High Performance Homes:
Top Innovations from Building America?

Energy Design Conference
Duluth, MN

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MOVING TO HIGH PERFORMANCE HOMES: WILL THEY BE ROBUST OR FRAGILE?

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

  "This educational offering is recognized by the Minnesota Department of Labor and Industry as satisfying **1.5 hours** of credit toward **Building Officials and Residential Contractors** continuing education requirements."

  For additional continuing education approvals, please see your credit tracking card.

MOVING TO HIGH PERFORMANCE HOMES: WILL THEY BE ROBUST OR FRAGILE?

- Part 1: Making a Case for Robust
- Part 2: Top Innovations from BA
- Part 3: DOE Challenge Home

=> Where have we been, where are we, and where do we need to go!

OVERARCHING THEMES

- We can and must do better!
  - Challenge ourselves towards better performance
- Existing technology can get us there, but …
  - We need to reduce the focus on products.
  - We must embrace more robust systems.
  - We need improvement in design & execution.
- Together we must find more robust designs, technologies, and processes for the future.

TOTAL BUILDING PERFORMANCE DEMANDS A "SYSTEMS APPROACH"

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

- If properly designed, constructed, and operated the whole should be more than the sum of the parts.

CAN WE GET MORE FOR LESS?

		Performance		
		Poorer	Same	Better
Costs	More	very bad	bad	likely
	Same	bad	*	good
	Less	likely	good	possible

KEEPING OUR EYE ON THE BALL

- Is high-performance – especially health and safety, long-term energy efficiency, and building durability – built into our current game plan?

- Reminder: In the past, excessive energy consumption provided forgiveness at many different levels of building performance.

KEEPING OUR EYE ON THE BALL

- Is it possible that we are putting our eggs into a very fragile basket?
  - It appears that some of the designs, systems, materials, and operations are falling short of our performance expectations.

KEEPING OUR EYE ON THE BALL

- Is it possible that we have over-invested in things and under-invested in design and execution?
  - How many times have you heard that we no longer have a qualified, skill work force in construction?
  - If that is true, it is even more important that we find designs, systems, materials, and methods that are not as installation sensitive.

KEEPING OUR EYE ON THE BALL

- Are we not being realistic about the process?
  - Are we investing in risky designs, systems, and materials and hoping for perfect execution?
  - Are we counting on perfect homeowner operation and maintenance?

A GROWING EPIDEMIC: NOTMYJOBITIS

HIGH-PERFORMANCE HOUSING: MAKING THE CASE FOR ROBUST

- We must ensure our high-performance houses meet our expectations today and in the future?

- High-performance houses will push the envelope (mechanical systems, occupants, etc).
  - 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

HIGH-PERFORMANCE HOUSING: MAKING THE CASE FOR ROBUST

- Robust
  - Strong, healthy, and hardy in constitution
  - Built, constructed, or designed to be sturdy, durable, or hard-wearing
  - A system that is able to recover from unexpected conditions during operation
- Things that seem to work regardless what your subs, nature, or client throw at them!

HIGH-PERFORMANCE HOUSING: MAKING THE CASE FOR ROBUST

- Fragile
  - Easily broken; not having a strong structure
  - Unlikely to withstand severe stresses and strains

- Things that make perfect sense on paper, but seem to be “too fickle” to handle the real life situations they encounter.

HIGH-PERFORMANCE HOUSING: MAKING THE CASE FOR ROBUST

- When push comes to shove; will your home's response be one of robustness or fragility?
  - Climate extremes
  - Abnormal interior conditions
  - Execution errors
  - Unusual operations
  - Neglected maintenance

HIGH-PERFORMANCE HOUSING: MAKING THE CASE FOR ROBUST

- Designs
  - House
  - Mechanicals
- Systems
  - Envelope
  - Equipment
- Materials/Products
  - Components
  - Assemblies
- Methods (Execution)
  - Techniques
  - Process/Sequence
  - Delivery system
- Operation & Maintenance
  - Normal operation
  - Preventative maintenance
  - Emergency response
  - Repair & replacement

LET'S START WITH FRAGILE

- Fragile Designs
  - Floors over unconditioned space
    - tuck-under garages
    - bonus rooms over garages
    - cantilevered floors
  - Complex roofs and roof/ wall connections
  - Tall window walls
  - Upper level laundry rooms

LET'S START WITH FRAGILE

- Fragile Systems
  - Interior foundation insulation
    - especially air & vapor permeable insulation
  - Ductwork outside the thermal envelope
    - especially below slab and attic ductwork
  - Vented crawl spaces
  - Cantilevered floors

LET'S START WITH FRAGILE

- Fragile Products/Materials
  - Natural draft water heater
    - especially in tighter homes
  - Flex duct
  - Cultured stone exteriors
    - w/o air space & drainage
  - Low-density attic insulation
  - Carpet on slabs
    - especially below grade

LET'S START WITH FRAGILE

- Fragile Execution
  - Tuck-under garages & bonus rooms over garages
  - Flanged windows
  - Air sealing complex ceiling designs
    - especially chases and recessed can lights
  - 2x6 walls with housewrap, OSB, batt, and poly

LET'S START WITH FRAGILE

- Fragile Operation
  - Air intakes
    - ventilation, make-up, or combustion air
  - Carpeting
  - Large range vents
  - Washing machines w/o drain pans

NOW LET'S THINK ABOUT ROBUST

- Robust Designs
  - Simple house geometry
  - Simple roof geometry
  - Detached garage

NOW LET'S THINK ABOUT ROBUST

- Robust Systems
  - Exterior insulation
    - foundation (with possible exception of above grade)
    - walls (with possible exception of shear walls)
  - Comprehensive & tested air sealing (0.1 cfm/sf)
  - Vented attics in cold climates
  - Active subslab depressurization systems

NOW LET'S THINK ABOUT ROBUST

- Robust Products/Materials
  - Sealed combustion equipment
  - Low-sone spot ventilation with sensors/controls
  - Low-e, warm-edge, NFRC-rated glazing systems
  - Vinyl siding (w/o contoured backing)
  - Integral foundation insulation

NOW LET'S THINK ABOUT ROBUST

- Robust Execution
  - Vented-rain screen
  - Open web floor trusses
  - Foundation waterproofing with drainage
  - Spray foam rims and bands

NOW LET'S THINK ABOUT ROBUST

- Robust Operation
  - Central exhaust systems
  - Well-drained foundation
  - Warm-edge windows
  - Basement (lowest level) laundry w/ pan and drain

MAKING THE CASE FOR ROBUST

- Robust: Don't think of it as a thing, but more of a conceptual way of evaluating new designs, systems, materials, execution, and operation.

- There are a number of ways to think of robust.
  - It is idiot proof, bullet proof, and unlikely to fail.
  - If it fails, it won't hurt anything else.
  - If it fails, it will be easy to repair or replace.
  - If it fails, there is a planned back-up or redundancy.

CHALLENGING QUESTION

- Did the move to …
  - bigger and more complex designs, with newer (perhaps, untested) materials
  - along with poor systems design and integration
  - and changes in the industry structure, trades, codes and standards
  - with clueless homeowners
- push us towards fragile and unacceptable performance?

CHALLENGING QUESTION

- What must we do to move away from the fragile edge and move towards more robust
  - Designs,
  - Systems,
  - Materials,
  - Methods, and
  - Operation?

MAKING THE CASE FOR ROBUST

- A Call for High-Performance Homes

- But it will demand a new approach. We must
  - design and engineer (not just build) our homes.
  - build forgiveness/tolerance into all systems.
  - build redundancy into critical materials.
    - or make it easy to repair and/or replace key components
  - develop a more predictable delivery system.
  - provide continuous feedback to the occupant.

A PATH FORWARD

- Develop New Partners
  - Energy Raters
  - Home Performance Consultant
  - Other Resources
    - Building America

A PATH FORWARD

- Tap Building America Resources
  - Publications & Case Studies
  - Top Innovations “Hall of Fame”
  - DOE Challenge Home
  - Building America Solutions Center

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.

