Proposed 2011 Specification
ENERGY STAR QUALIFIED HOMES PROPOSED 2011 SPEC

OUTLINE

• Introduction
• Compliance Options
• Mandatory Features
• Checklists
• The Road Ahead
Introduction
A voluntary labeling program that:

- **Defines Energy Efficient**
  - Rigorous Specifications
  - Third-Party Verified

- **Recognizes Builders**
  - Government-Backed Label
  - Web Site, Marketing, Awards
Goal:
- Risk
- Customer Satisfaction
- Differentiation
- Environmental Protection
- National Security

Affordable
Comfortable
Healthy
Durable

Better Home
Lower Cost
Badge of Honor

How:
- Control Air Flow
  - Loads/QA/QC
  - Driving Forces
  - Fans
- Control Thermal Flow
  - Conduction
  - Convection
  - Radiation
- Control Moisture Flow
  - Vapor
  - Bulk

METHOD TO ENERGY STAR MADNESS
Goal:
- < Risk
- > Customer Satisfaction
- > Differentiation
- > Environmental Protection
- > National Security

How:
- Control Air Flow
- Control Thermal Flow
- Control Moisture Flow

Method to Energy Star Madness:
- Affordable
- Comfortable
- Healthy
- Durable

Better Home
Lower Cost
Badge of Honor

Efficient HVAC
Air Sealing
Conduction
Radiation
Vapor
Low-E Windows

Verication
Driving Forces
Fans
Convection
Tight Ducts

1996
Goal:
- Control Moisture Flow
- Control Thermal Flow
- Control Air Flow

How:
- Loads/QA/QC
- Driving Forces
- Fans
- Conduction
- Convection
- Radiation
- Vapor
- Bulk

Efficient HVAC
- Air Sealing
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Efficient WH
- Air Barriers
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- Air Barriers

1996 Verification
- Air Sealing
- Air Sealing
- Air Sealing
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- Air Sealing

2006 Efficient Lgtg./Appl.
- Insulation Alignment
- Insulation Alignment
- InsulationAlignment
- Insulation Alignment
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- Insulation Alignment

Better Home
- Lower Cost
- Badge of Honor

Affordable
- Comfortable
- Healthy
- Durable
**ENERGY STAR QUALIFIED HOMES PROPOSED 2011 SPEC**

**WHY NEW SPECIFICATIONS?**

- **Codes Ramping Up**
- **Standard Business Practices Ramping Up**
- **Significant Value Opportunities**
<table>
<thead>
<tr>
<th><strong>Goal</strong></th>
<th><strong>Solution</strong></th>
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<tbody>
<tr>
<td>Ensure comprehensive building science approach</td>
<td>• Additional Mandatory Requirements</td>
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| Ensure high-efficiency equipment and products more consistently included | • Additional Mandatory Requirements  
• Reference Design vs. Fixed HERS Score |
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| Ensure high-efficiency equipment and products more consistently included | ▪ Additional mandatory requirements  
▪ Reference design vs. fixed HERS Score   |
| Enhance quality control of verification process | ▪ Additional mandatory checklists                       |
| Reduce carbon emissions from bigger homes     | ▪ Size Adjustment Factor                                |
Why Change Fixed HERS Score?

- Technical Challenge
- Built-in Flexibility
- Savings More Accurately Depicted
FACTORS AFFECTING HERS SCORE

- Size
- # Bedrooms
- Location within Given Climate Zone
- Aspect Ratio
- Foundation Type
- Attached vs. Detached
- Fuel Type
HERS Indices of Various Combinations of Configurations of a CZ4 ES Home

[Bar chart showing HERS indices for different configurations of homes, comparing gas and electric usage.]
HERS Indices of Various Combinations of Configurations of a CZ4 ES Home

Base Case-Lex-2-story-2,200sf-3BR-uncond.bsmt.
Base Case in Cincinnati
Nash-3story-3,300sf-4BR
Nash-3story-3,300sf-4BR-Tndunit
Base Case in Nashville
Nash-1story-1,100sf-2BR
sfl.fam.det.

