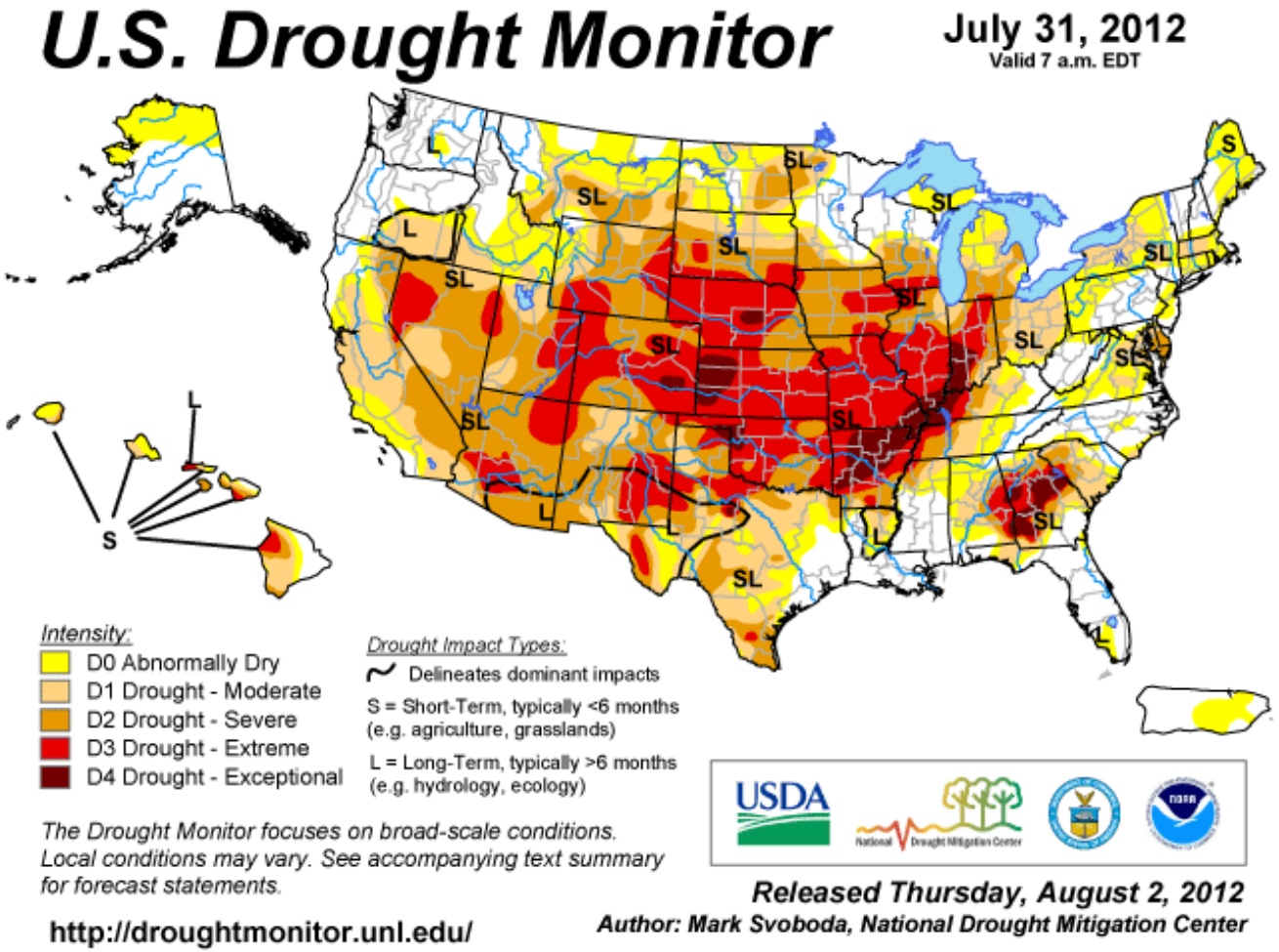
> Energy Eff. | **> Performance** | **> Innovation**



Hard Trend:
Decreasing Water Fixture Flow

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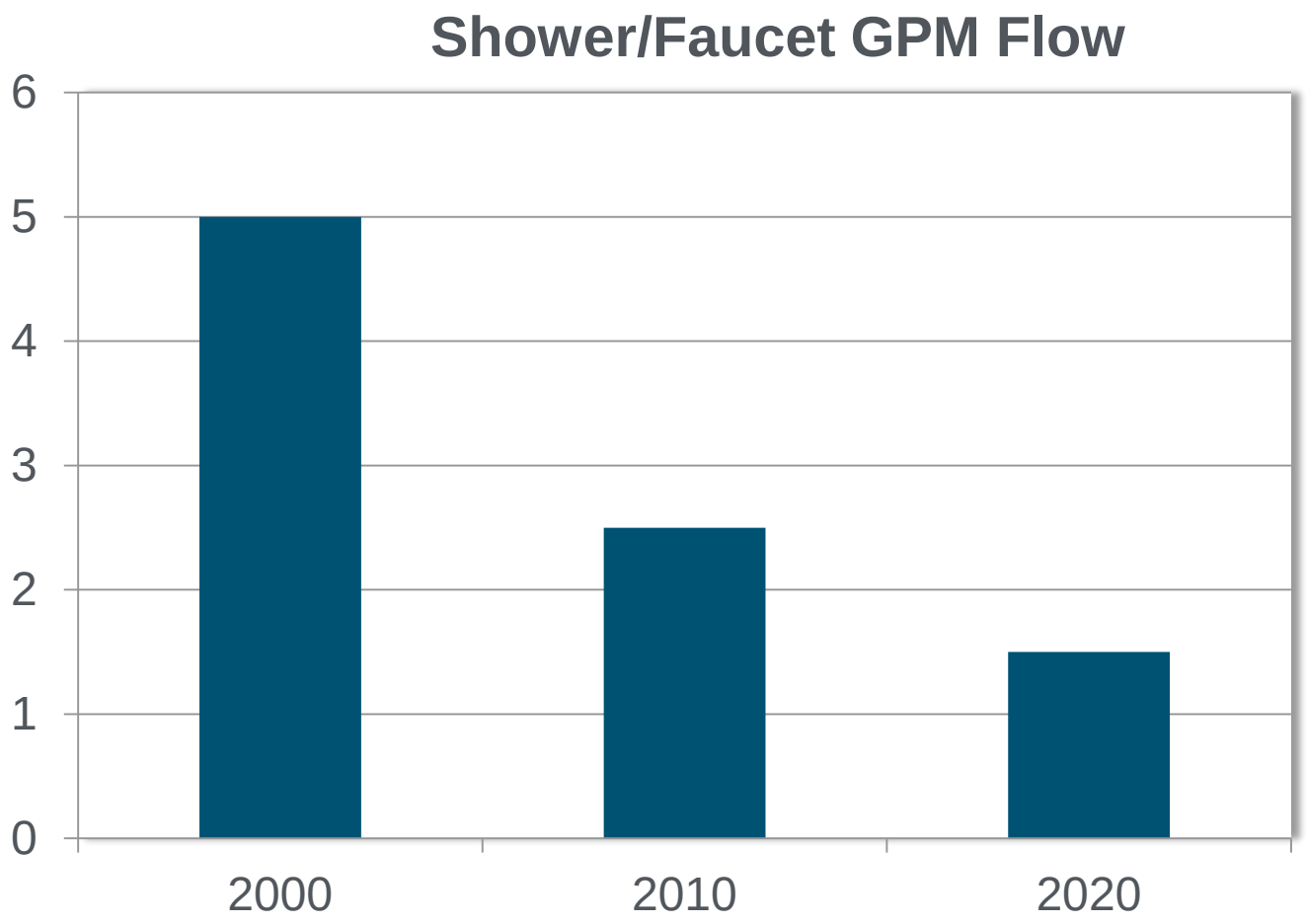
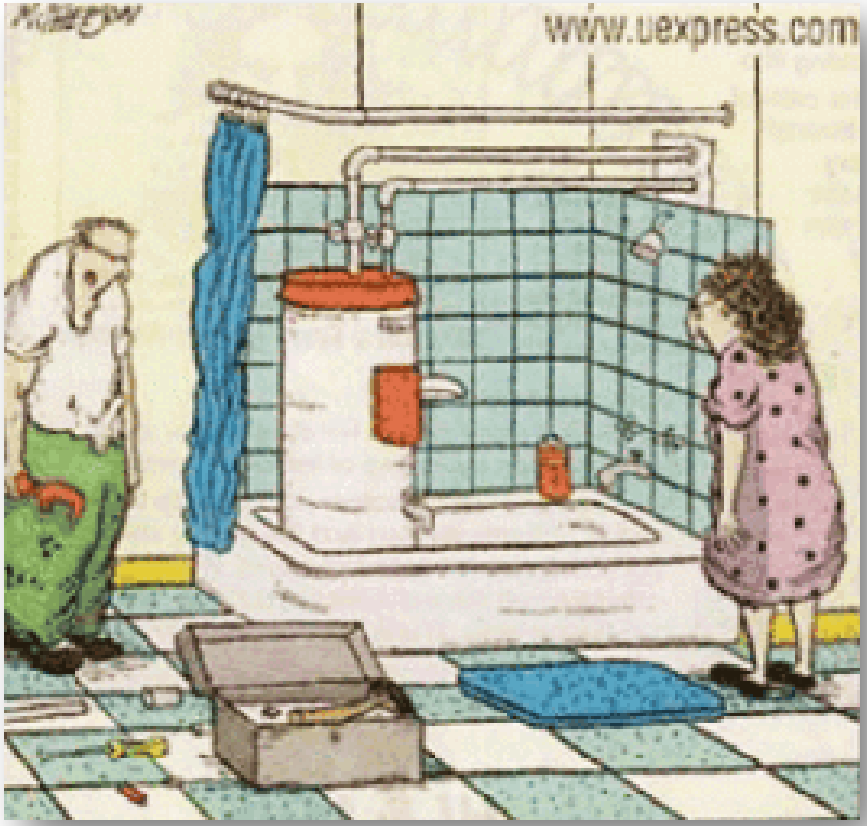
> Energy Eff. | > Performance | > Innovation



Hard Trend:
Decreasing Water Fixture Flow

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

> Energy Eff. | > Performance | > Innovation



“OK, there! I don’t want to hear anyone whining about how long it takes for the water to get hot!”