Building AMERICA SM
U.S. Department of Energy

Industry Research Teams

BA-PIRC

BARA
BUILDING AMERICA RETROFIT ALLIANCE

ARIES
Collaborative

Alliance for Residential Building Innovation

NorthernSTAR

CARB
Consortium for Advanced Residential Buildings

bsc Building Science Corporation

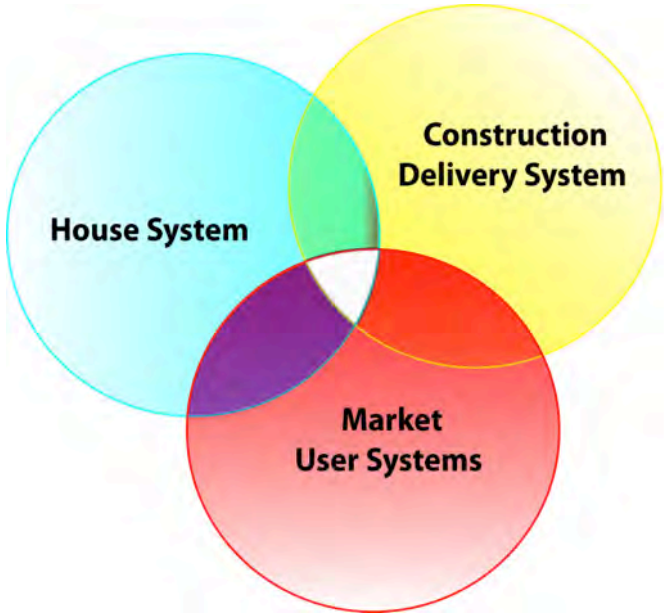
IBACOS
| Home Quality + Performance |

NAHB RESEARCH CENTER

PARR
The Partnership for Advanced Residential Retrofit

NorthernSTAR
A Building America partner in research, innovation, and real home solutions.

- 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



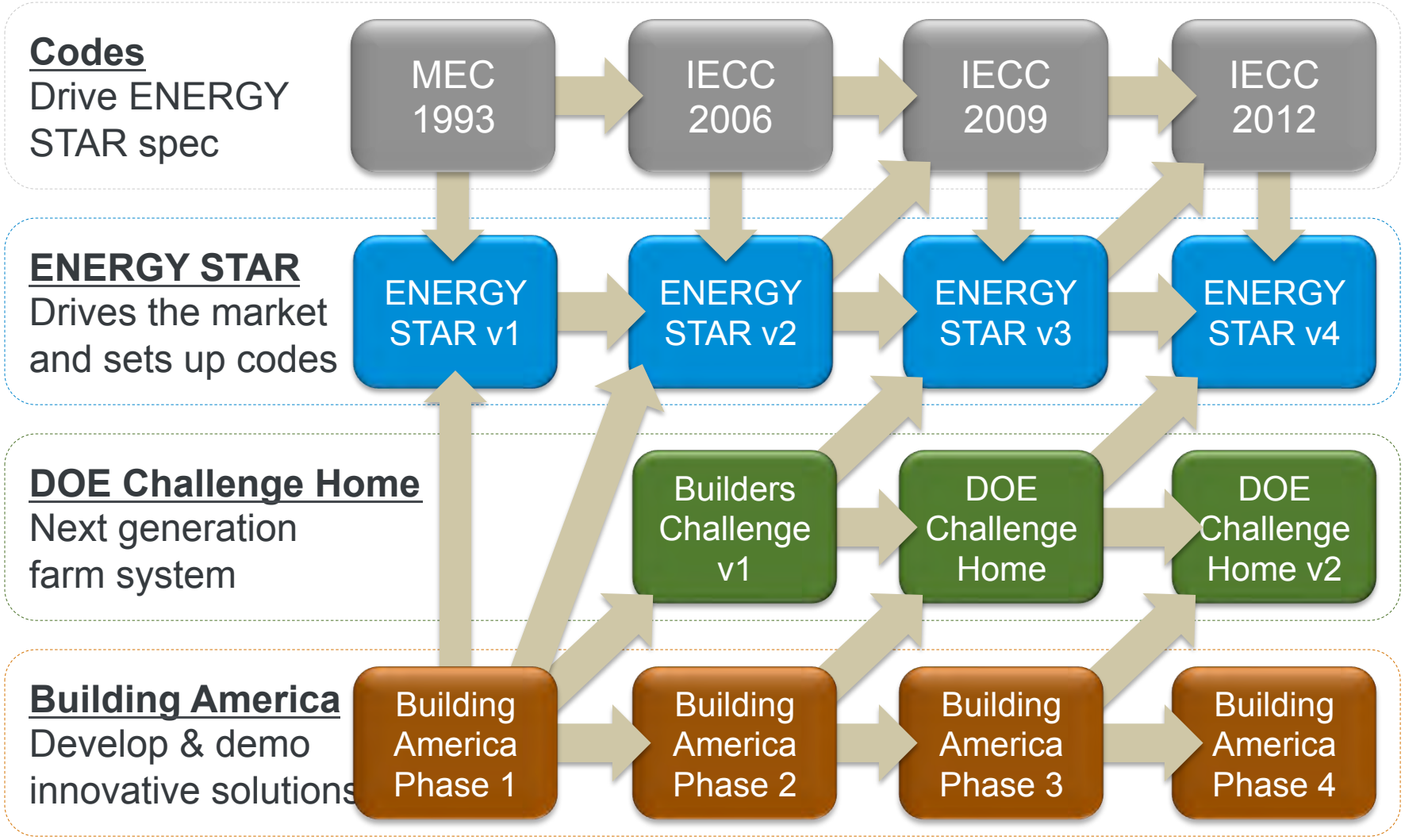
NorthernSTAR

A Building America partner in research, innovation, and real home solutions.

- 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

Why Building America Innovations

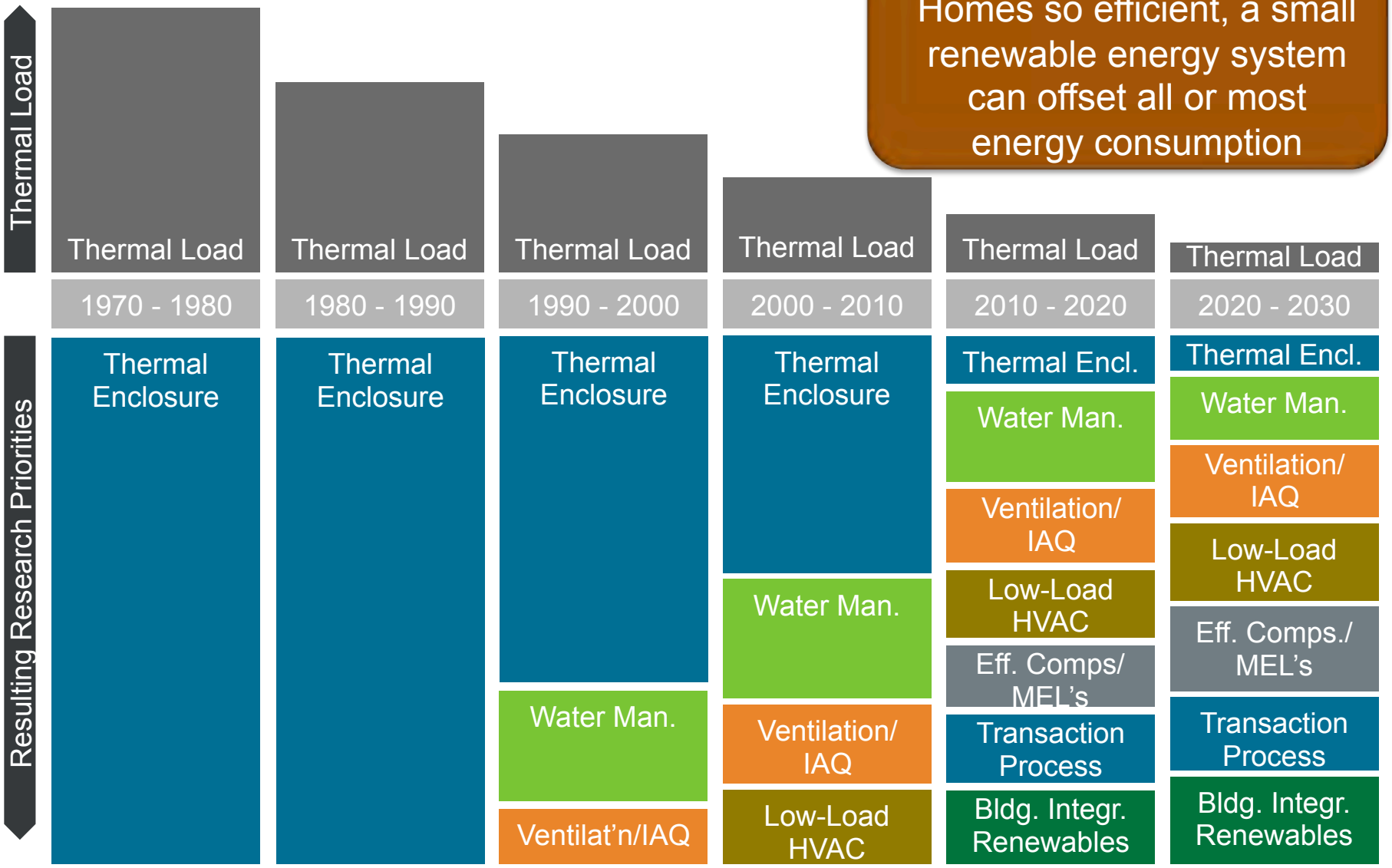
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy



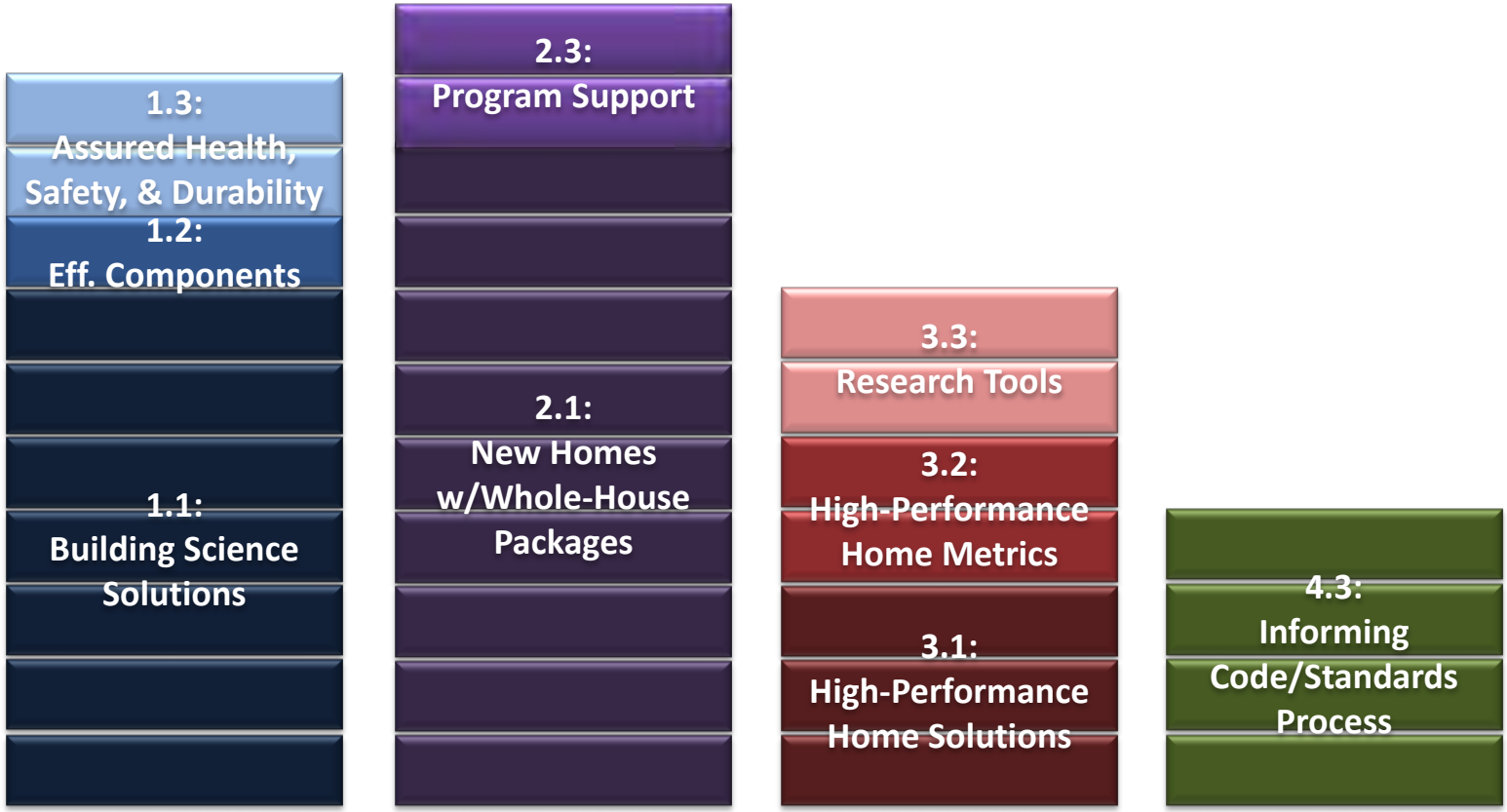
Building America Strategy

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

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

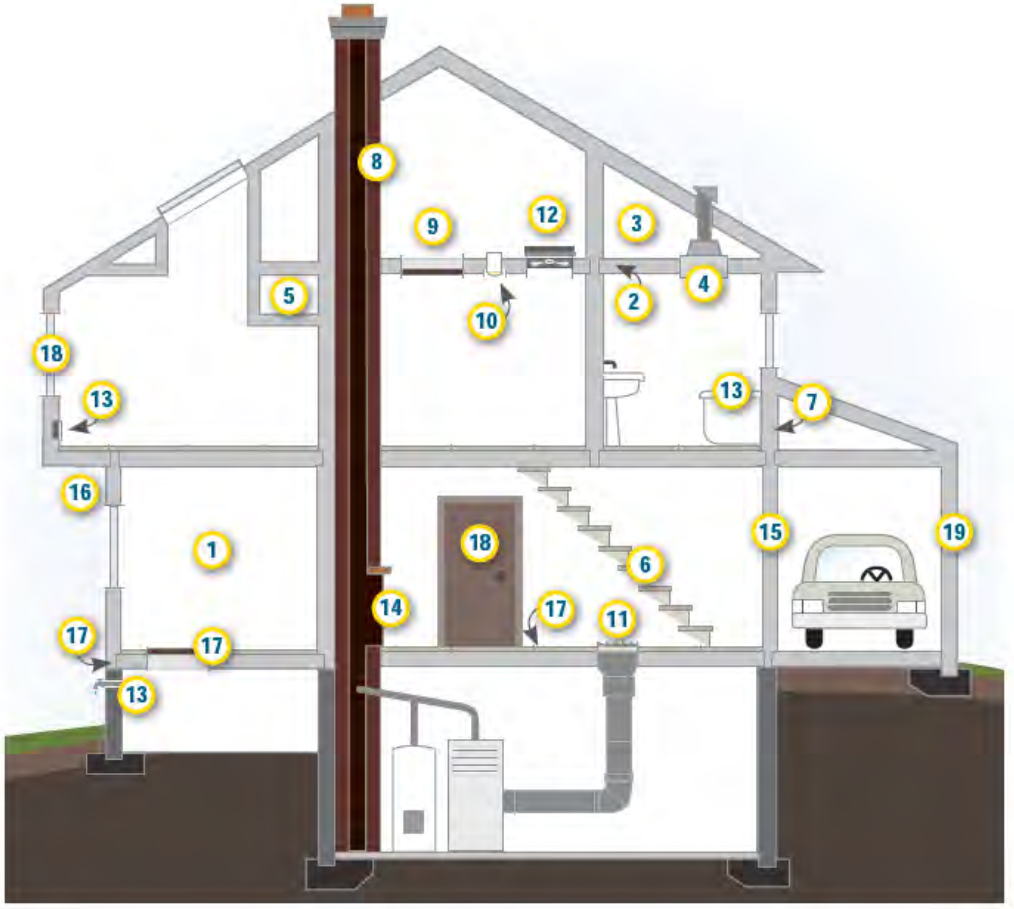


BA TOP INNOVATIONS 'HALL OF FAME'



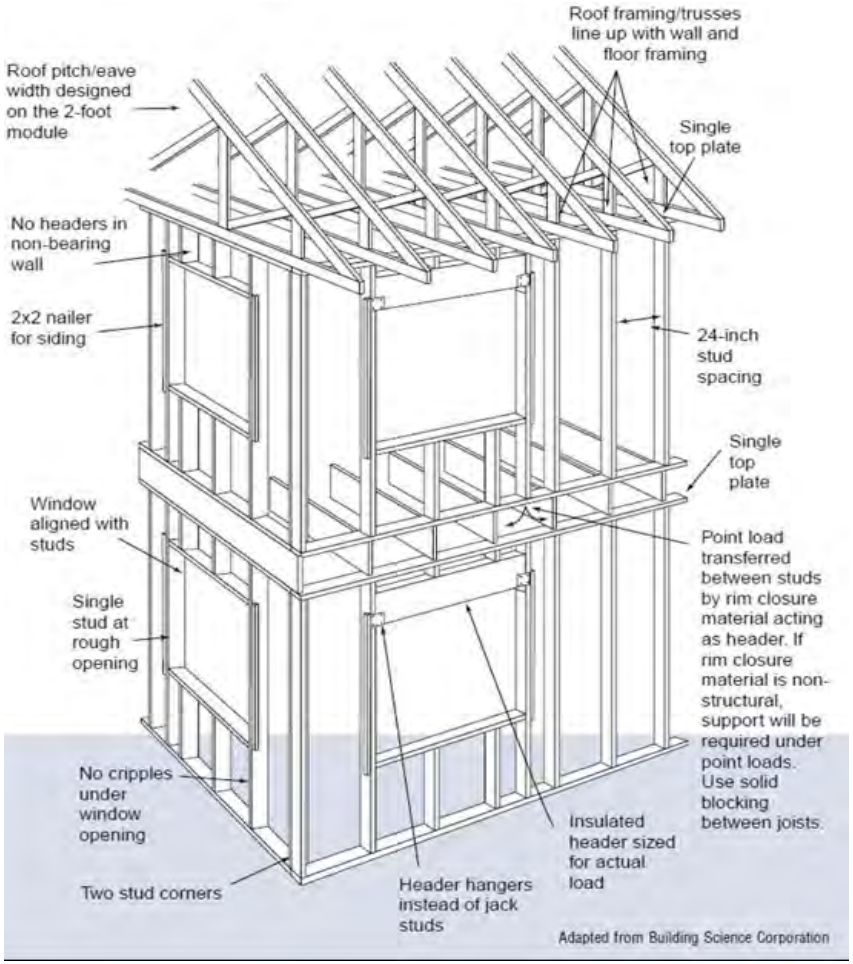
BA TOP INNOVATIONS 'HALL OF FAME'

- 1. Thermal Bypass & Air Barrier Specification
  - Minnesota is ahead of the curve here.
  - But we also have a greater need to push it even further.