GAS
ELECTRIC
HERS Indices of Various Combinations of Configurations of a CZ4 ES Home

Range of HERS Index Scores for Homes with Same Bundle of Energy Measures
Compliance Options
COMPLIANCE OPTIONS

PERFORMANCE VS. PRESCRIPTIVE

Mandatory Measures
COMPLIANCE OPTIONS
PERFORMANCE VS. PRESCRIPTIVE

**Prescriptive Path:**
All ENERGY STAR Reference Design Specs
[only for homes < Benchmark CFA]

**Performance Path:**
Alternative Energy Efficiency Measures
< HERS Index Target Score Adjusted for Size

Mandatory Measures + or
COMPLIANCE OPTIONS
PERFORMANCE VS. PRESCRIPTIVE

**Prescriptive Path:**
- All ENERGY STAR Reference Design Specs
  - [only for homes < Benchmark CFA]

**Performance Path:**
- Alternative Energy Efficiency Measures
  - [HERS Index Target Score < Adjusted for Size]

**Mandatory Measures** +

**ENERGY STAR Reference Design:**
- HVAC Equipment
- Envelope & Windows
- Water Heater
- Thermostat
- Lighting & Appl.
COMPLIANCE OPTIONS

PERFORMANCE VS. PRESCRIPTIVE

**Prescriptive Path:**
All ENERGY STAR Reference Design Specs [only for homes < Benchmark CFA]

**Performance Path:**
Alternative Energy Efficiency Measures < HERS Index Target Score Adjusted for Size

Mandatory Measures + **or**

**HERS Software Evaluation for Rated Home**

**ENERGY STAR Reference Design:**
- HVAC Equipment
- Envelope & Windows
- Water Heater
- Thermostat
- Lighting & Appl.

**ENERGY STAR HERS Index Target Score**
[Size Adjusted]
COMPLIANCE OPTIONS
SIZE ADJUSTMENT FACTOR STRATEGY

[Diagram showing a small house and a larger, more ornate house, with a CO2 footprint symbol before and after the adjustment, illustrating the concept of reduced CO2 emissions through size adjustment factor strategy.]
# Benchmark Home Size

<table>
<thead>
<tr>
<th>BR's</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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<tr>
<td><strong>CFA</strong></td>
<td>1000</td>
<td>1,600</td>
<td>2,200</td>
<td>2,800</td>
<td>3,400</td>
<td>4,000</td>
<td>4,600</td>
<td>5,200</td>
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\[
\left( \frac{\text{CFA Benchmark Home}}{\text{CFA Rated Home}} \right)^{0.5} \times \text{HERS Index Target Score}
\]

Size Modification Factor not to exceed 1.0
### Benchmark Home Size

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Size Modification Factor not to exceed 1.0
Current HERS Index Threshold

2011 HERS Index Target for 2,200 Sq. Ft. 3 BR Home

House Size [CFA in sq.ft.]
COMPLIANCE OPTIONS
2011 TARGET SCORE VS. FIXED SCORE

Current HERS Index Threshold
2011 HERS Index Target for 2,200 Sq. Ft. 3 BR Home
2011 HERS Index Target for 3 BR Home Various Sizes

House Size [CFA in sq. ft.]

Perf. or Prescriptive
Performance Only
COMPLIANCE OPTIONS
2011 TARGET SCORE VS. FIXED SCORE

Current HERS Index Threshold
2011 HERS Index Target for 2,200 Sq. Ft. 3 BR Home
2011 HERS Index Target for 3 BR Home Various Sizes
2011 HERS Index Target for 3 BR Home Adjusted for Size

Performance Only
Prescriptive Only
Perf. or Prescriptive

House Size [CFA in sq. ft.]

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<th>1,100</th>
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<th>4,400</th>
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<tr>
<td>HERS Index Threshold</td>
<td>88</td>
<td>87</td>
<td>86</td>
<td>85</td>
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<tr>
<td>2011 HERS Index Target</td>
<td>84</td>
<td>83</td>
<td>82</td>
<td>81</td>
</tr>
<tr>
<td>3 BR Home Various Sizes</td>
<td>80</td>
<td>79</td>
<td>78</td>
<td>77</td>
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<tr>
<td>3 BR Home Adjusted for Size</td>
<td></td>
<td></td>
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Current HERS Index Threshold

2011 HERS Index Target for 2,200 Sq. Ft. 3 BR Home

2011 HERS Index Target for 3 BR Home Various Sizes

2011 HERS Index Target for 3 BR Home Adjusted for Size

Performance or Prescriptive Only

House Size [CFA in sq. ft.]
Mandatory Requirements
MANDATORY REQUIREMENTS:
ALL LABELED HOMES

- **Hot Water Efficiency**
  - Shower Heads < 2.0 gpm
  - Efficient Hot Water Distribution

- **ENERGY STAR Products**
  - Refrigerator, Dishwasher, Clothes Washer where provided
  - ALP or Bulbs in 80% Sockets
  - Ceiling Fans, where provided

- **Six Checklists**
MANDATORY REQUIREMENTS:
EFFICIENT WATER HEATING SYSTEM

- Energy Factor
- Distribution
- Insulated Piping
- Heat Trap Above Tank/Heater
MANDATORY REQUIREMENTS:
WATER HEATING DISTRIBUTION