Visible Future: System #6

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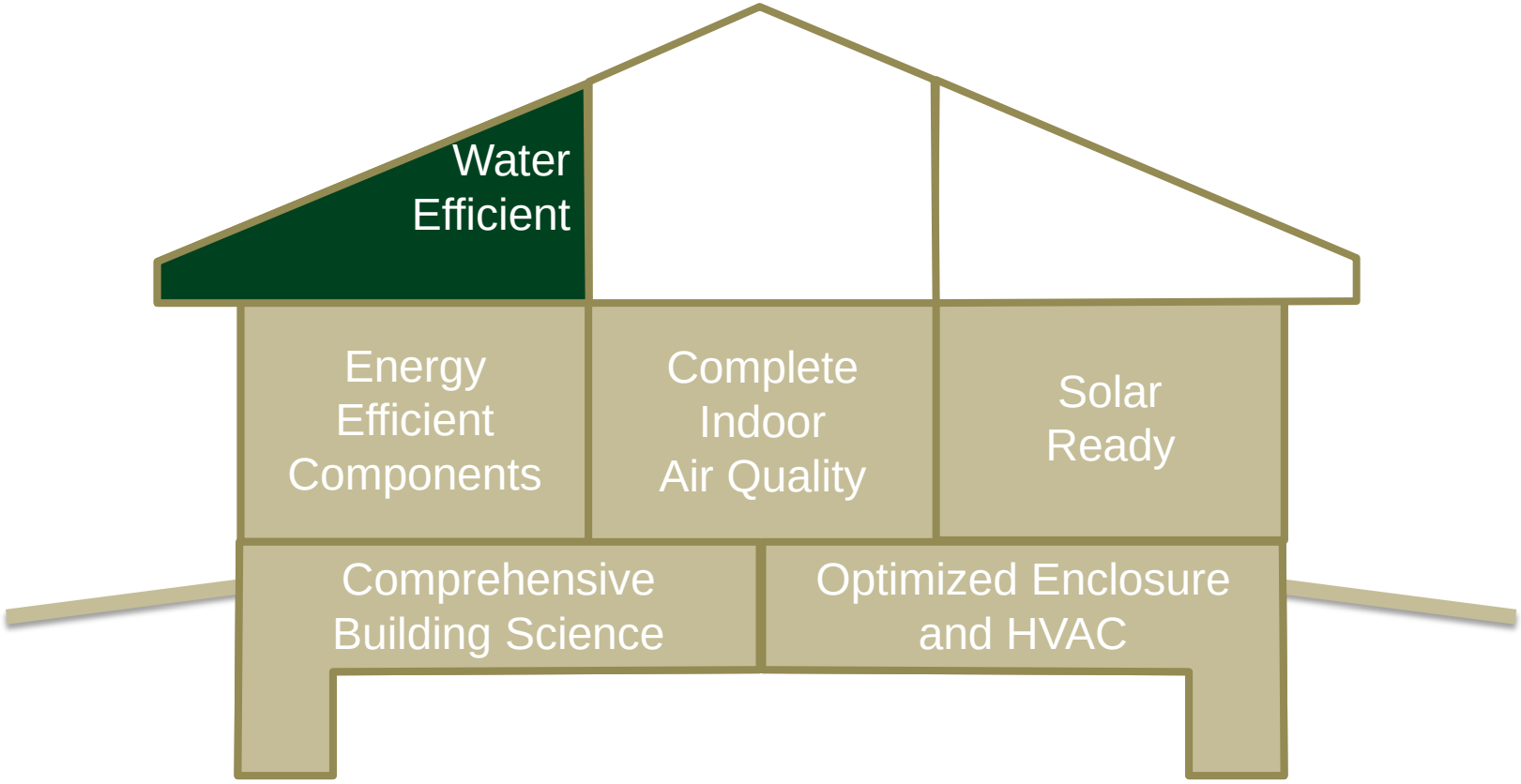
> Energy Eff. | > Performance | > Innovation

Water Efficiency:

Fixtures, Hot Water Distribution, & Landscaping

[EPA WaterSense specifications]



Increasing Extreme Weather

2013 Highlights

Tornadoes:

- Moore, OK:
  200 mph winds
  25 killed, 100's Injured,
  1,000+ homes destroyed
- El Reno, OK:
  widest tornado ever

2013 Highlights

Hurricane Sandy:

- 285 killed
- 115 mph winds
- Record largest spanning 1,100 miles
- $65 billion damage in the U.S.

Hard Trend:
Increasing Disaster Risk

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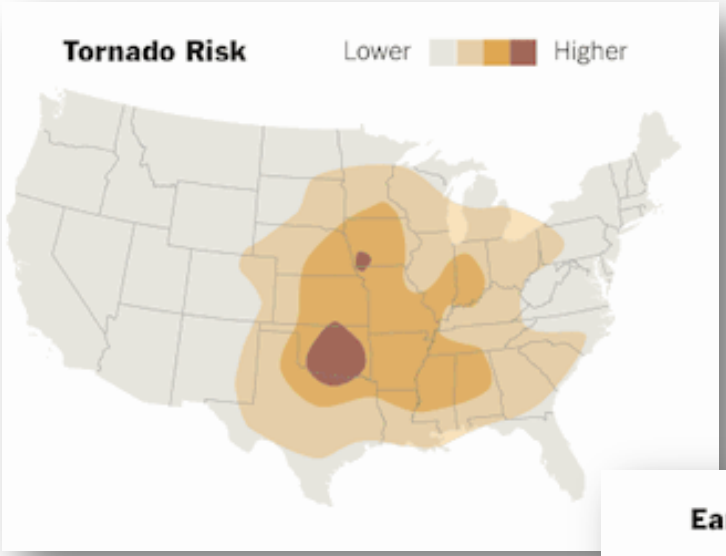
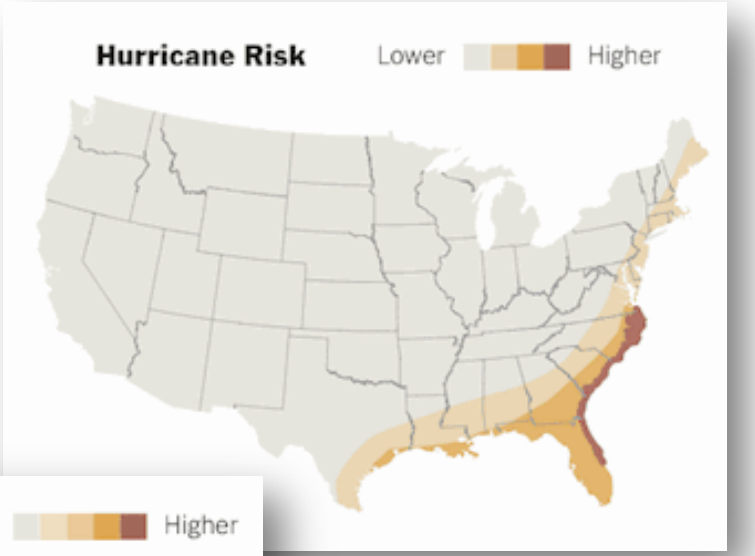
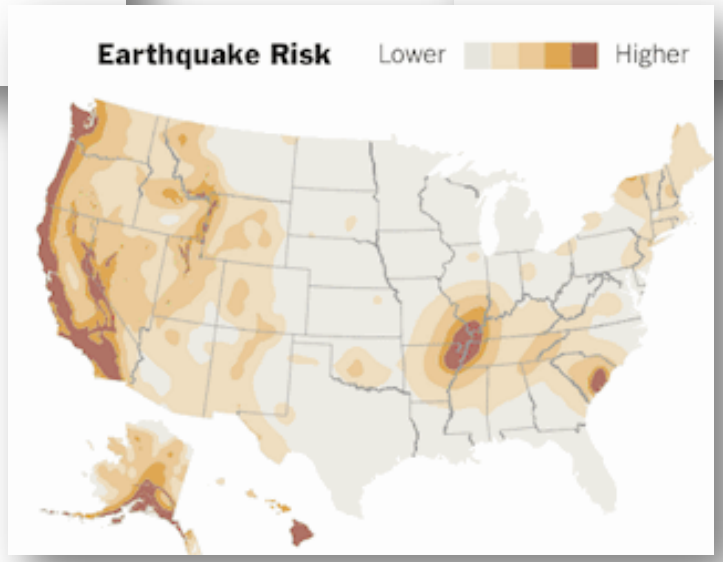
> Energy Eff. **> Performance** **> Innovation**







New York Times, April 30, 2011

Hard Trend:
Increasing Disaster Risk

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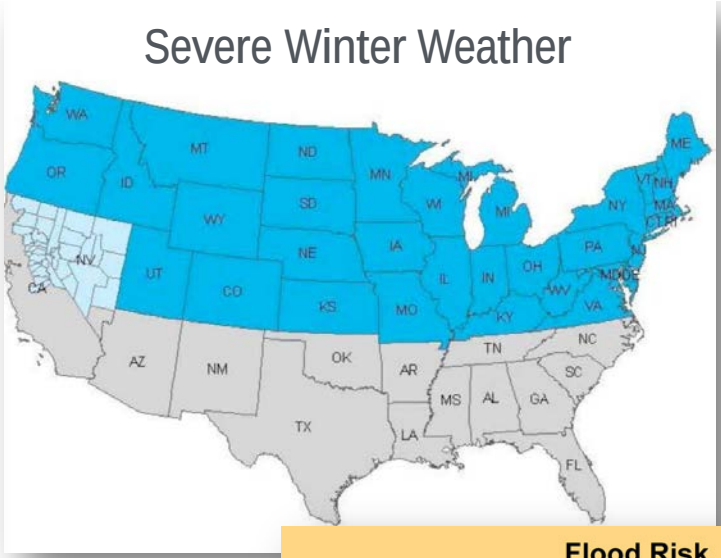
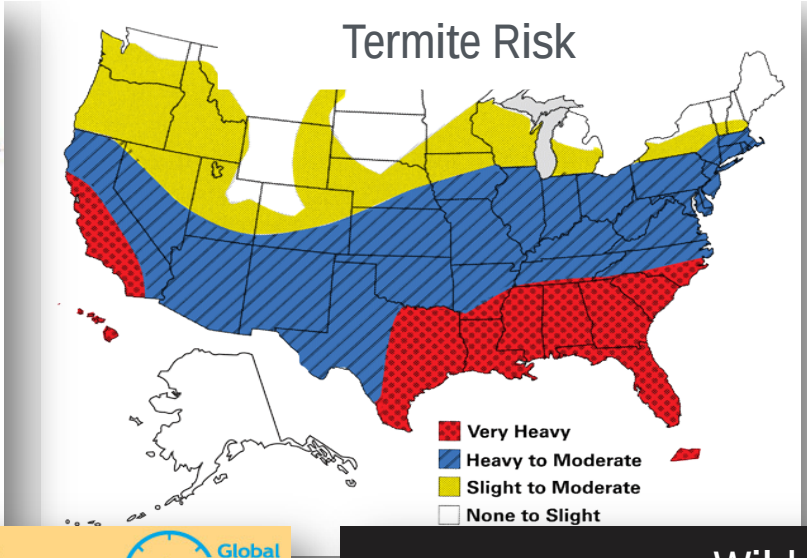
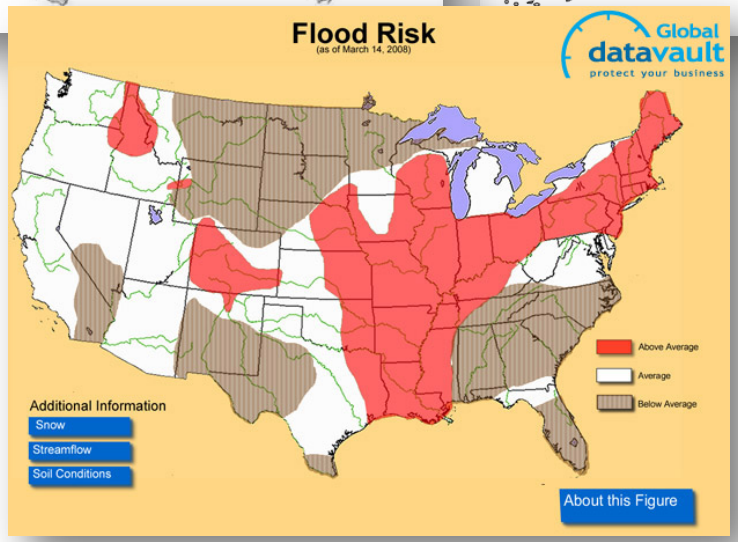
> Energy Eff. **> Performance** **> Innovation**