BA TOP INNOVATIONS 'HALL OF FAME'

- 2a. Advanced Framing Systems & Packages
  - great concept
  - sizable lumber savings
  - improved energy performance
  - but is a system that requires buy-in and excellent design and execution oversight



BA TOP INNOVATIONS 'HALL OF FAME'

- 2b. Next Generation Advanced Framing
  - continuous drywall?
  - reduce headers
  - extended sheathing w/ top chord overhang

BA TOP INNOVATIONS 'HALL OF FAME'

- 3. High R-Value Walls
  - evidence that we are moving in that direction
  - but there are "good, bad, and ugly" options

BA TOP INNOVATIONS 'HALL OF FAME'

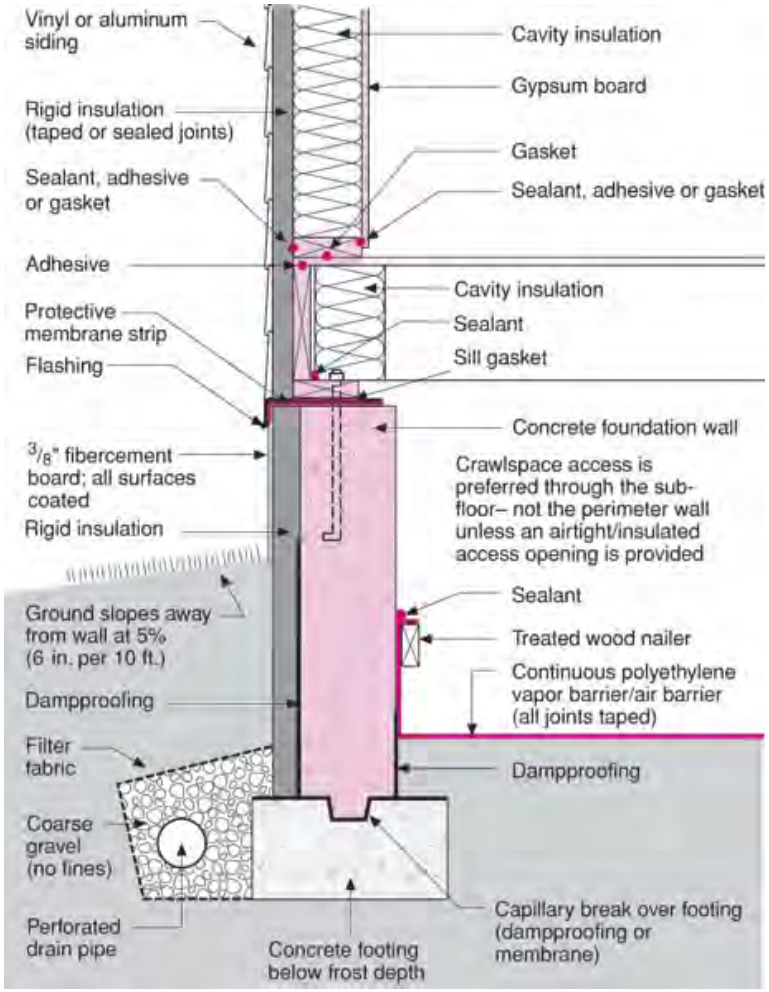
- 4. Exterior Rigid Insulation Systems
  - a leading solution to move away from cavity-insulated, two-sided walls
  - but requires a systems approach

BA TOP INNOVATIONS 'HALL OF FAME'

- 5a. Unvented, Conditioned Attics
  - adds great design and duct flexibility
  - details are critical

BA TOP INNOVATIONS 'HALL OF FAME'

- 5b. Unvented, Conditioned Crawlspaces
  - clear winner for our climate zone!



BA TOP INNOVATIONS 'HALL OF FAME'

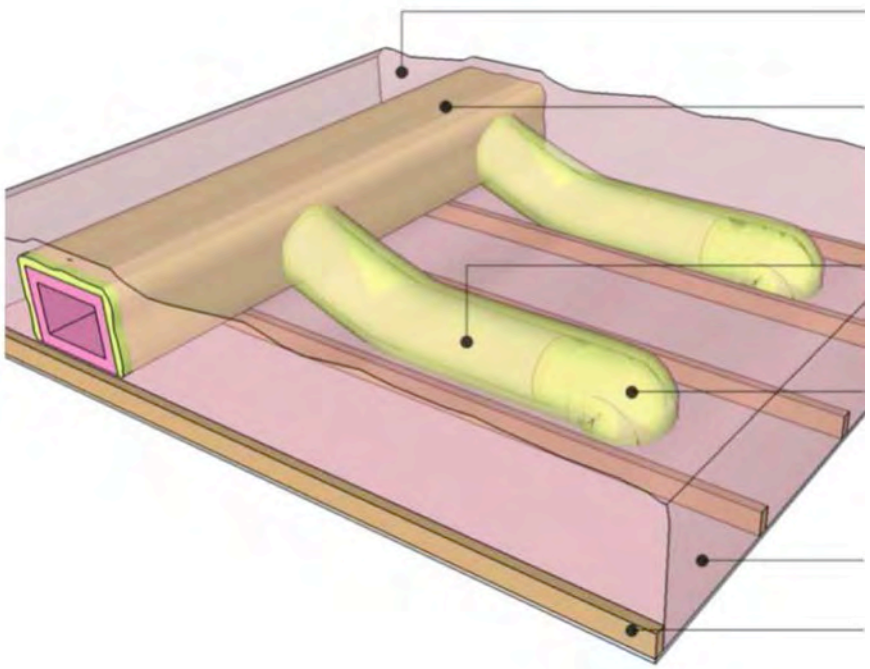
- 6. Integration of HVAC System Design with Simplified Duct Distribution
  - swapping quality for quantity

BA TOP INNOVATIONS 'HALL OF FAME'

- 7a. Ducts in Conditioned Space
  - easier said than done!

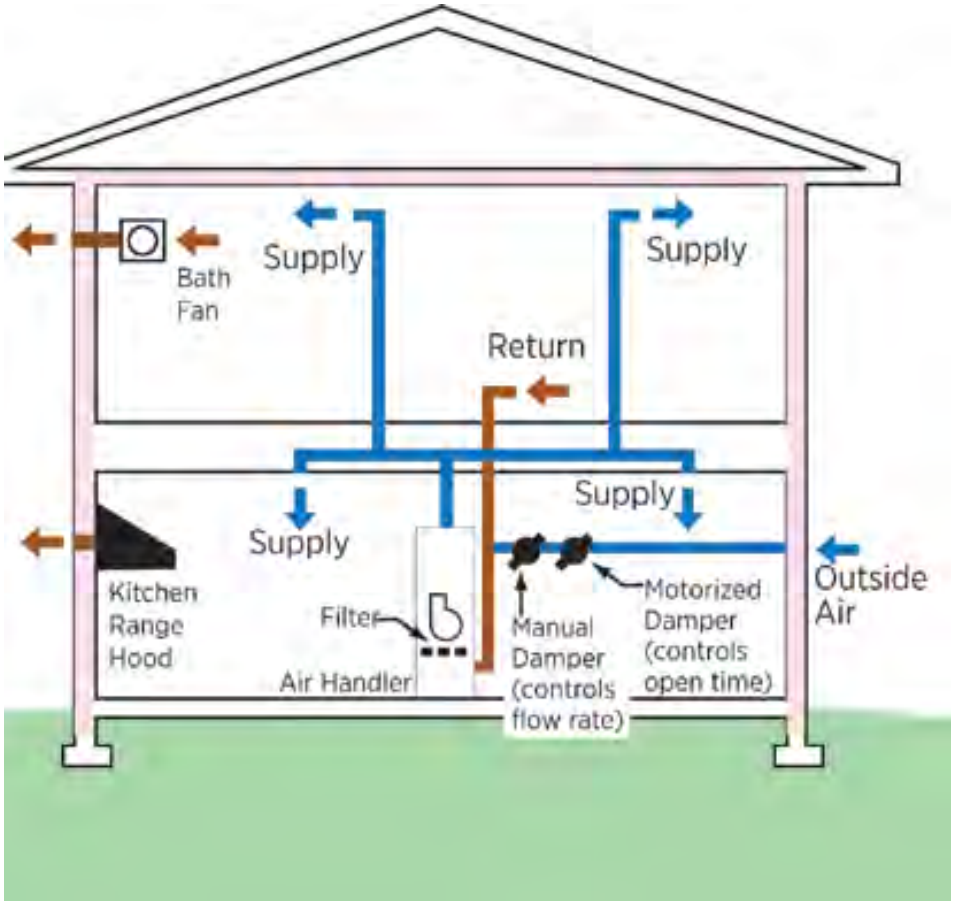
BA TOP INNOVATIONS 'HALL OF FAME'

