Beyond Code

March 2016
Dale Horton Architect
National Center for Appropriate Technology

State Building Codes Conference
RESNET’s NEW HERS INDEX TOOLS

Helping builders demonstrate the value of their Energy Efficient Homes.

Promote your HERS-rated homes to prospective buyers!

The HERS Index tools are part of RESNET’s ongoing commitment to support our builder partners in their efforts to successfully market their HERS-rated homes to consumers.

Visit www.resnet.us/professional/hers-index-tools to download your free suite of HERS Index tools.
1,735,669

TOTAL Number of HERS-rated Homes to Date

Number of homes HERS-rated in 2015
190,180

30% increase from 2014

38%

NEW HOMES sold in the US are HERS-rated
Energy Rating Index Option of the 2015 IECC

States that have adopted the 2015 International Energy Conservation Code (IECC), which includes the Energy Rating Index compliance option (R406):

ILLINOIS  MARYLAND  MICHIGAN  NEW JERSEY  TEXAS  VERMONT
Nationally, 2/3 of all HERS Ratings are ENERGY STAR

- U-0.27 Windows
- 3 ACH50
### Rater Design Review Checklist

**ENERGY STAR Certified Homes, Version 3 / 3.1 (Rev. 08)**

<table>
<thead>
<tr>
<th>Home Address</th>
<th>City</th>
<th>State</th>
<th>Permit Date</th>
<th>Rater Confirmed</th>
<th>Rater Verified</th>
</tr>
</thead>
</table>

1. **Partnership Status**
   - [ ] 1. Ray has verified that the building is an ENERGY STAR partner using [participation type].
   - [ ] 2. Ray has verified that the building has certified equipment to complete the HVAC Commissioning Checklist.
   - [ ] 3. HVAC contractor holds certification to commission the HVAC system.

2. **High-Performance Insulation**
   - [ ] 2.1. Insulation level meets or exceeds 2009 IEC requirements.
   - [ ] 2.2. R-value is documented for insulation and attic spaces.

3. **High-Performance Windows**
   - [ ] 3.1. Meets or exceeds 2009 IEC requirements.
   - [ ] 3.2. R-value is documented for windows and doors.

   - [ ] 4.1. HVAC Design Report contained, with no issues visible.

5. **Energy Efficiency**
   - [ ] 5.1. Meets or exceeds 2009 IEC requirements.
   - [ ] 5.2. R-value is documented for insulation and attic spaces.

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### Rater Field Checklist

**ENERGY STAR Certified Homes, Version 3 / 3.1 (Rev. 08)**

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</tr>
</thead>
</table>

1. **Thermal Enclosure System**
   - [ ] 1.1. Insulation meets or exceeds IEC requirements.
   - [ ] 1.2. Heat flow is documented for heat loss.

2. **Ductwork**
   - [ ] 2.1. Insulation is verified for ductwork.

3. **Reduced Thermal Bridging**
   - [ ] 3.1. Insulation is verified for reduced thermal bridging.

4. **Vented Attic Space**
   - [ ] 4.1. Insulation is verified for vented attic space.

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**Note:** This checklist is a summary of the Rater Design Review Checklist and Rater Field Checklist for ENERGY STAR Certified Homes, Version 3 / 3.1 (Rev. 08). Each section contains detailed criteria for verifying compliance with ENERGY STAR standards.
**ENERGY STAR**

**Builder Water Management Checklist**

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**Water Management System Builder Requirements**

**ENERGY STAR Certified Homes, Version 3 / 3.1 (Rev. 08)**

**Builder Responsibilities:**

- It is the exclusive responsibility of builders to ensure that each certified home is constructed to meet these requirements.
- While builders are not required to maintain documentation demonstrating compliance for each individual certified home, builders are required to develop a process to ensure compliance for each certified home (e.g., incorporate these requirements into the Scope of Work for relevant sub-contractors, require the site supervisor to inspect each home for these requirements, and/or sub-contract the verification of compliance to a Rater).
- In the event that the EPA determines that a certified home was constructed without meeting these requirements, the home may be decertified.