Visible Future: System #7

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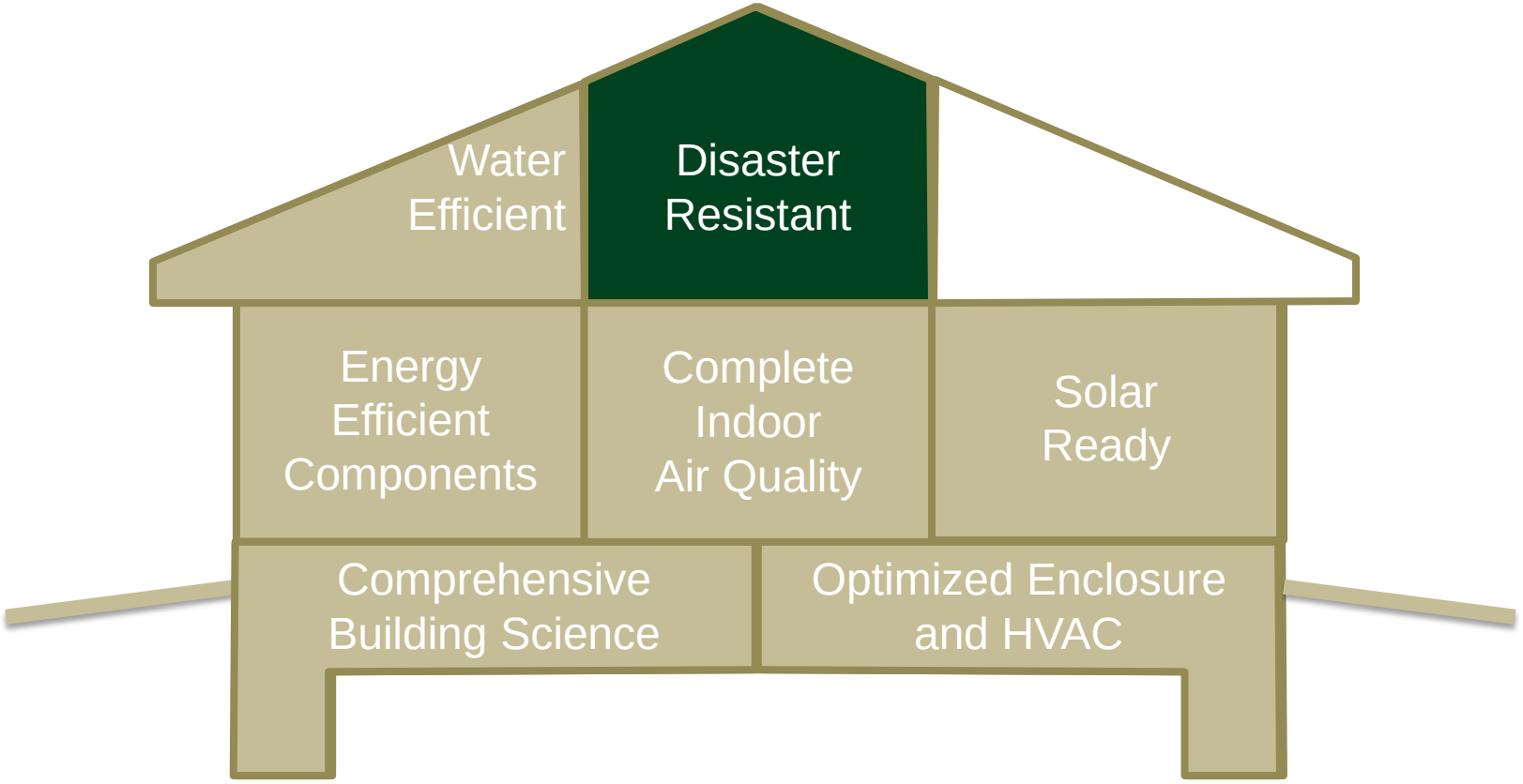
> Energy Eff. | > Performance | > Innovation

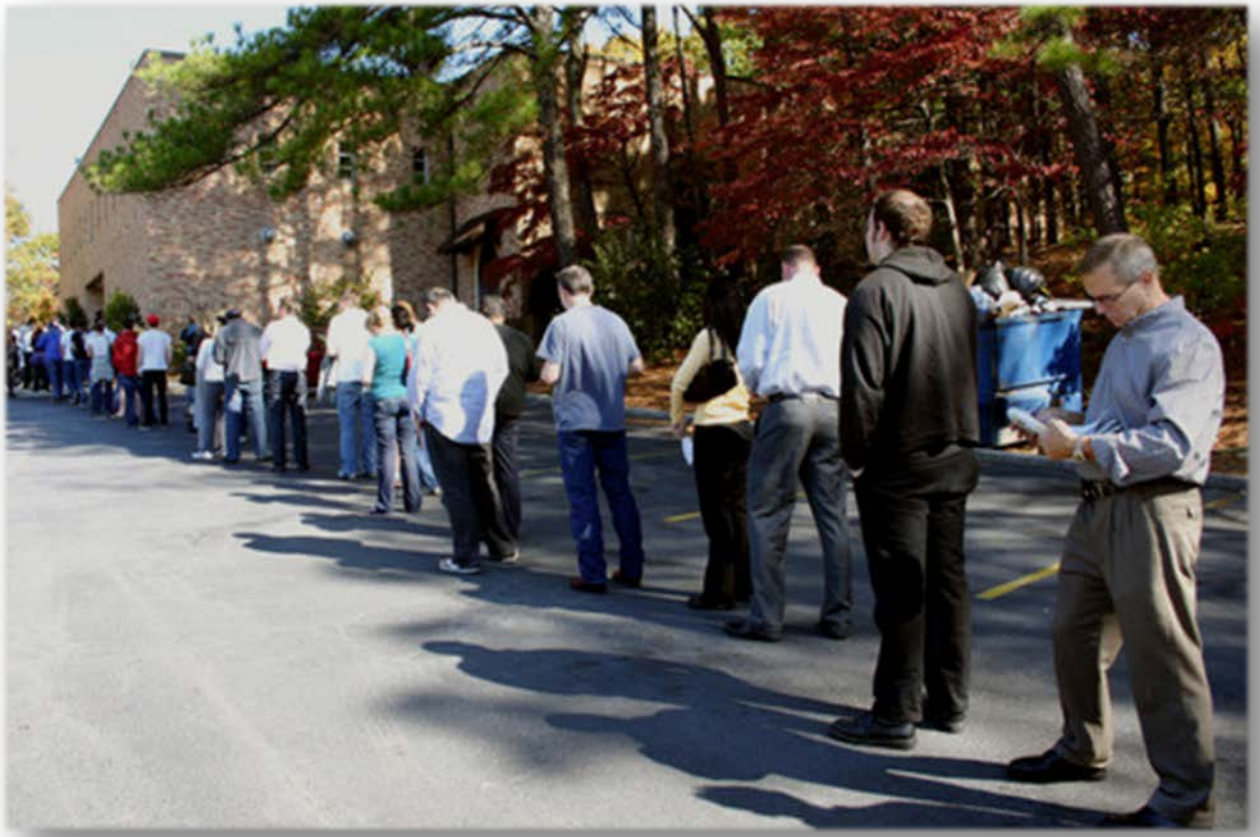
Disaster Resistance:

Weather, Natural Events, and Pests

[IBHS Fortified Homes plus Termite Protection]