- 7b. High-Performance Ducts
  - critical for attic ducts
  - similar solutions must be used for floors over unconditioned spaces



BA TOP INNOVATIONS 'HALL OF FAME'

- 8. Low-Cost, Integrated Ventilation Systems
  - built-in distribution
  - can integrate heat or energy recovery
  - an interim solution for proposed code



BA TOP INNOVATIONS 'HALL OF FAME'

- 9. Quality Management System Guidelines
  - a means to address robust design and execution

BA TOP INNOVATIONS 'HALL OF FAME'

- 10. Zero Net Energy Ready Single Family Homes
  - current focus on DOE Challenge Home

PAT'S PICKS

- Dry and Warm Foundation
  - Quality exterior waterproofing
  - R-15 exterior insulation
    - extruded polystyrene or semi-rigid fiberglass
  - Good vertical drainage
    - with 6" impermeable cap
  - Exterior draintile protected by rock & fabric
  - Capillary break between footing and wall

PAT'S PICKS

- Dry and Warm Slab w/ RRNC
  - 4" of ¾" and up aggregate; no fines
  - 1 to 3" of extruded polystyrene
  - Poly vapor retarder (optional)
  - 4" high quality slab; all joints and edges sealed
  - Sealed sump basket
  - 3 or 4" passive vent from below slab to the roof
    - with electrical box nearby in attic for fan activation

PAT'S PICKS

- Combi Space and Water Heating
  - ECM driven air handler on an efficiently planned, airtight duct system.
  - Properly sized hot water and AC coils
  - Sealed combustion water heater (or small boiler)
  - Both airflow and water temperature can be modulated to meet loads and comfort
  - Can be used for circulation and/or ventilation air distribution
  - Water storage could be handy for excess energy

PAT'S PICKS

- Ventilation Integrated with Forced Air
  - Use the forced air system for supply air to all habitable rooms
    - could tie in exhaust air in some situations.
  - Provides an opportunity for both conditioning and MERV 10+ filtration of outside air
  - Can be used for both continuous and boost ventilation
  - Can incorporate heat/energy recovery

PAT'S PICKS

- Whole House Dehumidification
  - Since ventilation does not equal humidity control, it is critical to provide systematic dehumidification.
  - Independent control for indoor humidity for condensation, mold, and dust mites
  - Aid in summer comfort
  - Might be able to use a smart, variable output AC with combo space heating.

PAT'S PICKS (& WISH LIST)

- Windows Designed for Integration
  - High-quality low U-value, warm-edge window
  - Comes with a custom fit sill pan and head flashing with end dams
  - Flanges are air/water tight with tabs to integrate with flashing and weather resistive barrier

PAT'S PICKS (& FAVORITE)

- Exterior Thermal & Moisture Mgmt. System
  - Build the entire structure; foundation, floor systems, walls, and roof
  - Wrap the entire envelope with a "peel & stick" membrane integrated with openings/penetrations
  - Add rigid foam insulation 2 to 3" on foundation, 3 to 4" on walls and 6 to 8" on the roof.
  - Add furring strips, overhangs, etc.
  - Install siding; roof sheathing and roofing.


STERLING
4 11:54AM


L S
722 2345


Shurtape


GRACE
Bituthene
Perm-A-Barrier
GRACE VYCOR PLUS
GRACE VYCOR


GRACE
Bituthene


METROPOLITAN

DOE Challenge Home

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Building America
DOE Challenge Home

Lots of Recognition Choices…

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

Zero Net-Energy Ready Homes

Made Simple

ZNERH Strategy

Ultra-High Efficiency

- Enclosure
- Low-Load HVAC
- Components

+

High-Performance

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

Efficiency + Performance Example

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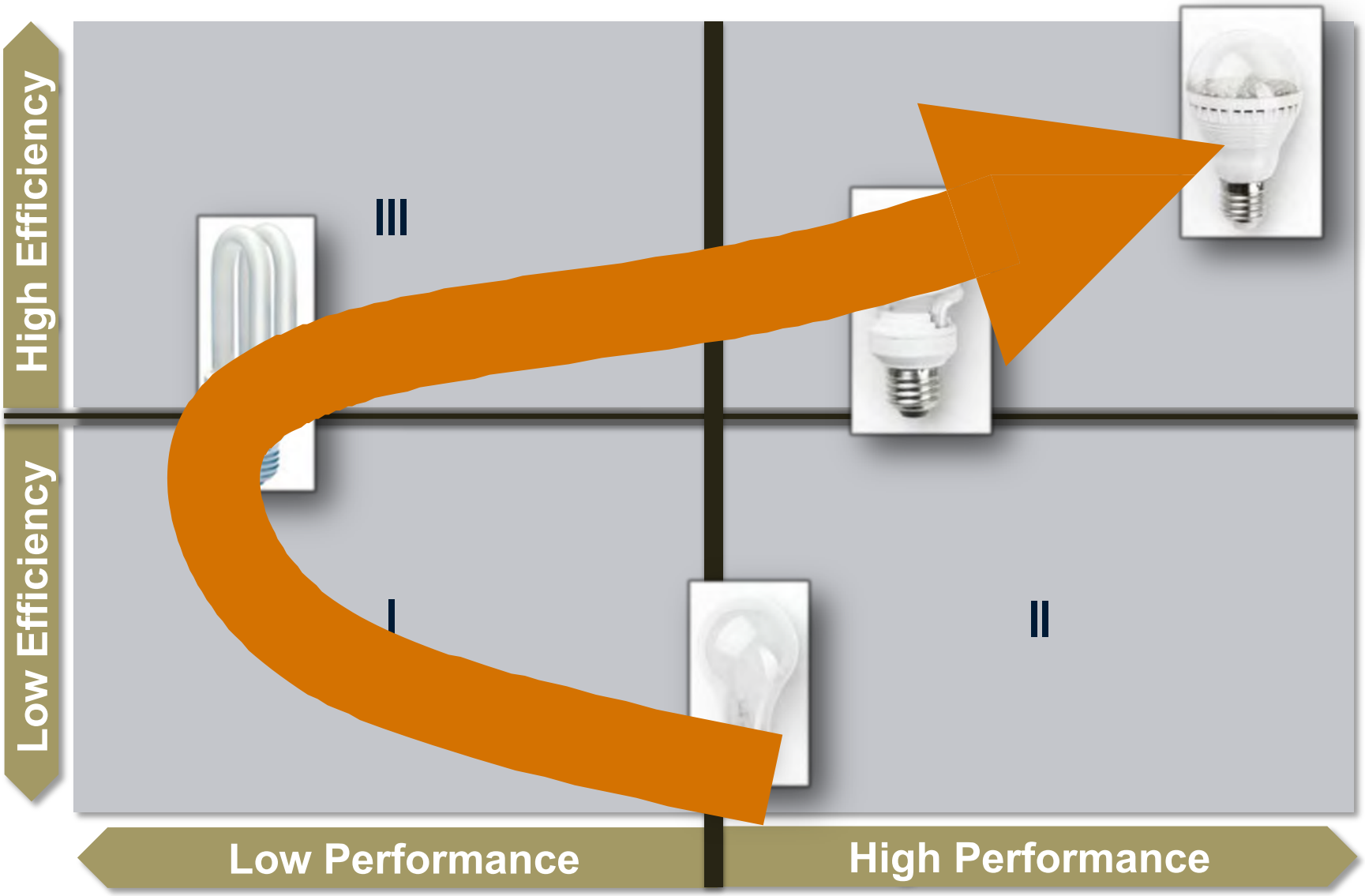