- Core System (Wet Walls)
- Manifold System
- Demand Pumping System
WATER HEATING DISTRIBUTION:
MANIFOLD HOT WATER DISTRIBUTION
WATER HEATING DISTRIBUTION:
MANIFOLD HOT WATER DISTRIBUTION
WATER HEATING DISTRIBUTION: DEMAND PUMPING SYSTEM

[Diagram of water heating distribution]
WATER HEATING DISTRIBUTION:
DEMAND PUMPING SYSTEM
WATER HEATING DISTRIBUTION:
DEMAND PUMPING SYSTEM
MANDATORY REQUIREMENTS:
ENERGY STAR APPLIANCES/FANS
• Thermal Bypass
• Quality Framing
• HVAC Quality Installation Contractor
• HVAC Quality Installation Verifier
• Indoor Air Quality
• Water Managed Construction
THERMAL BYPASS CHECKLIST:
INSULATION INSTALLATION PROBLEM

- Gaps
- Compression
- Voids
THERMAL BYPASS CHECKLIST:
PROPER INSULATION
THERMAL BYPASS CHECKLIST:
PROPER INSULATION

Insulated Concrete Forms (ICFs)
PROPER INSULATION
THERMAL BYPASS CHECKLIST:
BYPASS AT WALL/ATTIC INTERFACE
Choose One System:
- Optimum Value Engineered Framing (OVE)
- Insulated Sheathing
- Structural Insulated Panels (SIPS)
- Insulated Concrete Forms (ICF)
- Double Wall Framing

Plus:
- Raised Heel Trusses
- Raised HVAC Attic Platform Framing
FRAMING QUALITY CHECKLIST:
OVE FRAMING

INSIDE “TWO-STUD” CORNERS

Position clip support for gypsum board so that it does not interfere with trim nailing.

Backer support for gypsum board.

The first drywall sheet is installed against side with clip or backer.

Courtesy of Building Science Corp.

Courtesy of Southface Institute
Ladder T - Allows insulation in exterior wall cavity at wall intersections
FRAMING QUALITY CHECKLIST:
INSULATED SHEATHING
FRAMING QUALITY CHECKLIST:
INSULATED CONCRETE FORMS
FRAMING QUALITY CHECKLIST:
RAISED HEEL TRUSSES

Raised Heel Conventional Truss
No Scale
Detail 42

Raised Heel Scissor Truss
No Scale
Detail 43

Airflow
Baffle
Eave Venting
Truss Framing
Attic Insulation
Built Up Over Exterior Wall Framing
Exterior Wall Framing
Attic Insulation
Built Up Over Exterior Wall Framing
Eave Venting
Exterior Wall Framing
FRAMING QUALITY CHECKLIST:
RAISED HEEL TRUSSES
INCREASE ATTIC INSULATION LEVELS UNDER DECKING

For many products, an insulation depth of 10 to 14 inches is needed to achieve an R-30 to R-38 insulation value. Thus, a 2x4 or 2x6 extension needs to be added to a 2x6 joist to provide sufficient depth before installing decking.
• **Air-Tight Assemblies** *(Reference Design Air Leakage)*
• **Six-Sided Air Barrier** *(Thermal Bypass Checklist)*
• **Zero-Tolerance** *(Grade 1 Installation Mandatory)*
• **Minimal Thermal Bridging** *(Framing Checklist)*
## HVAC Quality Installation Checklists

### Right-Sizing
- Equipment (ACCA Manual J/S)
- Ducts (ACCA Manual D)
- Terminals (ACCA Manual T)

### Air Distribution
- Duct Leakage
- Static Pressure
- Flow Across Coil
- Air Flow

### Refrigerant Charge
- Testing
- TXV Valve

### Duct Installation
- Installation
- R-8 Ducts in Attic
- Leakage to Outdoors and Total Pressure Balancing
Exit grille is over here!
HVAC QUALITY INSTALLATION:
PRESSURE BALANCING: SOLUTIONS

TRANSFER GRILLE

JUMP DUCT
INDOOR AIR QUALITY CHECKLIST:
WHOLE-HOUSE VENTILATION

CONTINUOUS EXHAUST  FRESH AIR DAMPER  DUCTED FRESH AIR SUPPLY
INDOOR AIR QUALITY CHECKLIST:
WHOLE-HOUSE VENTILATION

ERV
Screw pinning damper closed- No airflow

Only testing will find these things
This is the reading from a **110 cfm** fan:

Testing tells the story
WATER MANAGED CONSTRUCTION CHECKLIST:
WATER MANAGED ROOFS