> Energy Eff. | > Performance | > Innovation



78 Million Innovation Junkies

Visible Future: System #8

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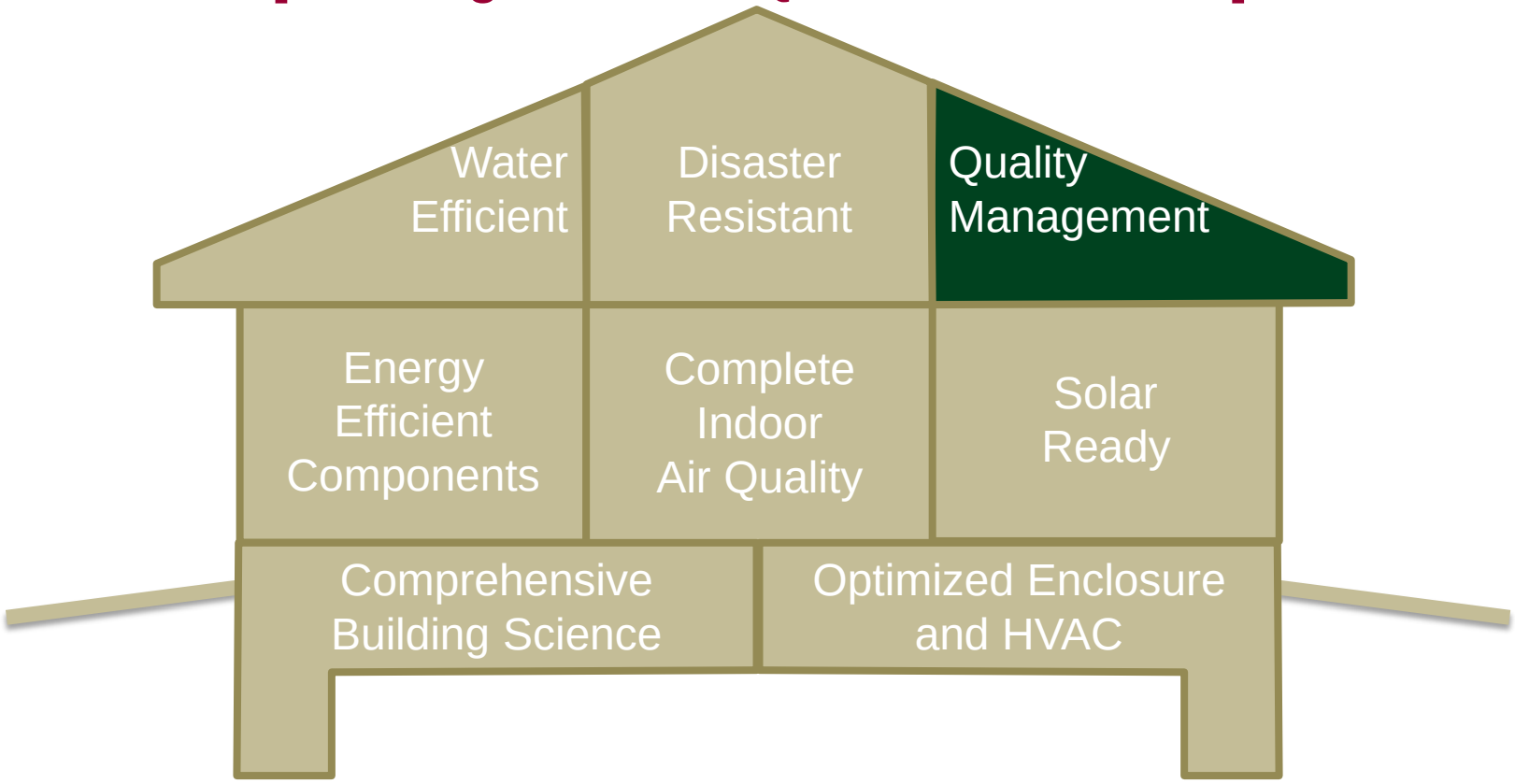
> Energy Eff. | > Performance | > Innovation

Quality Assurance:

Integrated Design, Contract Docs, and QM Plan

[Building America QA Best Practices]

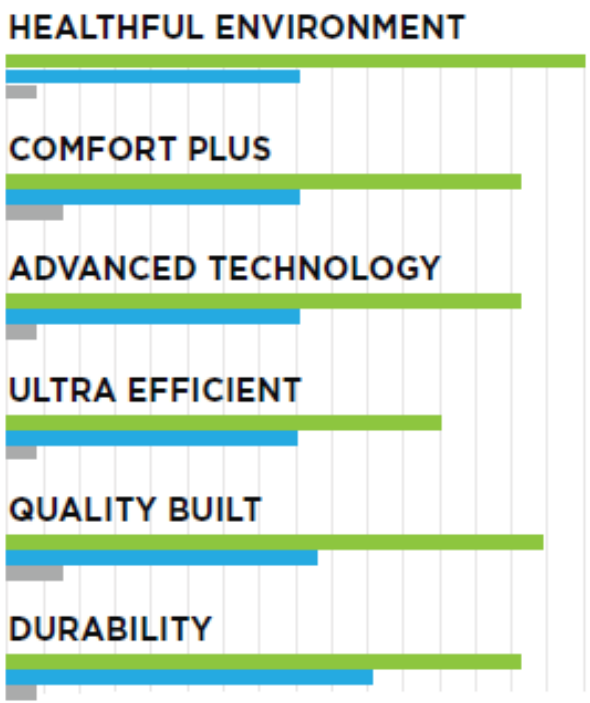


Zero Energy Ready Homes

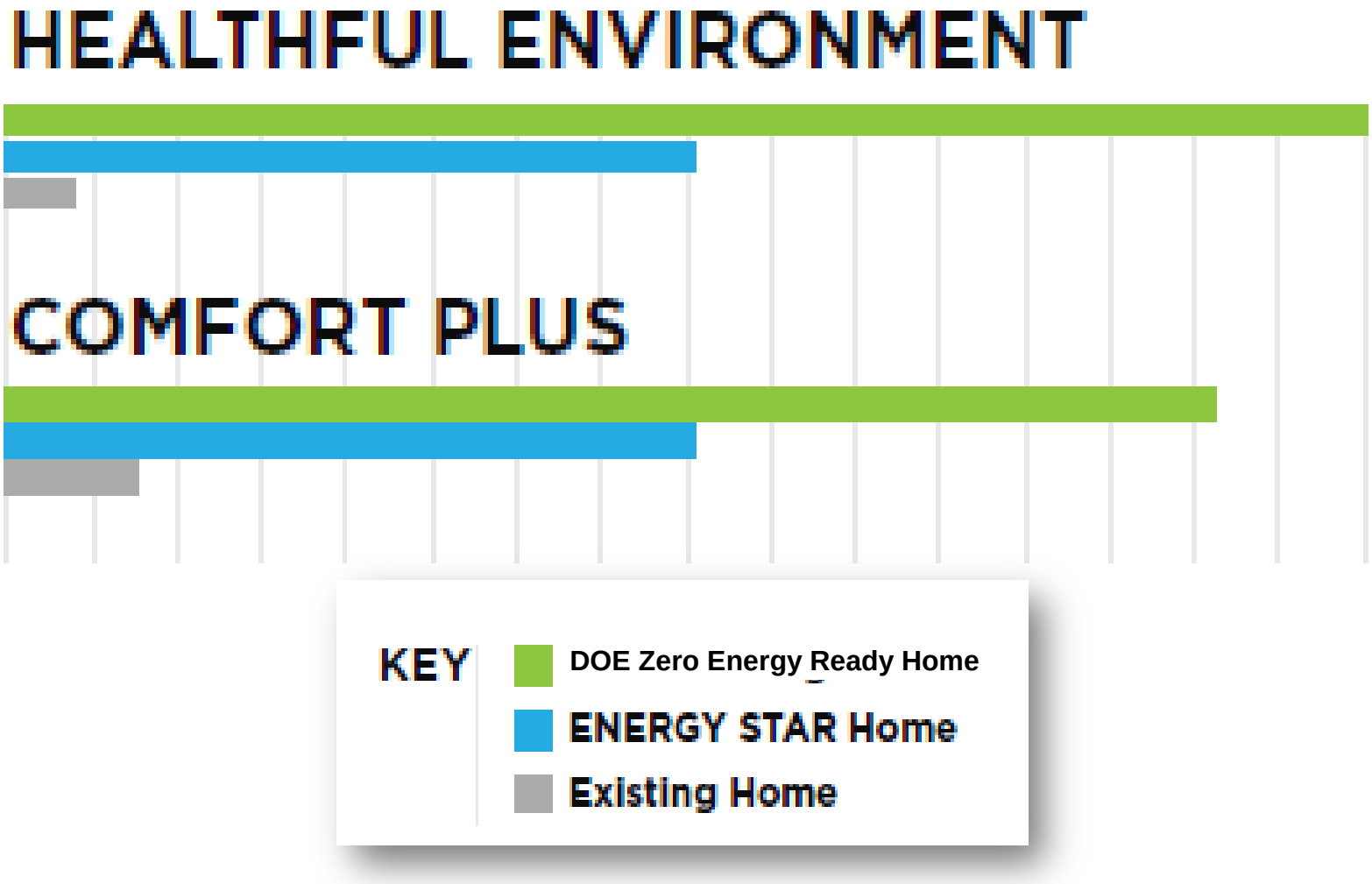
Value Propositions

Translating Value Proposition

ZERO ENERGY READY HOME
U.S. DEPARTMENT OF ENERGY



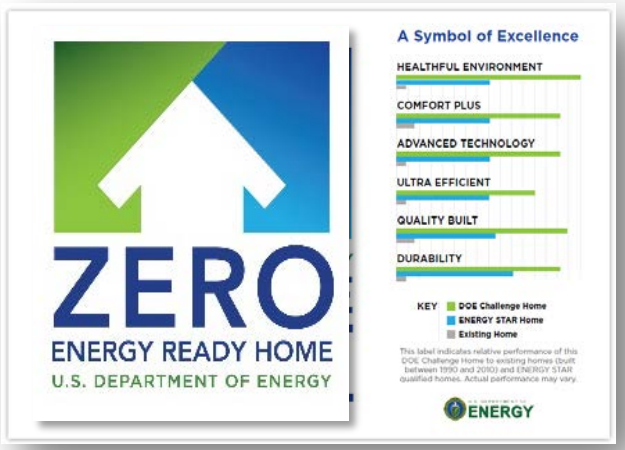
Translating Zero Energy Ready Home Value



Value Proposition Transparency

DOE Challenge Home Label Methodology

October 2012



DOE Challenge Home Label Methodology October 2012 1

Translating ZERH Value Proposition

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

Front Cover | Inside Spread | Flap | Back Cover

Translating Value Proposition

Translating Value Proposition

Compare and Contrast

Zero Energy Ready Homes

Business Case

Old Business Solution:

Minimize Cost

NAHB estimates for every **$1,000 increase** in sales price, nearly **250,000 households** fail to qualify for a mortgage on a typical new home.

[http://www.nahb.org/fileUpload_details.aspx?contentTypeID=3&contentID=40372&subContentID=112293]

Maximize Value

with proven innovations
homebuyers have to have once they try them
(e.g., make new housing compelling again).