DOE Challenge Home Path

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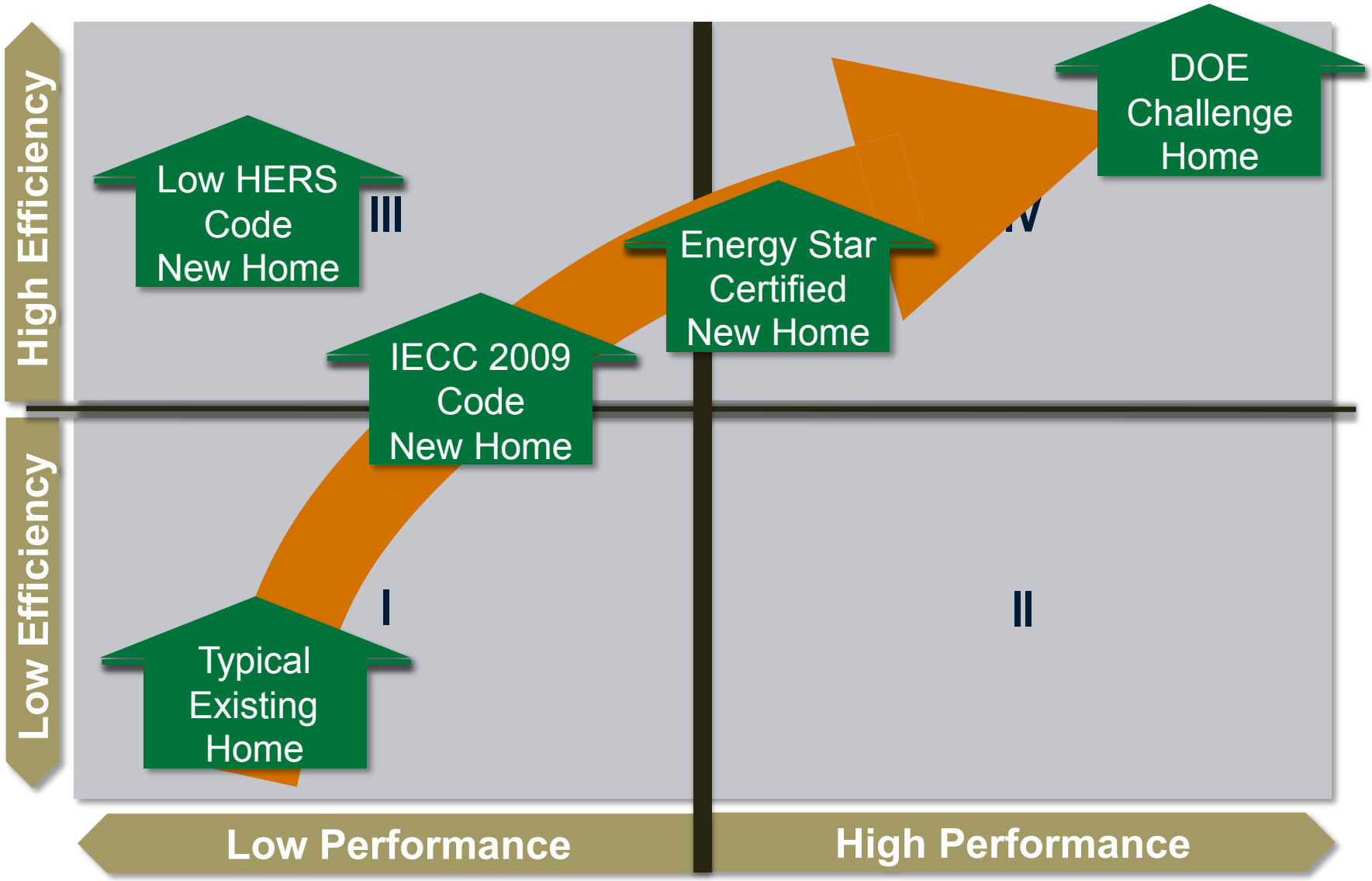


The Pitch

By constructing DOE Challenge 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 Challenge 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 Net-Energy Ready Homes

Business Case

Old Business Solution:

Minimize Cost

to attract and convince buyers
to choose your product over your competition
and the existing housing market.

New Business Solution:

Maximize Value

so homebuyers are compelled
to want new housing again
and choose your home
over competitor's products.

Zero Net-Energy Ready Homes

Value Proposition

Value Proposition #1

ACME Homes

U.S. Department of Energy

Exclusive

Only the top builders in the country
meet extraordinary levels of excellence
specified by U.S. Department of Energy (DOE) guidelines.

Feel great knowing you selected a 'best-in-class' home.

ACME Homes

U.S. Department of Energy

Advanced Technology

Starting with a solid foundation of building science specified by ENERGY STAR for Homes, every DOE Challenge Home adds advanced technology features from DOE's world-class research program, Building America.

Look for the proven innovations that work better.

Value Proposition #3

ACME Homes

Visionary

Every DOE Challenge Home embraces a unique opportunity during design and construction to meet and exceed forthcoming codes. Additional details can save $1,000s installing a solar system down the road.

Rest assured your largest investment will meet future expectations.

ACME Homes

Ultra-Efficient

Every DOE Challenge Home is so energy efficient,
a small solar system can often offset most, or all, of your utility bills.
We call this ***Zero Net-Energy Ready.***

Never worry
about rapidly increasing utility costs.

Value Proposition #5

ACME Homes

Comfort Plus

Extraordinary attention to detail and better equipment
included in every DOE Challenge Home
surround you with even temperatures, low humidity, and quiet
in every room on every floor.

Take home satisfaction to a new level.

Value Proposition #6

ACME Homes

Healthful

The same way we want nutritious food on our plates,
we want healthy air in our homes.
Every DOE Challenge Home has a comprehensive package of measures that minimize dangerous pollutants, provide continuous fresh air, and effectively filter the air you

Provide a healthier home for your family.

Value Proposition #7

ACME Homes

Quality-Built

Advanced construction practices and technologies are specified for every DOE Challenge Home, but that is not enough. Independent verifiers rigorously inspect and test each home with detailed checklists diagnostics.

Hold your home to a higher standard.

U.S. Department of Energy

Value Proposition #8

ACME Homes

Enduring

The advanced levels of energy savings, comfort, health, durability, quality, and future performance in every DOE Challenge Home deliver exceptional value.

Value that will stand the test of time.

Live life in a home built to last.

Value Proposition #9

ACME Homes

Smart

It costs less to own our DOE Challenge Homes
because the monthly energy savings can easily exceed
the increased monthly mortgage cost for all the added value

Spend less for a better home.

Building America

DOE Challenge Home

Ensure Comprehensive Building Science

with complete systems to control air, thermal and moisture flow.

[comply with ENERGY STAR Certified Homes v3]

ZNERH Step #2:

Add proven technologies and best practices
to optimize the thermal enclosure and HVAC system.
[apply innovations from DOE's Building America program]

ZNERH Step #3:

Include energy efficient components

to complement the high-performance enclosure.

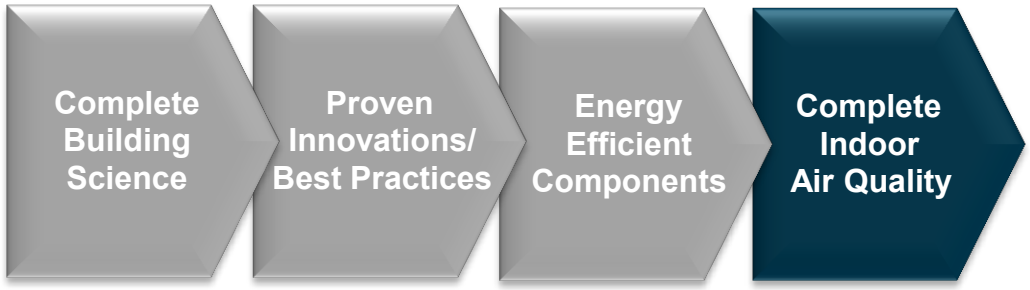
[specify ENERGY STAR appliances, lighting, and fans]

ZNERH Step #4:

Provide comprehensive pollutant control

because IAQ is critical in homes this tight and well-insulated.

