ENERGY STAR Qualified Homes, Version 3 (Rev. 04) County-Level Reference Design: Climate Zone 4 [1]

Qualifying Homes

The following homes are eligible to earn the ENERGY STAR:

- Single family homes; OR
- Units in any multifamily building with 4 units or fewer; OR
- Units in multifamily buildings with 3 stories or fewer above-grade [2,3]; OR
- Units in multifamily buildings with 4 or 5 stories above-grade [2,3] that have their own heating, cooling, and hot water systems [4], separate from other units, and where dwelling units occupy 80% or more of the occupiable [3] square footage of the building [5]. When evaluating mixed–use buildings for eligibility, exclude commercial / retail space when assessing whether the 80% threshold has been met.

Units in multifamily buildings that are not eligible to earn the ENERGY STAR through the New Homes Program may be eligible through the Multifamily High Rise Program.

Homes may earn the ENERGY STAR using the following ENERGY STAR Prescriptive Path or Performance Path in all states except those with an energy code exceeding the 2009 IECC and for which EPA regional program requirements have been developed. See EPA's Web site for the latest list. Note that compliance with these guidelines is not intended to imply compliance with all local code requirements that may be applicable to the home to be built. [6]

ENERGY STAR Prescriptive Path

The Prescriptive Path provides a single set of measures that can be used to construct an ENERGY STAR qualified home. Modeling is not required; however, no tradeoffs are allowed. Follow these steps to use the Prescriptive Path:

1. First, assess the eligibility to follow the Prescriptive Path by comparing the conditioned floor area (CFA) of the home to be built to the CFA of the Benchmark Home as specified in Exhibit 2. [7] For the purposes of this step, calculate the number of bedrooms and the CFA of the home to be built using RESNET standards with the following exception: floor area in basements with at least half of the gross surface area of the basement's exterior walls below grade shall not be counted. [8] If a home has zero bedrooms with regard to the Benchmark Home Size determination, then the Benchmark Home Size for one bedroom shall be used. If the CFA of the home to be built exceeds the CFA of the Benchmark Home, then the Performance Path shall be used. See www.energystar.gov/newhomesguidelines for more information on the Performance Path.
2. If the home to be built is eligible to follow the Prescriptive Path, build the home using all requirements of the ENERGY STAR Reference Design, Exhibit 3, and the Mandatory Requirements for All Qualified Homes, Exhibit 1.
3. Using a Rater, verify that all requirements have been met in accordance with the Mandatory Requirements for All Qualified Homes and with RESNET's On-Site Inspection Procedures for Minimum Rated Features. [9]

Mandatory Requirements for All ENERGY STAR Qualified Homes

All ENERGY STAR Qualified New Homes must meet the requirements of the checklists in Exhibit 1. The Water Management System Builder Checklist is not required for homes that also qualify for Indoor airPLUS. [10]

Exhibit 1: Mandatory Requirements for All Qualified Homes

Area of Improvement	Mandatory Requirements
1. Thermal Enclosure System	• Completed Thermal Enclosure System Rater Checklist
2. Heating, Ventilation, & Air Conditioning (HVAC) System	• Completed HVAC System Quality Installation Contractor Checklist • Completed HVAC System Quality Installation Rater Checklist
3. Water Management System	• Completed Water Management System Builder Checklist [10]

Exhibit 2: Benchmark Home [7]

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

Checklist Instructions

The Rater must review all items in this county-level reference design checklist. The column titled "N/A," which denotes items that are "not applicable," should be used when the checklist item is not present in the home or conflicts with local requirements. In the event that a Rater finds an item that is inconsistent with this county-level reference design, the home cannot earn the ENERGY STAR until the item is corrected. If correction of the item is not possible, the home cannot earn the ENERGY STAR. In the event that an item cannot be inspected by the Rater, the home also cannot earn the ENERGY STAR.