Innovation/Value Premium

Willingness to Pay for Valued Services

Price Based on 'Value', NOT Cost

New Revenue

Innovation/Value Premium

Profit

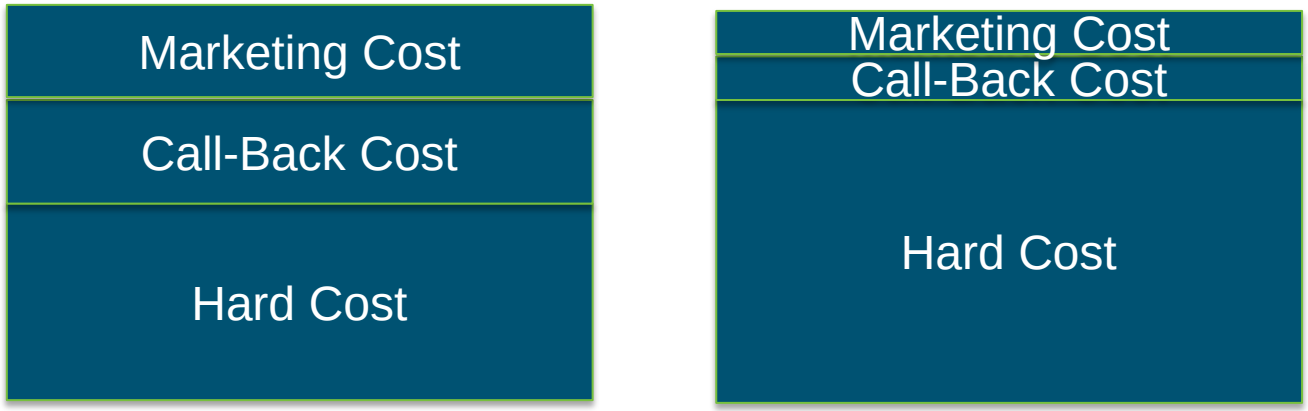
i-Phone Cost

Profit

Old Cell Phone Cost

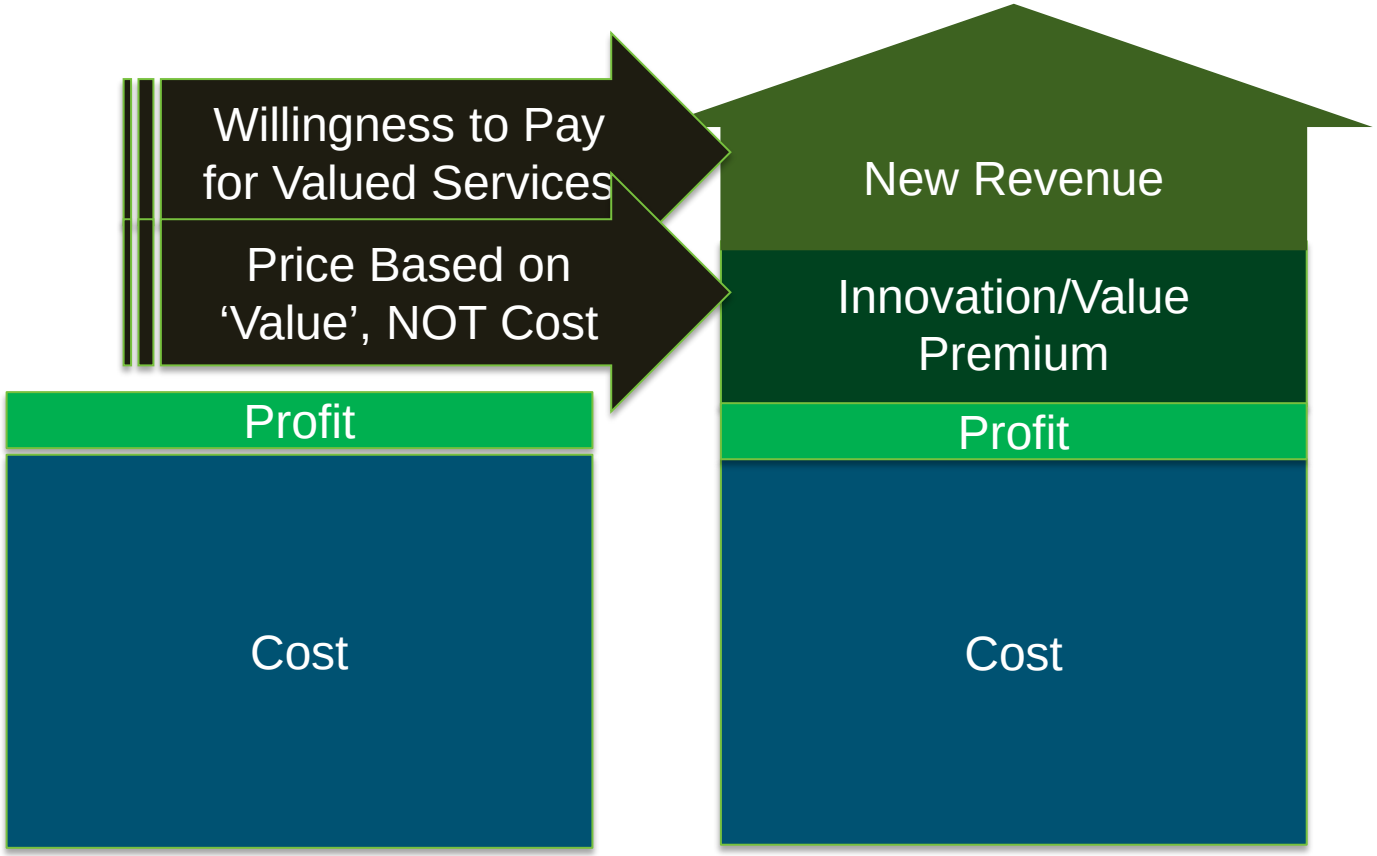
VS.

Home Innovation Real Cost



Standard Home **VS.** ZERH

Home Innovation/Value Premium



Standard Home **VS.** ZNERH

Why Trust So Important to Builders

Nearly 1 in 3 consumers indicated they

do not trust

home building and real estate companies.

Source: The business of Trust – The Most Trusted Builders in America, Lifestory Research, January 2013

ZERH 'Brand' Recognition

Independent Voice of Authority vs. "Trust me."

Pent-up ZERH Demand

The Washington Post

Date: Saturday, June 16, 2012
Location: WASHINGTON, DC
Circulation (DMA): 511,688 (8)
Type (Frequency): Newspaper (D)
Page: E1,E3
Keyword: KB Home

Model home shows off its green side

House in Waldorf demonstrates eco-friendly and money-saving features to buyers

BY V. DION HAYNES

"Becoming more environmentally friendly has been the focus of the country," Moran added. "We want to give people a vision of where we think home building will be in a few years."

Thus far, net-zero houses are a very tiny segment — perhaps as small as 1 percent — of the market.

Production of energy from solar panels, one of the largest components of the green-home movement, is growing. The amount of megawatts produced by home solar panels rose 104 percent in 2010, 109 percent in 2011 and is expected to increase 75 percent this year, according to Boston-based GTM Research, a consulting firm that tracks the industry for the

"They didn't have this [model] when we purchased our home" three doors down the street in October, said Nickiea Youmans, who along with her husband, Linzy, walked into the back yard to check out the house. "We would have been very interested in this," she added.

Sensing Pent-up ZERH Demand

~8,000 ZERH's Committed

~1/4 Staff/Budget/Time

Roles, Responsibilities and Process

DOE Zero Energy Ready Home
Partner Responsibilities

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

- **Take Orientation Training**
  after registering and renew training every year
- **Provide Certificate**
  for DOE Zero Energy Ready Home to each home owner
- **Adhere to Brand Identity Guidelines**
  for proper use of the DOE Zero Energy Ready Home name and logo
- **Build/Verify at Least One Home/Year**
  to maintain active partnership

To view the full Agreement terms and disclaimers, visit:
www.buildings.energy.gov/zero

Register to Become a Partner
Process

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

- Review
  - technical guidelines
  - terms of the partnership agreement
- Register and electronically sign agreement
- Choose optional commitments

DOE Zero Energy Ready Home
Partner Benefits

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- **Resources**
  - ❑ **Customizable Homebuyer Brochures**
  - ❑ Branding [Logos, Home Certificates and Labels]
  - ❑ Electronic Newsletter [updates, policy changes, new innovations]
  - ❑ Appraisal Guidance
- **Technical Support**
  - ❑ **Building America Solution Center**
  - ❑ Building America Stakeholder Meetings
  - ❑ Building America Research Studies
- **Recognition**
  - ❑ DOE Zero Energy Ready Home Builder Profile on Locator Tool
  - ❑ Case Studies/Virtual Parade of Home [coming]
  - ❑ **DOE Housing Innovation Awards**

DOE Housing Innovation Awards

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

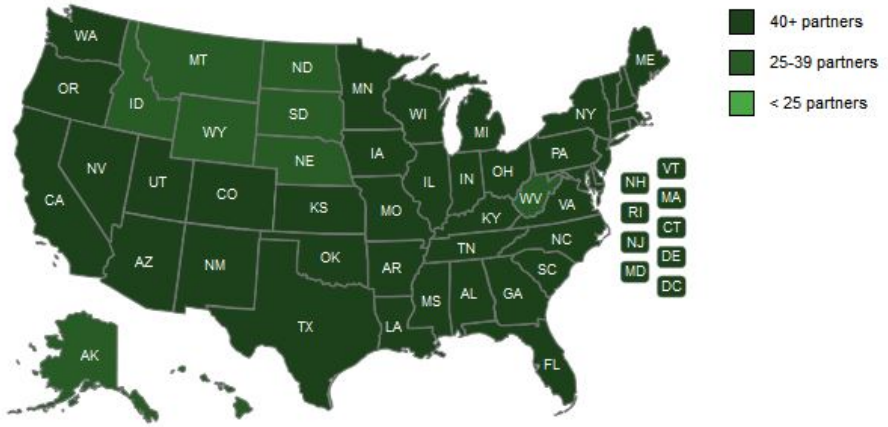
Partner Locator Tool

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

Links Buyers to Leading Edge Builders:

- Contact Information
- Optional Commitments

- # Labeled Homes
- Website link



For All Active Partners

Profiles with logos and case studies

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DOE Zero Energy Ready Home: Partner Profile

Palo Duro Homes, Inc.

PALO DURO HOMES, INC.