[substantially comply with EPA Indoor air Plus]

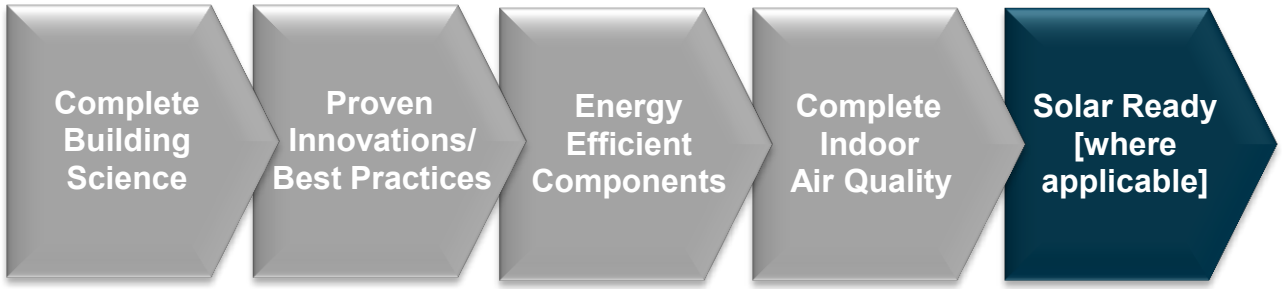


ZNERH Step #5:

Ensure low/no-cost details that can save $1,000's downstream to install solar

since homes are ready for zero net-energy performance.

[implement elements of EPA Renewable Ready checklist]

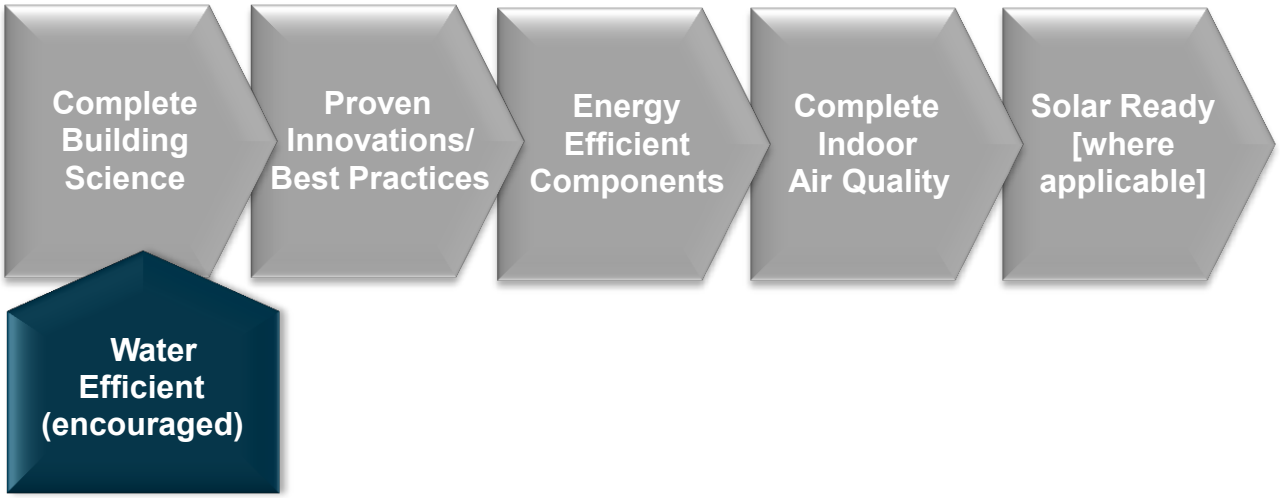


ZNERH Step #6:

Start addressing related water efficiency issues

to complete environmentally responsive strategy.

[encourage EPA WaterSense specifications]

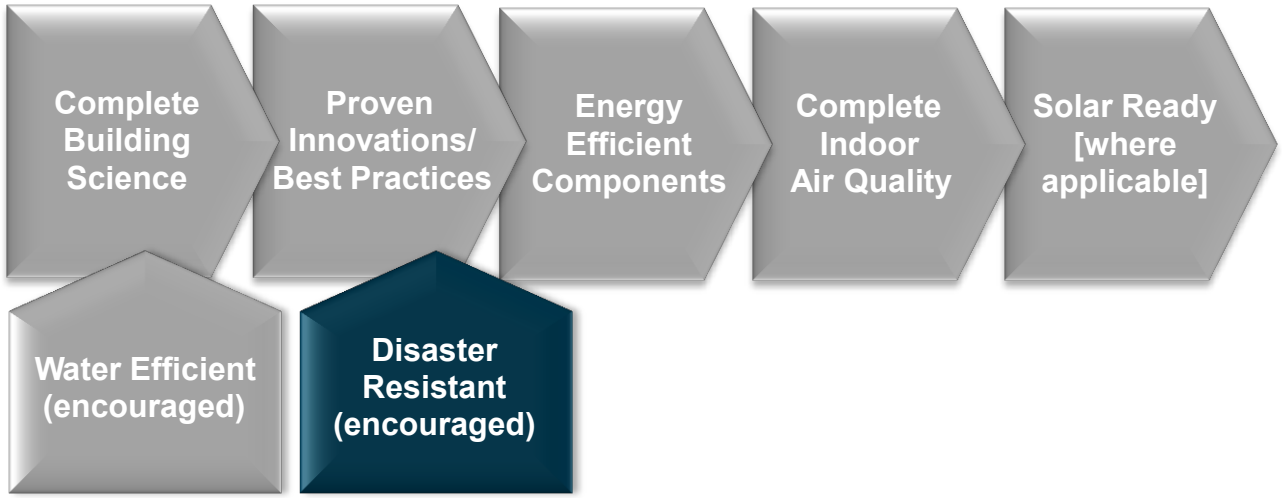


ZNERH Step #7:

Don’t ignore disaster resistance

to help ensure homes built this well last 100’s of years.

[encourage IBHS Fortified Homes specifications]



ZNERH Step #8:

Integrate QA/QC practices

to help ensure the success of builder partners.

[encourage Building America QA best practices]

ZNERH Summary:

All the steps add up to DOE Challenge Home...

ZNERH Definition

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

DOE Challenge Home Specs

Technical Specifications:

- Building Science
- Best Practices
- Ducts in Conditioned Space
- Super Air-Tight Construction
- 2012 IECC Insulation
- Efficient Low-Load HVAC
- Efficient Components
- Indoor Air Quality
- Solar Ready
- Water Conservation
- Disaster Resistance
- Quality Management

DOE Challenge Home Framework

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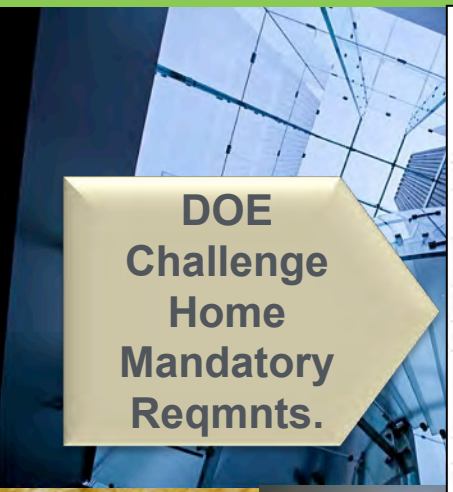


DOE Challenge Home Mandatory Reqmnts.

"Target Home" Design Specs

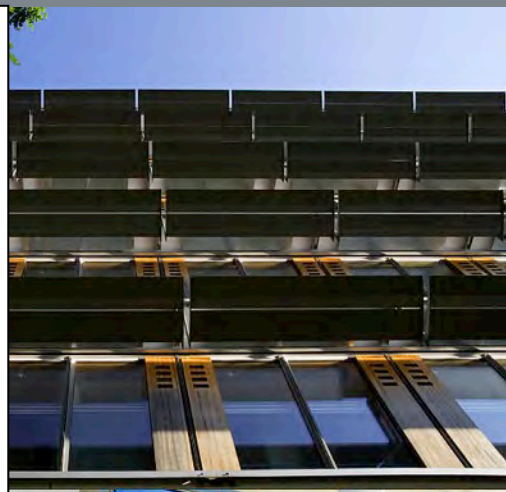
DOE Challenge Home National Program Requirements
April 1, 2012

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

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 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			
• Programmable thermostat (except for zones with radiant heat)			



DOE Challenge Home Framework

Size Adjustment Factor

Exhibit 3: Benchmark Home Size[26]

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

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

DOE Challenge Home Mandatory Requirements

Exhibit 1: DOE Challenge Home Mandatory Requirements for All Labeled Homes

Area of Improvement	Mandatory Requirements
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Encouraged:

- EPA WaterSense
- EPA Indoor airPLUS (full compliance)
- Quality Management
- Disaster Resistance (IBHS Fortified Home)

DOE Challenge Home Target Home Design

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)
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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.