ENERGY STAR Qualified Homes, Version 3 (Rev. 04)
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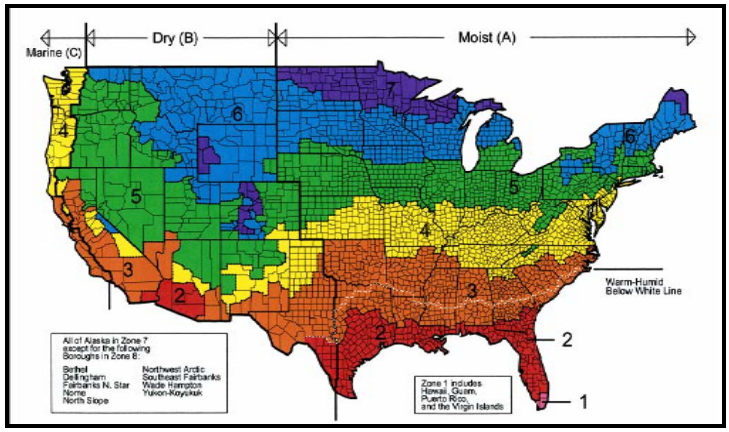
Exhibit 3: ENERGY STAR Reference Design

Home Address:_____City:_____State:_____

System	Inspection Guidelines	Rater Verified	Must Correct	NA
Benchmark Home Size	Home Size (ft^2) ≤ Benchmark Home Size (ft^2) # BR: _____ Home Size (ft^2): _____ Benchmark Home Size (ft^2): _____	☐	-	-
Cooling Equipment [12]	Cooling equipment, where provided, meets one of the options below (check one): ☐ ≥ 13 SEER A/C ☐ Heat pump (See Heating Equipment)	☐	☐	☐
Heating Equipment [12]	Heating equipment meets one of the options below (check one): ☐ ≥ 90 AFUE gas furnace, ENERGY STAR qualified ☐ ≥ 85 AFUE oil furnace, ENERGY STAR qualified ☐ ≥ 85 AFUE boiler, ENERGY STAR qualified ☐ ≥ 8.5 HSPF / 14.5 SEER / 12 EER ENERGY STAR qualified air-source heat pump with electric backup [13] ☐ ≥ 8.2 HSPF / 14.5 SEER / 12 EER ENERGY STAR qualified air-source heat pump with ENERGY STAR qualified dual-fuel backup ☐ Ground source heat pump, any product type, ENERGY STAR qualified [14]	☐	☐	☐
Envelope	Infiltration rate ≤ 5 ACH50	☐	☐	☐
	Insulation achieves Grade I installation per RESNET standards. [15]	☐	☐	☐
	Ceiling insulation ≥ 38 R-Value [16]	☐	☐	☐
	Wall insulation ≥ 13 R-Value [16]	☐	☐	☐
	Floor insulation over unconditioned space ≥ 19 R-Value [16]	☐	☐	☐
	Slab insulation ≥ 10 R-Value; Depth ≥ 2 ft [16,17]			
	Crawlspace wall insulation for unvented crawlspace meets one of two options (check one): [16] ☐ ≥ 10 R-Value Continuous ☐ ≥ 13 R-Value Framed Wall	☐	☐	☐
	Basement wall insulation next to conditioned space meets one of two options (check one): [16] ☐ ≥ 10 R-Value Continuous ☐ ≥ 13 R-Value Framed Wall	☐	☐	☐
Windows & Doors [18,19]	Windows: ≤ 0.32 U-Value; ≤ 0.40 SHGC	☐	☐	☐
	Skylights: ≤ 0.55 U-Value; ≤ 0.40 SHGC	☐	☐	☐
	If total window-to-floor area ≥ 15%, then U-values or SHGCs adjusted as outlined in Footnote 19.	☐	☐	☐
	Door U-Value: Opaque: ≤ 0.21 ≤½ lite: ≤ 0.27 >½ lite: ≤ 0.32	☐	☐	☐
	Door SHGC: Opaque: No Rating ≤½ lite: ≤ 0.30 >½ lite: ≤ 0.30	☐	☐	☐
Water Heater	Energy Factor (EF) meets the requirements based upon fuel type and tank size. [20] Fuel Type: ☐ Gas ☐ Elec ☐ Oil Tank Size (gal.): _____ Req. EF: ____	☐	☐	☐
Thermostat & Ductwork	Programmable thermostat installed unless thermostat controls a zone with electric radiant heat, for which a manual thermostat is allowed. [21]	☐	☐	☐
	Supply ducts in unconditioned attic ≥ R-8; All others in unconditioned space ≥ R-6	☐	☐	☐
	Total duct leakage ≤ 6 CFM25 per 100 sq. ft. of CFA. [22,23]	☐	☐	☐
	Duct leakage to outdoors ≤ 4 CFM25 per 100 sq. ft. of CFA. [22,23,24]	☐	☐	☐
Lighting & Appliances	ENERGY STAR qualified refrigerators, dishwashers, ceiling fans, exhaust fans. [25]	☐	☐	☐
	ENERGY STAR qualified CFLs or pin-based lighting in 80% of fixtures. [26]	☐	☐	☐

ENERGY STAR Qualified Homes, Version 3 (Rev. 04) County-Level Reference Design Notes

1. The following map is shown to depict Climate Zone boundaries. It is for illustrative purposes only and is based on 2009 IECC Figure 301.1.