Partner ID:	143
Organization Type:	Builder
Main Contact:	Thomas Wade
Address:	4420 TOWER RD SW ALBUQUERQUE, NM 87121
Primary Phone Number:	(505) 243-0005
Certified DOE Zero Energy Ready Homes (2012 - Present):	132
Certified Builders Challenge Homes (2008 - 2012):	235
Website:	www.palodurohomes.com

All Places of Business

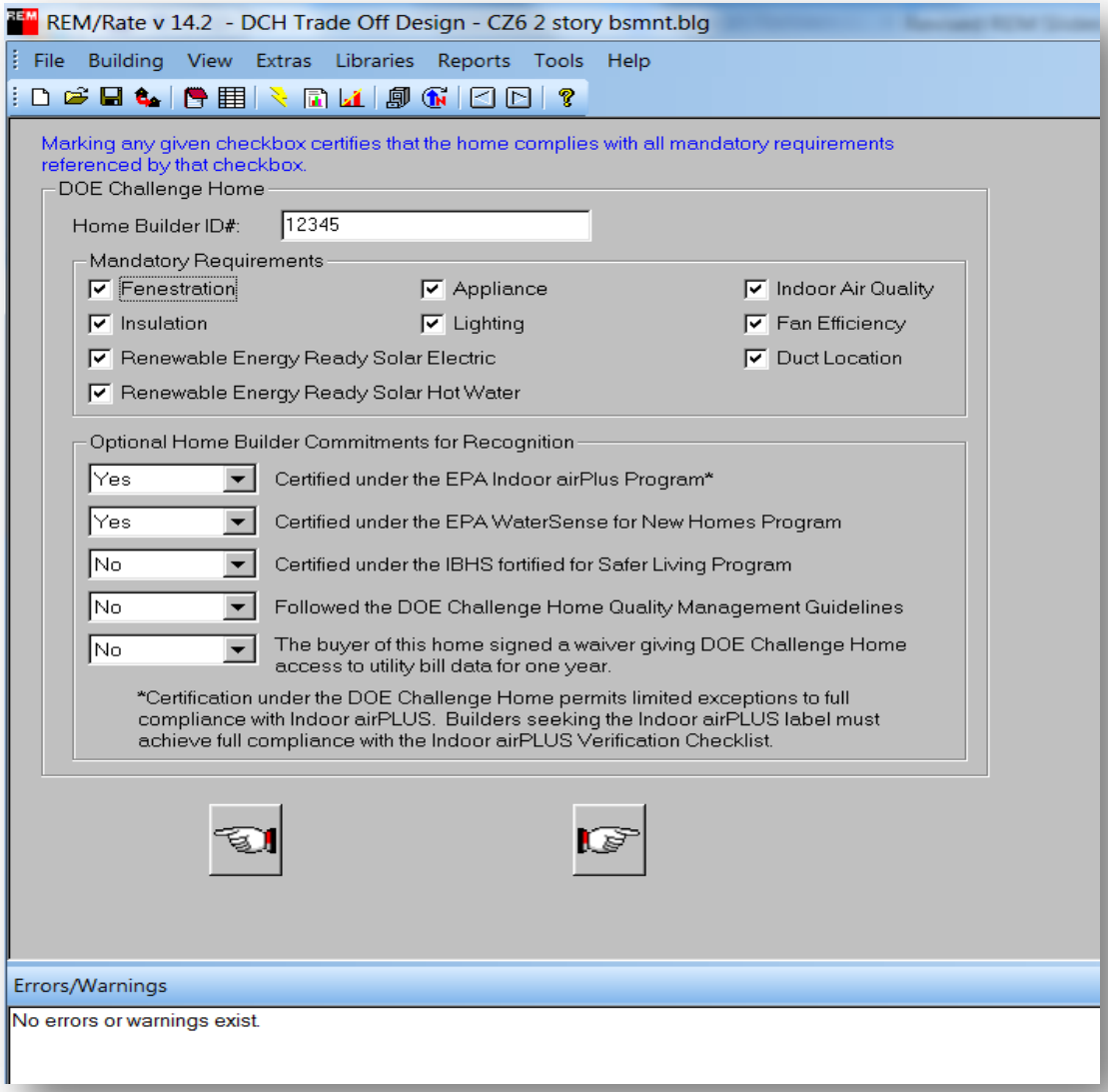
AZ, CO, NM

Commitments

Rating & Verifying Homes

- Same: ENERGY STAR Homes framework
- New:
  - Indoor airPLUS Checklist;
  - Renewable Energy Ready Home Checklists (where applicable)
  - Hot Water Distribution test
- Submissions:
  - **Send "DOE Zero Energy Ready Home Verification Summary" electronically to** zero@newportpartnersllc.com
  - Otherwise builders will not receive "credit" on ZERH website
  - Considering RESNET National Homes Registry for future

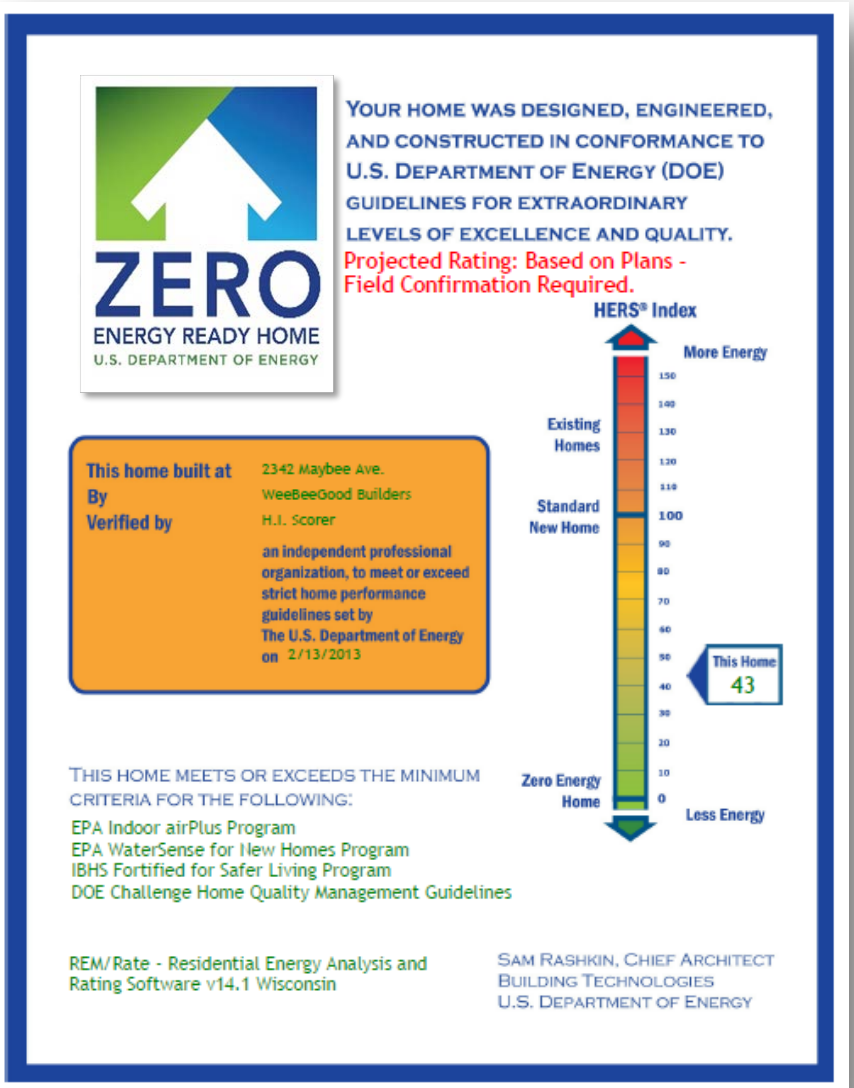
- Automatically programs the Target Home and compares to Design Home
- Mandatory Requirements
- Optional Home Builder Commitments



DOE Zero Energy Ready Home
Certificate

Within REM/Rate, located under Reports/DOE Zero Energy Ready Home Certificate

Also available with EnergyGauge USA software



Zero Energy Ready Homes

Technical Specifications

Note: state-specific specs exist for CA & WA

DOE Zero Energy Ready Home
Framework

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

Mandatory Req's.

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

Area of Improvement	Mandatory Requirements
1. ENERGY STAR for Homes Baseline	☐ Certified under ENERGY STAR Qualified Homes Version 3 [9, 10]
2. Envelope [11]	☐ Fenestration shall meet or exceed latest ENERGY STAR requirements [12, 13] ☐ Ceiling, wall, floor, and slab insulation shall meet or exceed 2012 IECC levels [14, 15]
3. Duct System	☐ Ducts located within the home's thermal and air barrier boundary [16]
4. Water Efficiency	☐ Hot water delivery systems shall meet efficient design requirements [17]
5. Lighting & Appliances [18]	☐ All installed refrigerators, dishwashers, and clothes washers are ENERGY STAR qualified. ☐ 80% of lighting fixtures are ENERGY STAR qualified or ENERGY STAR lamps (bulbs) in minimum 80% of sockets ☐ All installed bathroom ventilation and ceiling fans are ENERGY STAR qualified
6. Indoor Air Quality	☐ Certified under EPA Indoor airPLUS [19]
7. Renewable Ready [19]	☐ Consolidated Renewable Energy Ready Home (RERH) Checklist

Must Comply

'Target Home' 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			
• Insulation levels shall meet the 2012 IECC and achieve Grade 1 installation, per RESNET's standards. • Infiltration [24] (ACH50): 3 in CZs 1-2 | 2.5 in CZs 3-4 | 2 in CZs 5-7 | 1.5 in CZ 8			
Windows [25, 26, 27]			
	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

Trade-Off Flexibility

Size Adjust. Factor

Exhibit 3: Benchmark Home Size [28]

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

Identical to Energy Star

Zero Energy Ready Homes

Technical Specifications Mandatory Requirements:

Mandatory Requirements

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

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6. Indoor Air Quality	☐ Certified under EPA Indoor airPLUS [10]
7. Renewable Ready [19]	☐ Consolidated Renewable Energy Ready Home (RERH) Checklist