Zero Net-Energy Ready

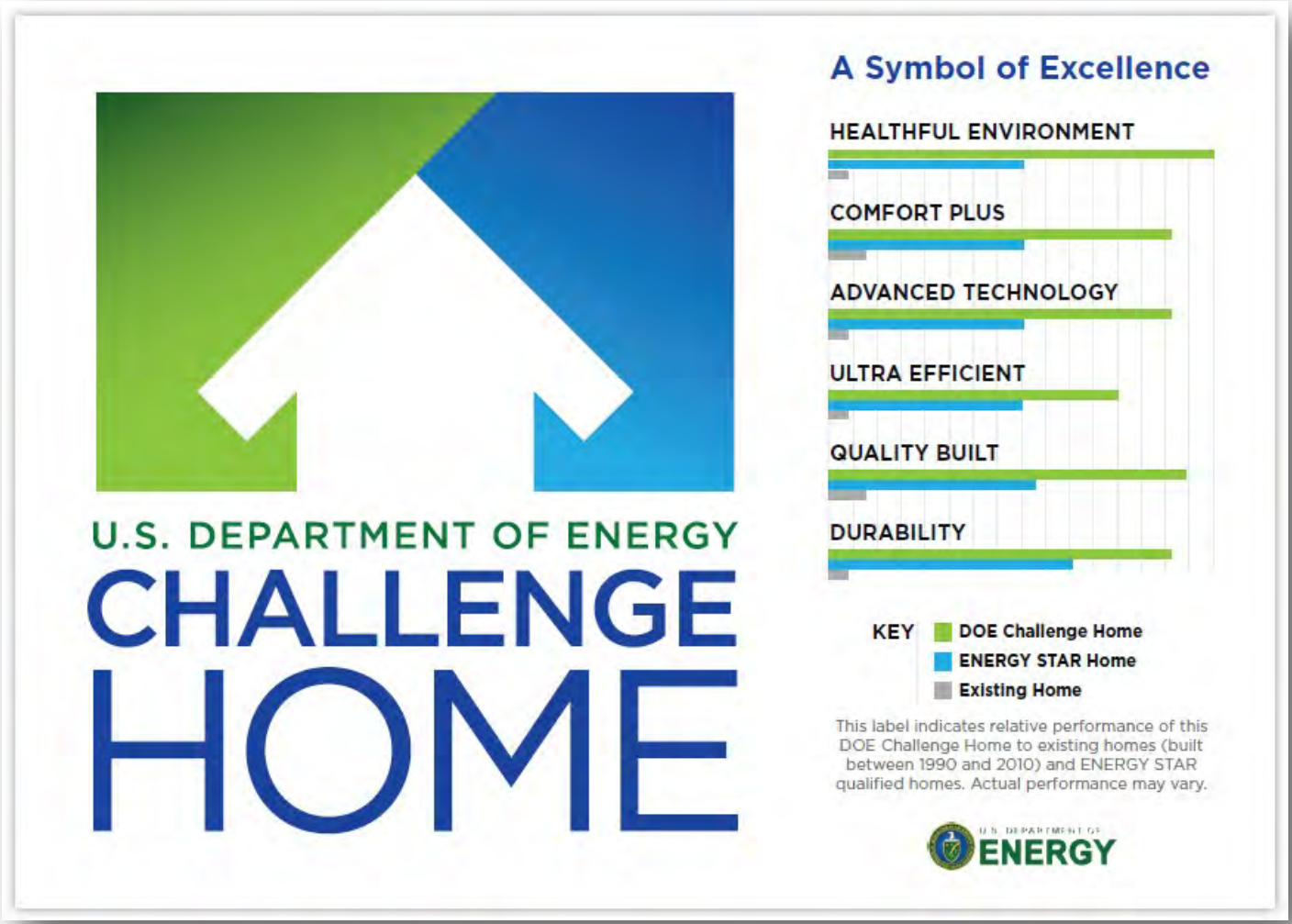
Recognition with DOE Challenge Home

Partner 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

- **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.

Translating Value Proposition



Strong Marketing Message

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

Front Cover

Inside Spread

Back Cover

DOE Challenge Home Opportunities

- **NorthernSTAR DOE Challenge Home Project**
  - Looking for Builder Partners
  - We can provide technical assistance and support

- **Upcoming Builder Orientation Session**
  - March 5, 2014; 8 to Noon
  - BATC Education Center in Roseville, MN
  - Sponsored by Energy Panel Structures

Path to Zero Net-Energy Ready

Zero Net-Energy Ready:

- The New Reality
- Home of the Future
- Builders in Action
- Made Simple
- Business Case
- Value Proposition
- Technical Specifications
- Recognition w/Challenge Home
- Local Solution

For More Information

Visit the Challenge Home web site to learn more and find approved builder partners:

http://www1.eere.energy.gov/buildings/challenge/

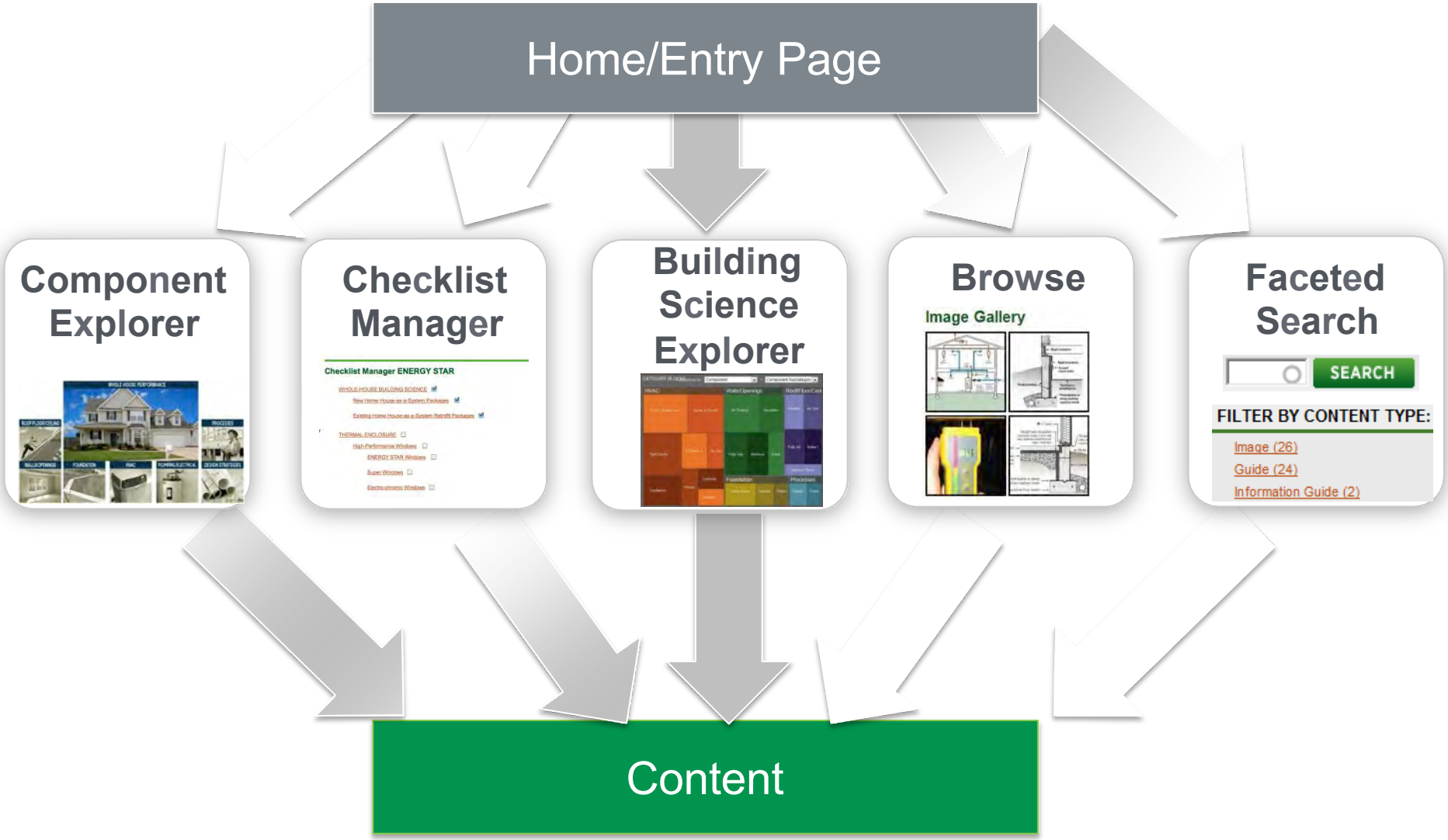
World-Class Research…

Building America Solution Center

BASC.energy.gov

…At Your Fingertips

Multiple Interfaces



Quick Tour: Component Explorer

Walls/Openings
- 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

A. Install a top and bottom plate or blocking at the top and bottom of all knee wall cavities.
B. Back attic knee walls with a rigid air barrier or other supporting material to prevent insulation from sagging and create a continuous thermal barrier*
C. Seal all seams, gaps, and holes of the air barrier with caulk or foam.
D. 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

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

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

- Discussion & Questions

Contact Information

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