2. Any above-grade story with 20% or more occupiable space, including commercial space, shall be counted towards the total number of stories for the purpose of determining eligibility to participate in the program. The definition of an 'above-grade story' is one for which more than half of the gross surface area of the exterior walls is above-grade. All below-grade stories, regardless of type, shall not be included when evaluating eligibility.

3. Per ASHRAE 62.2-2010, occupiable space is any enclosed space inside the pressure boundary and intended for human activities or continual human occupancy, including, but not limited to, areas used for living, sleeping, dining, and cooking, toilets, closets, halls, storage and utility areas, and laundry areas.

4. Central systems for domestic hot water are allowed if solar energy provides at least 50% of the domestic hot water needs for the residential units.

5. Units in multifamily buildings with 4 or 5 stories above-grade, including mixed–use buildings, that have their own heating, cooling, and hot water systems, separate from other units, *but where dwelling units occupy less than 80%* of the residential (i.e., excluding commercial / retail space for mixed-use buildings) occupiable square footage of the building may qualify for the ENERGY STAR through either the New Homes Program or the Multifamily High Rise Program if permitted prior to July 1, 2012. Units in buildings of this type that are permitted after this date shall only be eligible to earn the ENERGY STAR through the Multifamily High Rise (MFHR) Program.

6. Where requirements of the local codes, manufacturers' installation instructions, engineering documents, or regional ENERGY STAR programs overlap with the requirements of these guidelines, EPA offers the following guidance:

    a. In cases where the overlapping requirements exceed the ENERGY STAR guidelines, these overlapping requirements shall be met;

    b. In cases where overlapping requirements conflict with a requirement of these ENERGY STAR guidelines (e.g., slab insulation is prohibited to allow visual access for termite inspections), then the conflicting requirement within these guidelines shall not be met. Qualification shall only be allowed if the Rater has determined that no equivalent option is available that could meet the intent of the conflicting requirement of these ENERGY STAR guidelines (e.g., switching from exterior to interior slab edge insulation).

7. The average-size home with a specific number of bedrooms is termed the "Benchmark Home". The conditioned floor area of a Benchmark Home (CFA Benchmark Home) is determined by selecting the appropriate value from Exhibit 2. For homes with more than 8 bedrooms, the CFA Benchmark Home shall be determined by multiplying 600 sq. ft. times the total number of bedrooms and adding 400 sq. ft.

    Example: CFA Benchmark Home for a 10 bedroom home = (600 sq. ft. x 10) + 400 sq. ft. = 6,400 sq. ft.

    A bedroom is defined by RESNET as a room or space 70 sq. ft. or greater size, with egress window and closet, used or intended to be used for sleeping. A "den", "library", or "home office" with a closet, egress window, and 70 sq. ft. or greater size or other similar rooms shall count as a bedroom, but living rooms and foyers shall not.

    An egress window, as defined in 2009 IRC section R310, shall refer to any operable window that provides for a means of escape and access for rescue in the event of an emergency. The egress window definition has been summarized for convenience. The egress window shall:

- have a sill height of not more than 44 inches above the floor; AND
- have a minimum net clear opening of 5.7 sq. ft.; AND
- have a minimum net clear opening height of 24 in.; AND
- have a minimum net clear opening width of 20 in.; AND
- be operational from the inside of the room without the use of keys, tools or special knowledge.

8. To determine whether at least half of the basement wall area is below grade, use the gross surface area of the walls that are in contact with either the ground or ambient outdoor air, measured from the basement floor to the bottom of the basement ceiling framing (e.g., the bottom of the joists for the floor above). Note that the exception regarding the floor area in basements is only for the purpose of determining a home's Benchmark Home Size, Size Adjustment Factor, and eligibility to use the Prescriptive Path. The full conditioned floor area, per RESNET's standards, should be used when rating the home (e.g., determining compliance with duct leakage requirements).