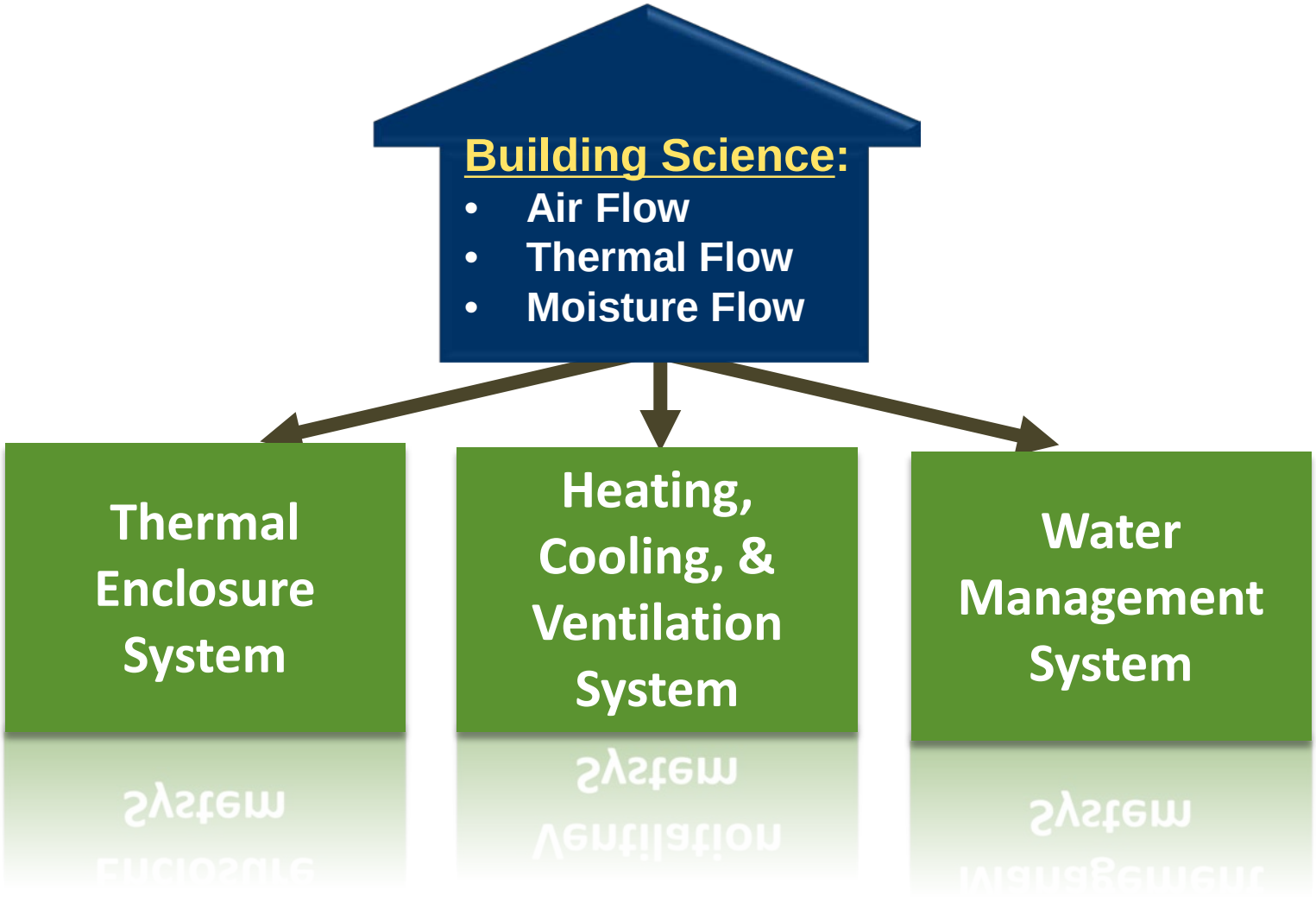
Encouraged:

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

Zero Energy Ready Homes

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

What is Building Science



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

Thermal Enclosure | Heating, Cooling & Ventilation | Water Management

A well-insulated and air-sealed home, with good windows and doors, reduces the amount of energy needed to keep the home comfortable.

What We're Trying to Avoid

Thermal Enclosure | **Heating, Cooling & Ventilation** | **Water Management**

Attic air infiltration into the wall

Drywall Sealed at Top Plates

Foam

Sill sealer

Constr. Adhesive

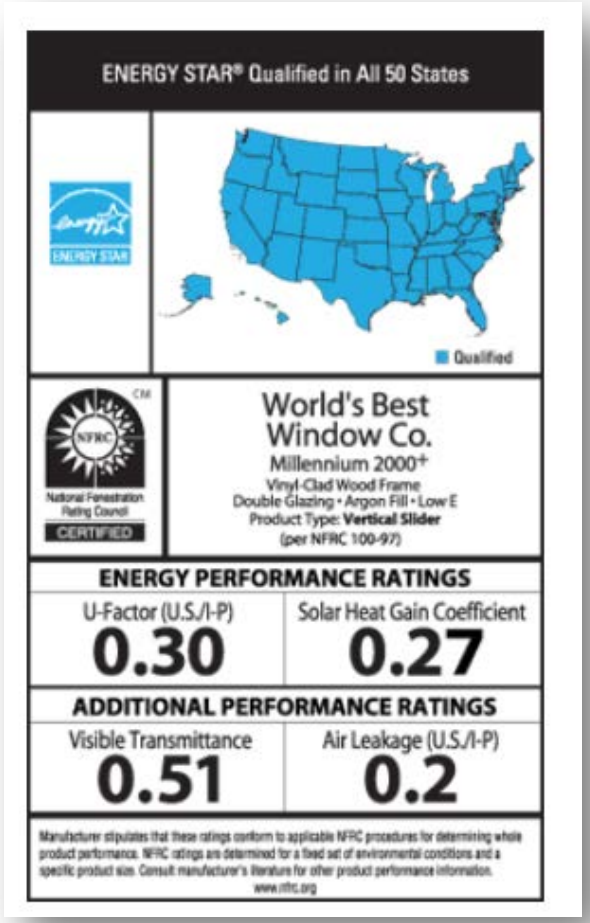
Zero Energy Ready Homes

Technical Specifications Mandatory Requirements

Envelope: Advanced Windows

ENERGY STAR Windows

- Assures beyond-code window performance
- Fenestration used for passive solar design are exempt from the U-factor and SHGC requirements
- Area-weighted averages for U-factor, SHGC permitted



Good, Better, Best Windows

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

	Hot Climates IECC CZ 1-2		Mixed Climates IECC CZ 3-4 except Marine		Cold Climates IECC CZ 5-8 and 4 Marine	
	SHGC	U-value	SHGC	U-value	SHGC	U-value
Mandatory: ENERGY STAR	0.27	0.60	[4] 0.40 [3] 0.30	[4] 0.32 [3] 0.35	Any ≥0.35 ≥0.40	0.30 0.31 0.32
Performance: Target Home	0.25	0.4	0.27	0.3	Any	0.27
Encouraged: R-5	0.22	0.21	0.25	0.21	Any	0.21

Zero Energy Ready Homes

Technical Specifications Mandatory Requirements: Envelope: 2012 IECC Insulation

2012 IECC Insulation

- Compliance with next generation code

- Three Options:
  - ✓ Prescriptive
  - ✓ Alternative equivalent U-factor
  - ✓ Total UA calculation [including windows]
    - o Done automatically in Rating Software

Prescriptive Requirements

Climate Zone	Fenestration	Skylight U-Factor	Glazed Fenestration SHGC	Ceiling R-Value	Wood Frame Wall R-Value
1	NR	0.75	0.25	30	13
2	0.40	0.65	0.25	38	13
3	0.35	0.55	0.25	38	20 or 13+5[h]
4 except Marine	0.35	0.55	0.40	49	20 or 13+5[h]
5 & Marine 4	0.32	0.55	NR	49	20 or 13+5[h]
6	0.32	0.55	NR	49	20+5 or 13+10[h]
7 & 8	0.32	0.55	NR	49	20+5 or 13+10[h]

Prescriptive Requirements (cont.)

Climate Zone	Mass Wall R-Value [i]	Floor R-Value	Basement [c] Wall R-Value	Slab [d] R-Value, Depth	Crawl Space [c] Wall R-Value
1	3/4	13	0	0	0
2	4/6	13	0	0	0
3	8/13	19	5/13[f]	0	5/13
4 except Marine	8/13	19	10 /13	10, 2 ft	10/13
5 & Marine 4	13/17	30[g]	15/19	10, 2 ft	15/19
6	15/20	30[g]	15/19	10, 4 ft	15/19
7 & 8	19/21	38[g]	15/19	10, 4 ft	15/19

Zero Energy Ready Homes

Technical Specifications Mandatory Requirements: Ducts in Conditioned Spaces

Why Ducts in Conditioned Space?

- **Significant Thermal Losses:**
  - Thermal losses triple for ducts in unconditioned vs. conditioned space
  - Total thermal losses can range from 10-45%
  - Extensive unconditioned space penetrations
- **Significant Performance Impacts:**
  - IAQ
  - Comfort
  - Durability

Ducts in Condit. Space Exemptions

- **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
- **Ductless HVAC system**

Ducts in Condit. Space Options

- **Conditioned Floor Space [3 options]**
  within the thermal boundary
- **Unvented Crawl Space/Basement**
  which is within the home's thermal boundary
- **Unvented Attic**
  regardless of whether conditioned with a supply register
- **Vented Attic**
  equivalent option where other locations in conditioned space are impractical, expensive, don't work well in specific climates, or increase envelope loads

Zero Energy Ready Homes

Technical Specifications Mandatory Requirements: Efficient Hot Water Distribution

Water Efficiency as a System

- **Indoor Fixtures**
  - Plumbing Fixtures
  - Appliances and Other Equipment
- **Distribution**
  - Service Pressure
  - Metering (for Multi-Family Homes)
  - Leak Prevention
  - **Hot Water Distribution**
- **Outdoor**
  - Landscape Design
  - Irrigation (if installed)

Efficient Hot Water Distribution

- "Must Have" for zero net-energy ready homes
- Based on EPA WaterSense Specifications:
  - ≤ 0.5 gallons (64 oz.) of water in any piping/manifold b/w hot water source & any hot water fixture.
  - ≤ 0.6 gallons of water collected from the hot water fixture before hot water delivered

Hot Water Distribution Options

- Core Plumbing Layout (wet wall)
- Manifold System
- Demand Pumping System

Zero Energy Ready Homes

Technical Specifications Mandatory Requirements: Efficient Components: Lighting, Appliances, & Fans

Efficient Components

Components and MEL's are increasingly Important in Low-Load Homes (~25 to 40%). Therefore, DOE ZER 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)