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1. **Water-Managed Site and Foundation**
   - 1.1 Patio slabs, porch slabs, walks, and driveways sloped a 0.25 in. per ft. away from home to edge of surface or 10 ft., whichever is less.
   - 1.2 Back-fill has been tamped and final grade sloped a 0.5 in. per ft. away from home for a 10 ft. See Footnote for alternatives.
   - 1.3 Capillary break beneath all slabs (e.g., slab on grade, basement slab) except crawlspace slabs using either a 6 mil polyethylene sheeting, appx. 6-12 in., or a 1 in. extruded polystyrene insulation with taped joints.
   - 1.4 Capillary break at all crawlspace floors using 6 mil polyethylene sheeting, taped 6-12 in., & installed using one of the following:
     - 1.4.1 Placed beneath a concrete slab; OR
     - 1.4.2 Lapped up each wall or pier and fastened with furring strips or equivalent; OR
     - 1.4.3 Secured in the ground at the perimeter using stakes.
   - 1.5 Exterior surface of below-grade walls of basements & unwarranted crawlspace finished as follows:
     - a) For poured concrete, masonry, & insulated concrete forms, finish with damp-proofing coating. Finish with polyethylene and adhesive or other equivalent waterproofing.
   - 1.6 Class 1 vapor retarder not installed on interior side of air permeable insulation in exterior below-grade walls.
   - 1.7 Sump pump covers mechanically attached with full gasket seal or equivalent.
   - 1.8 Drain tile installed at basement and crawlspace walls, with the top of the drain tile pipe below the bottom of the concrete slab or crawlspace floor. Drain tile surrounded with a 6 in. of ½ in. washed or clean gravel and with gravel layer fully wrapped with fabric cloth. Drain tile level or sloped to discharge to outside grade (daylight) or to a sump pump. If drain tile is on interior side of footing, then channel provided through footing to exterior side.

2. **Water-Managed Wall Assembly**
   - 2.1 Flashing at bottom of exterior walls with weep holes included for masonry veneer and weep screen for stucco cladding systems, or equivalent drainage system.
   - 2.2 Fully sealed continuous drainage plane behind exterior cladding that laps over flashing in Item 2.1 and fully sealed at all penetrations. Additional bond-break drainage plane layer provided behind all stucco and non-structural masonry cladding wall assemblies.
   - 2.3 Window and door openings fully flashed.

3. **Water-Managed Roof Assembly**
   - 3.1 Step and kick-out flashing at all roof-wall intersections, extending 4" on wall surface above roof deck and integrated shingle-style with drainage plane above, boot/collar flashing at all roof penetrations.
   - 3.2 For homes that do not have a slab-on-grade foundation and do not have expensive or collapsible soils, gutters & downsprout provided that empty to lateral piping that discharges water on sloping final grade a 5 ft. from foundation, or to underground catchment system not connected to the foundation drain system that discharges water a 10 ft. from foundation. See Footnote for alternatives & exemptions.
   - 3.3 Self-adhering polymer-modified bituminous membrane at all valleys & roof deck penetrations.
   - 3.4 In 2009 IEC Climate Zones 5 & higher, self-adhering polymer-modified bituminous membrane over sheathing at edges from the eave to the 2 ft. up roof deck from the interior plane of the exterior wall.

4. **Water-Managed Building Materials**
   - 4.1 Wall-to-wall carpet not installed within 2.5 ft. of toilets, tubs, and showers.
   - 4.2 Cement board or equivalent moisture-resistant backing material installed on all walls behind tub and shower enclosures composed of tile or panel assemblies with caulked joints. Paper-faced backerboard shall not be used.
   - 4.3 In Warm-Humid climates, Class 1 vapor retarders not installed on the interior side of air permeable insulation in above-grade walls, except at shower and tub walls.
   - 4.4 Building materials with visible signs of water damage or mold not installed or allowed to remain.
   - 4.5 Framing members & insulation products having high moisture content not enclosed (e.g., with drywall).
   - 4.6 For each condensate-producing HVAC component, corrosion-resistant drain pan (e.g., galvanized steel, plastic) included that drains to a conspicuous point of disposal in case of blockage. Backflow prevention valve included if connected to a shared drainage system.
### HVAC Design Report

**ENERGY STAR Certified Homes, Version 3 / 3.1 (Rev. 08)**

#### Design Overview
- **1.1 Designer name:** [Designer's name]
- **1.2 Selected which party you're providing these design services to:** [Builder, Owner, Other]
- **1.3 Name of company you're providing these services to:** [Design firm name]
- **1.4 Area that system serves:** Whole house, Whole sections, Group design, Group design for this house plan, Configuration modeled
- **1.5 HVAC Design Report:** To the builder or certified HVAC contractor and to the Home Energy Rater.

#### Whole-House Mechanical Ventilation Design
- **2.1 Airflow:** [CFM]
- **2.2 Ventilation rate required by continuous system:** [CFM]
- **2.3 Design for this system:** [CFM] Run-per-cycle time
- **2.4 System type:** Supply, Exhaust, Balanced
- **2.5 Supply location:** [Specify location]
- **2.6 HVAC system type:** [Specify type]
- **2.7 HVAC system efficiency:** [Specify efficiency]
- **2.8 HVAC system type includes a airflow control over a valve (e.g., Master bath, utility room):** [Specify]
- **2.9 HVAC system type includes a airflow control over a valve (e.g., Master bath, utility room):** [Specify]
- **2.10 HVAC system type includes a airflow control over a valve (e.g., Master bath, utility room):** [Specify]
- **2.11 HVAC system type includes a airflow control over a valve (e.g., Master bath, utility room):** [Specify]