9. The term 'Rater' refers to the person completing the third-party inspections required for qualification. This party may be a certified Home Energy Rater, Rating Field Inspector, BOP Inspector, or an equivalent designation as determined by a Verification Oversight Organization such as RESNET.

10. A completed and signed Indoor airPLUS Verification Checklist may be submitted in lieu of the Water Management System Builder Checklist. Indoor airPLUS is a complimentary EPA label recognizing new homes equipped with a comprehensive set of Indoor Air Quality (IAQ) features. Indoor airPLUS verification can be completed by a Rater during the ENERGY STAR verification process. For more information, see www.epa.gov/indoorairplus.

11. The Rater may define the 'permit date' as either the date that the permit was issued or the date of the contract on the home. In cases were permit or contract dates are not available, Providers have discretion to estimate permit dates based on other construction schedule factors. These assumptions should be both defensible and documented.

12. Where ENERGY STAR qualified heating or cooling systems are required, all installed equipment of that system type must be ENERGY STAR qualified.

13. The required efficiency for air source heat pumps in Climate Zones 4, 5, & 6 exceed the ENERGY STAR minimum of 8.2 HSPF.

14. The following efficiency levels shall be used based on ground-source heat pump product type:

    - Closed Loop Water-to-Air: ≥ 3.5 COP / 16.1 EER
    - Open Loop Water-to-Air: ≥ 3.8 COP / 18.2 EER
    - Direct Geo-Exchange (DGX): ≥ 3.6 COP / 16 EER
    - Closed Loop Water-to-Water: ≥ 3.0 COP / 15.1 EER
    - Open Loop Water-to-Water: ≥ 3.4 COP / 19.1 EER

15. Insulation shall be verified by a Rater to achieve Grade I installation as defined in the RESNET Standards, except for ceiling, wall, and floor assemblies with continuous rigid insulation sheathing. For such homes, Grade II installation is acceptable for the cavity insulation only if the rigid insulation sheathing meets or exceeds the following levels: R-3 in Climate Zones 1 to 4; R-5 in Zones 5 to 8.

16. Insulation levels in a home shall meet or exceed the component insulation requirements in the 2009 IECC - Table 402.1.1. The following exceptions apply:

    a. Steel-frame ceilings, walls, and floors shall meet the insulation requirements of the 2009 IECC – Table 402.2.5. In CZ 1 and 2, the continuous insulation requirements in this table shall be permitted to be reduced to R-3 for steel-frame wall assemblies with studs spaced at 24 in. on center. This exception shall not apply if the alternative calculations in d) are used;

    b. For ceilings with attic spaces, R-30 shall satisfy the requirement for R-38 and R-38 shall satisfy the requirement for R-49 wherever the full height of uncompressed insulation at the lower R-value extends over the wall top plate at the eaves. This exemption shall not apply if the alternative calculations in d) are used;

    c. For ceilings without attic spaces, R-30 shall satisfy the requirement for any required value above R-30 if the design of the roof / ceiling assembly does not provide sufficient space for the required insulation value. This exemption shall be limited to 500 square ft. or 20% of the total insulated ceiling area, whichever is less. This exemption shall not apply if the alternative calculations in d) are used;

    d. An alternative equivalent U-factor or total UA calculation may also be used to demonstrate compliance, as follows:

       An assembly with a U-factor equal or less than specified in 2009 IECC Table 402.1.3 complies.

       A total building thermal envelope UA that is less than or equal to the total UA resulting from the U-factors in Table 402.1.3 also complies. The insulation levels of all non-fenestration components (i.e., ceilings, walls, floors, and slabs) can be traded off using the UA approach under both the Prescriptive and the Performance Path. Note that fenestration products (i.e., windows, skylights, doors) shall not be included in this calculation. Also, note that while ceiling and slab insulation can be included in trade-off calculations, the R-value must meet or exceed the minimum values listed in Items 4.1 through 4.3 of the Thermal Enclosure System Rater Checklist to provide an effective thermal break, regardless of the UA tradeoffs calculated. The UA calculation shall be done using a method consistent with the ASHRAE Handbook of Fundamentals and shall include

the thermal bridging effects of framing materials. The calculation for a steel-frame envelope assembly shall use the ASHRAE zone method or a method providing equivalent results, and not a series-parallel path calculation method.