*Only where installed by builder

Zero Energy Ready Homes

Technical Specifications Mandatory Requirements: Indoor Air Quality

Comprehensive Indoor Air Measures through ENERGY STAR + IAP

ENERGY STAR + Indoor airPLUS

- Envelope
- HVAC
- Moisture
- CO

+

- Radon
- Pests
- Materials
- CO +
- HVAC +
- Moisture +

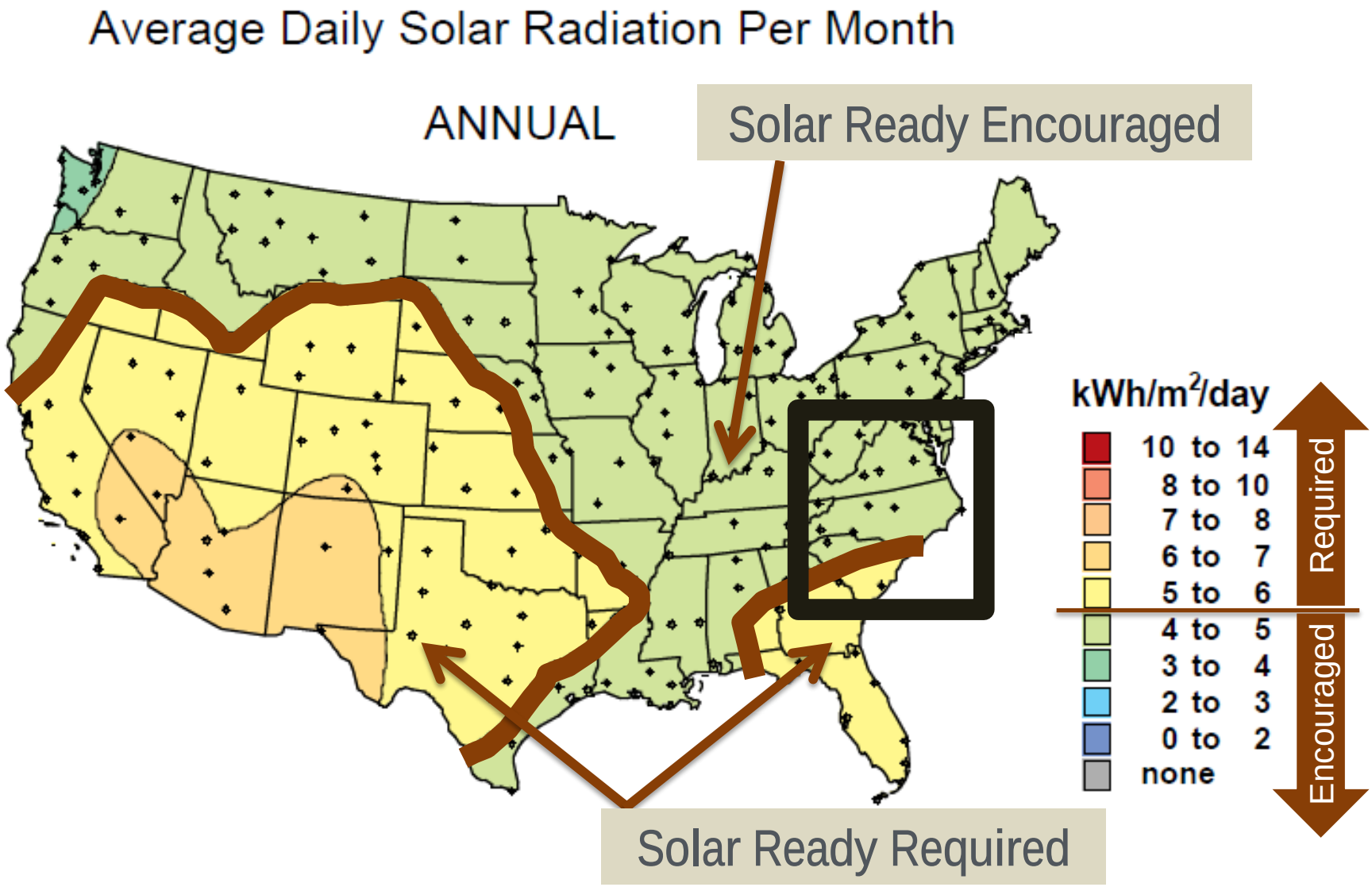
=

Comprehensive Indoor Air Quality Protection

Zero Energy Ready Homes

Technical Specifications Mandatory Requirements: **Renewable Ready** [Where Applicable]

RERH Applicability



Screen for RERH Applicability

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

- **Renewable Energy Ready Checklists**
  - Determine applicability by zip code
  - http://gisatnrel.nrel.gov/PVWatts_Viewer/index.html
  - In this Mid-Atlantic example, solar resources = 4.8 kWh/m^2/day

Zero Energy Ready Homes

Performance Threshold

‘Target Home’ vs. Energy Star Spec

Higher Eff. HVAC Equip.

2012 vs. 2009 IECC Insul.

More Eff. Windows

Half ACH50

ENERGY STAR Water Htg.

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

- Insulation levels shall meet the 2012 IECC and achieve Grade 1 installation, per RESNET standards.
- Infiltration [20] (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 Clim** (2012 IECC Zones
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

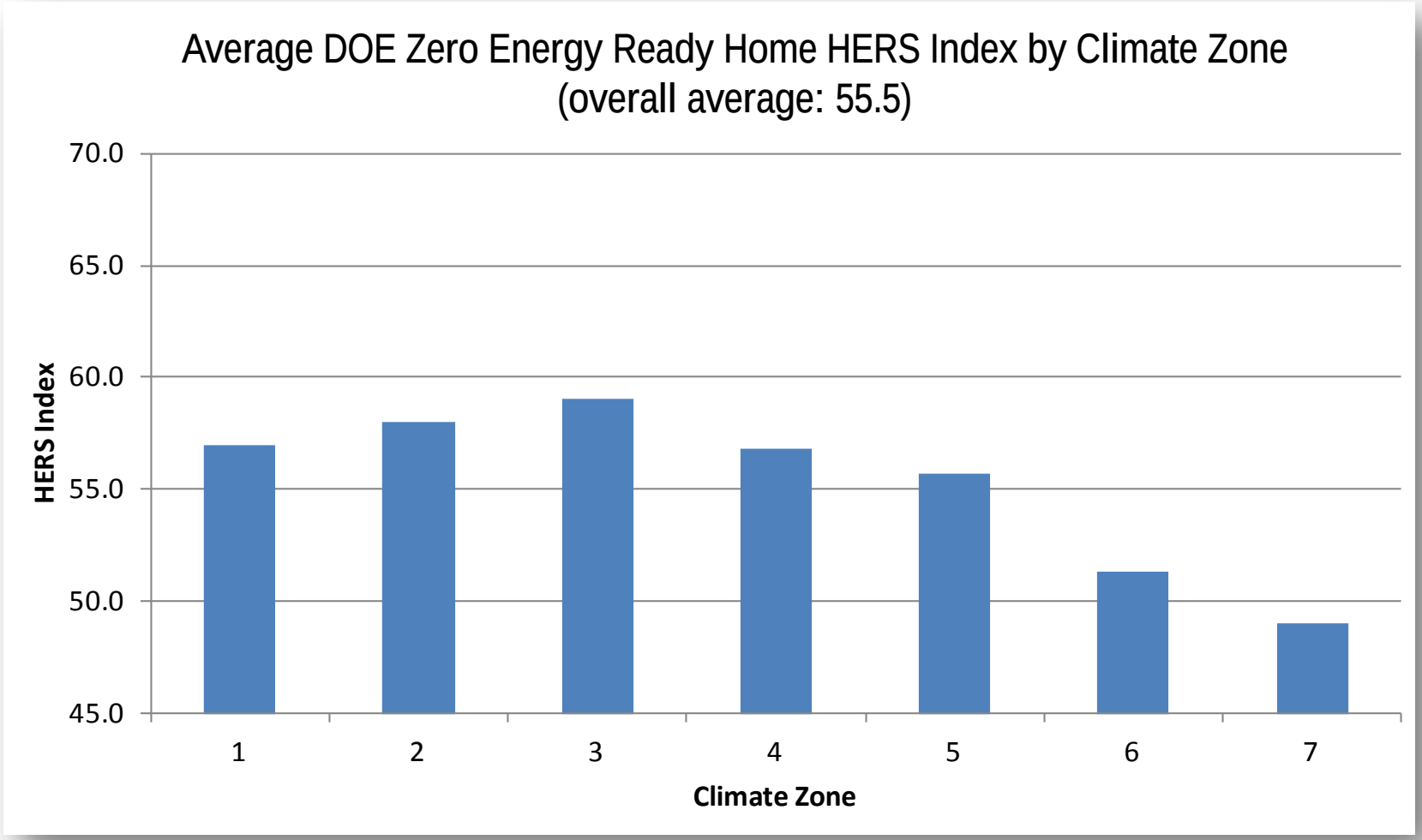
Thermostat [25] **& Ductwork**

- Programmable thermostat (except for zones with radiant heat)

Lighting & Appliances

- 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.

Target Home Avg. HERS Scores



Based on 1800, 2400, and 3600 ft ^{2} prototypes on climate-appropriate foundations.

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 Size[28]

Bedrooms in Home to be Built	1	2	3	4	5	6	7	8
Conditioned Floor Area $_{\text{Benchmark Home}}$	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 DOE Zero Energy Ready Home HERS Index Target Score, but may be used for the incremental HERS Index points needed for the Size Adjustment Factor.

Size Mod. Factor = $[CFA_{\text{Benchmark Home}} / CFA_{\text{Home to Be Built}}]^{0.25}$

[Not to Exceed 1.0]

Performance Path Example
CZ4 Prototype - 4 BR, 2400 SF

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

Specification	Target Home Spec	Design Home
AGW Insulation	R20 or R13+5	R21
Attic Insulation	R49 (U=0.026)	R50
Basement Walls	R10/13	R10
Windows	U=0.30; SHGC=0.27	U=0.30; SHGC=0.27
Infiltration	2.5 ACH50	3.0 ACH50
Ducts	Total ≤ 8 CFM25 per 100 SF of CFA; Leakage to outdoors ≤ 4 CFM25 per 100 SF of CFA	Total leakage 288 CFM25 Leakage to outdoors 140 CFM25
Furnace AFUE	90	90
A/C SEER	15	15
Whole-House Mech. Vent.	77 cfm; 1.4cfm/W no heat exchange;	77 cfm; 8.0 cfm/W exhaust-only
Water Heater	ENERGY STAR	Gas storage 0.67 EF
HERS Index	**52**	**52 COMPLIES!**

THANK YOU!

- You have now completed the DOE Zero Energy Ready Home Orientation Training course.

- For builders, raters, and other interested in partnering with the DOE Zero Energy Ready Home program, please visit the website to review the Partner Agreement:

Thank You

For More Information:

www.buildings.energy.gov/ZERO

e-mail Contact:

zero@newportpartnersllc.com

Upcoming Events:

- 2014 Housing Innovation Awards – Awards Ceremony in September
- Technical Training Webinars (Indoor airPLUS – next week)
- Zero Net-Energy Trainings (throughout U.S.) - ongoing