BITUMINOUS MEMBRANE AT VALLEYS

TYPICAL FASCIA AND EAVE DETAIL
MORE ROOF FLASHING DETAILS
WATER MANAGED CONSTRUCTION CHECKLIST:
WATER MANAGED WALLS

DRAINAGE PLANE DESIGN
WATER MANAGED CONSTRUCTION CHECKLIST:
WATER MANAGED WALLS

BEST PRACTICE INSTALLATION

Window Flashing

Building Tips

Example of window flashing detail for home with board-and-batten siding on SSB wall sheathing:

STEP 1 - Pre-Installation

1. Apply at least a 1/4" gap at top of building paper or horizontal part below the transfer sill.
2. If the window sill is close to the sill plane, the cap must extend all the way to the sill plane.
3. The caps should extend at least 1" past the sides of the window opening, or to the first and last cap on wall construction.
4. Attach only to the cap's top edge with cap nails.

STEP 2 - Flashing

1. Cut the horizontal section to the width opening in the frame of a window.
2. Fold the side and bottom flaps into the window opening and secure.
3. Above the window opening, cut a flap that is wide enough to cover the top of the opening and secure with a flap that will be the second edge of the cap that will be used to apply the flashing below the window in the outside wall.

STEP 3 - Jamb Channel

1. Cut the metal edge of the heats and side jamb to the side jamb.
2. Do not cut across the sill.
3. Insert the flashings into the wall with the metal side jamb and follow manufacturer's specifications.


Version 3.11.2015 • TBD 4
WATER MANAGED CONSTRUCTION CHECKLIST:
WATER MANAGED WALLS

WINDOW/DOOR PAN FLASHING
WATER MANAGED CONSTRUCTION CHECKLIST:
WATER MANAGED FOUNDATIONS

FOUNDATION DRAINAGE SYSTEM
WITH CAPILLARY BREAKS

Free-draining back-fill
Perforated drainage pipe in gravel with fabric filter
Poly vapor retarder/capillary break
Course gravel granular drainage
Pipe connection to granular drainage
The Road Ahead
• 11+ million
• 1+ million
• 12+ million (1/5)
“The automotive companies being in a crisis [means] now’s the time for a disruptive technology… The automotive industry has now moved beyond trying to protect old technology…”

Alex Molinaroli, President of Power Solutions at Johnson Controls
Net-Zero Ready Homes

~30% - 50% Less

- Square Feet with 100% Function
- Cooling/Heating Loads
- Framing
- Ducts
- Plumbing
- HVAC Equipment Size
- Waste
- Construction Time

~70% Less Call-Backs
THE ROAD AHEAD: PATH TO NO/LOW CARBON

ENERGY STAR for Homes 2006 Specs

ENERGY STAR for Homes 2011 Draft Specs

Advanced Technologies

EPA Indoor airPlus
THE ROAD AHEAD:
CLIMATE CHOICE ADVANCED TECHS.

**Base:** ENERGY STAR 2011 + Indoor airPlus

**Advanced Technologies:**
- Super Air-Tight Construction
- Super Insulation
- Super Windows
- Super-Efficient Equipment
- Ducts Inside Conditioned Space
- ENERGY STAR Water Heating
THE ROAD AHEAD:
PATH TO NO/LOW CARBON

ENERGY STAR for Homes 2006 Specs

ENERGY STAR for Homes 2011 Draft Specs

Advanced Technologies

Advanced Design

Occupant Behavior

Renewable Power (Purchase or On-site)

EPA Indoor airPlus

THE ROAD AHEAD:
PATH TO NO/LOW CARBON

ENERGY STAR

EPA

CLIMATE CHOICE
THE ROAD AHEAD:
WHY CLIMATE CHOICE?

- Capture Moment in Time
- "Farm System"
THE ROAD AHEAD: NICHE OR MAINSTREAM?
Extreme Home Energy
Makeovers Coming?

- Rigid Insulation Cladding
- Advanced Air Sealing
- Advanced Duct Sealing
- Super Windows
- Super Attic Insulation
- Super Efficient, Right-Sized HVAC

~30-50% > Code
CURING HOMES WITH ENERGY STAR

Existing Homes

Seal and Insulate with

HVAC Quality Installation

Home Energy Yardstick

Qualified Products

Qualified Home

Home Performance with

Home Advisor

House as a ‘System’

Qualified Products

New Homes

Existing Homes
THE ROAD AHEAD: TIMELINE

<table>
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<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
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<tbody>
<tr>
<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
<td>Q4</td>
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- **2008**
  - CC Vetting
  - CC Devel.

- **2009**
  - ES 2011 Vetting

- **2010**
  - ES 2011 Released

- **2011**
  - ES 2011 Enforced
  - Climate Choice Implementation
On the Web at:
http://www.energystar.gov/homes