#### Room-by-Room Heating & Cooling Loads
- **3.1 R-values:** [Specify R-values]
- **3.2 Design outdoor temperatures used in loads:** 70°F for heating and 55°F for cooling
- **3.3 Indoor design temperatures used in loads:** [Specify]
- **3.4 Outdoor design temperatures used in loads:** [Specify]

### HVAC Commissioning Checklist

**ENERGY STAR Certified Homes, Version 3 / 3.1 (Rev. 08)**

#### Commissioning Overview
- **1.1 Contractor name:** [Contractor's name]
- **1.2 Organization that your company is certified with:** ACCA, AHERA, EcoStar, Other
- **1.3 Builder's name:** [Builder's name]
- **1.4 Home address:** [Home address]
- **1.5 HVAC Design Report corresponding to this home is collected from designer or builder:** [Builder's name]
- **1.6 Area that system serves:** Whole house, Whole sections, Group design, Group design for this house plan, Configuration modeled
- **1.7 Recommended heating power:** [Recommended heating power]
- **1.8 HVAC system type:** [Specify type]
- **1.9 HVAC system efficiency:** [Specify efficiency]
- **1.10 HVAC system type includes a airflow control over a valve (e.g., Master bath, utility room):** [Specify]
- **1.11 HVAC system type includes a airflow control over a valve (e.g., Master bath, utility room):** [Specify]

#### Indoor HVAC Fan Airflow
- **3.1 Mode:** [Specify mode]
- **3.2 Test hole location criteria:** [Specify criteria]
- **3.3 Test hole location for return external static pressure:** [Specify location]
- **3.4 Test hole location for supply external static pressure:** [Specify location]
- **3.5 Test hole location for return external static pressure:** [Specify location]
- **3.6 Test hole location for supply external static pressure:** [Specify location]
- **3.7 Measured return external static pressure:** [Specify pressure]
- **3.8 Measured supply external static pressure:** [Specify pressure]
- **3.9 Measured HVAC fan airflows:** [Specify airflow]
- **3.10 Measured HVAC fan airflows:** [Specify airflow]
- **3.11 Measured HVAC fan airflows:** [Specify airflow]
- **3.12 Measured HVAC fan airflows:** [Specify airflow]

### Additional Information
- **HVAC Design Report:** [Version and revision information]
- **HVAC Commissioning Checklist:** [Version and revision information]
Indoor airPlus Design and Construction Features

- Moisture Control
- Radon Control
- Pest Management
- HVAC
- Combustion Venting
- Building Materials
- Quality Assurance and Homeowner Education

All Indoor airPLUS qualified homes also meet strict guidelines for energy efficiency set by ENERGY STAR, the nationally-recognized symbol for energy efficiency.
Indoor airPlus

Refer to Section 6 of References
Radon Risk is High in much of the U.S. Check State & local authorities for more detailed information on Radon risk in your area.

EPA recommends that all homes built in Zone 1 have radon reduction systems.

Note: these maps indicate average risk by county. However, High levels of Radon can be found anywhere, and soil gases may be toxic!
Radon enters a home through cracks in concrete, joints in construction below grade, and through poorly sealed crawl space construction.
Radon Mitigation

A. Gas Permeable Layer
(4” clean gravel)

B. Plastic Sheeting
(under slab or over crawl space)

C. Sealing and Caulking
(all openings in concrete floor)

D. Vent Pipe
(3 or 4 inch PVC pipe)

E. Junction Box
(if fan needed later)
Radon Mitigation
As Industry Scales, Prices Fall

Blended Average Solar PV Price ($/watt)

Solar PV Installations

Solar PV Prices

Source: SEIA / GTM Research
Zero Energy Ready Home
National Program Requirements

- ENERGY STAR for Homes Certified
- ENERGY STAR Appliances
- ENERGY STAR Windows
- 2015 IECC Insulation Levels
- Ducts Inside
- Indoor airPlus Certified
- Solar PV Ready (Recommended in MT)
Average Daily Solar Radiation Per Month

ANNUAL

Solar Ready Encouraged

Solar Ready Required

kWh/m²/day

- 10 to 14
- 8 to 10
- 7 to 8
- 6 to 7
- 5 to 6
- 4 to 5
- 3 to 4
- 2 to 3
- 0 to 2
- none

DOE ZERHs Must Meet
ENERGY STAR v3.1 & 2015 IECC
UA Levels for the Building Envelope
Documentation of the maximum allowable dead load and live load ratings of the existing roof (Rec DL.: 6 lbs./sq. ft.)

Conduit to run DC wire from roof to inverter

Dedicated Area for installing inverter and balance of system

Conduit to run AC wire from inverter location to electric panel

Circuit Breaker designated and/or installed for use by the PV system in the electric panel
Residential Stretch Energy Code for Montana?

- Must be more EE than state code
- Available to Local Jurisdictions
- Must have local incentive
Presentations Online

www.ncat.org

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Training Presentations