17. Consistent with the 2009 IECC, slab edge insulation is only required for slab-on-grade floors with a floor surface less than 12 inches below grade. Slab insulation shall extend to the top of the slab to provide a complete thermal break. If the top edge of the insulation is installed between the exterior wall and the edge of the interior slab, it shall be permitted to be cut at a 45-degree angle away from the exterior wall.

18. All windows, doors, and skylights shall meet ENERGY STAR Program Requirements for Residential Windows, Doors, and Skylights – Version 5.0 as outlined at www.energystar.gov/windows. If no NFRC rating is noted on the window or in product literature (e.g., for site-built fenestration), select the U-factor and SHGC value from Tables 4 and 14, respectively, in 2005 ASHRAE Fundamentals, Chapter 31. Select the highest U-factor and SHGC value among the values listed for the known window characteristics (e.g., frame type, number of panes, glass color, and presence of low-e coating). Note that the U-factor requirement applies to all fenestration while the SHGC only applies to the glazed portion. The following exceptions apply:

    a. An area-weighted average of fenestration products shall be permitted to satisfy the U-factor requirements;

    b. An area-weighted average of fenestration products more than 50% glazed shall be permitted to satisfy the SHGC requirements;

    c. 15 square feet of glazed fenestration per dwelling unit shall be exempt from the U-factor and SHGC requirements, and shall be excluded from area-weighted averages calculated using a) and b), above;

    d. One side-hinged opaque door assembly up to 24 square feet in area shall be exempt from the U-factor requirements and shall be excluded from area-weighted averages calculated using a) and b), above;

    e. Fenestration utilized as part of a passive solar design shall be exempt from the U-factor and SHGC requirements, and shall be excluded from area-weighted averages calculated using a) and b), above. Exempt windows shall be facing within 45 degrees of true south and directly coupled to thermal storage mass that has a heat capacity > 20 btu / ft^3x^oF and provided in a ratio of at least 3 sq. ft. per sq. ft. of south facing fenestration. Generally, thermal mass materials will be at least 2 in. thick.

19. All decorative glass and skylight window areas count toward the total window area to above-grade conditioned floor area (WFA) ratio. For homes using the Prescriptive Path that have a WFA ratio > 15%, the following additional requirements apply:

    a. In Climate Zones 1, 2, and 3, an improved window SHGC is required and is determined by:

        Improved SHGC = [0.15 / WFA] x [ENERGY STAR SHGC]

        Where the ENERGY STAR SHGC is the maximum allowable SHGC in Exhibit 3, ENERGY STAR Reference Design, for the Climate Zone where the home will be built.

    b. In Climate Zones 4, 5, 6, 7, and 8, an improved window U-Value is required and is determined by:

        Improved U-Value = [0.15 / WFA] x [ENERGY STAR U-Value]

        Where the ENERGY STAR U-Value is the maximum allowable U-Value in Exhibit 3, ENERGY STAR Reference Design, for the Climate Zone where the home will be built.

20. To determine domestic hot water (DHW) EF requirements use the chart below or, for additional tank sizes, the following equations: Gas DHW EF ≥ 0.69 - (0.002 x Tank Gallon Capacity); Electric DHW EF ≥ 0.97 - (0.001 x Tank Gallon Capacity); Oil DHW EF ≥ 0.61 - (0.002 x Tank Gallon Capacity). The minimum efficiency for instantaneous water heaters shall be determined using the above equations and assuming a 1 gallon capacity.

    Water heater systems that are integrated with a space-heating boiler may be used in place of a stand-alone system. However, an integrated indirect storage system shall be used rather than an integrated tankless coil system.

Minimum Water Heater Efficiencies by Fuel Type and Tank Size

Tank Size:	30 Gal	40 Gal	50 Gal	60 Gal	70 Gal	80 Gal
Gas:	0.63 EF	0.61 EF	0.59 EF	0.57 EF	0.55 EF	0.53 EF
Electric:	0.94 EF	0.93 EF	0.92 EF	0.91 EF	0.90 EF	0.89 EF
Oil:	0.55 EF	0.53 EF	0.51 EF	0.49 EF	0.47 EF	0.45 EF

21. For homes with heat pumps, the thermostat shall have 'Adaptive Recovery' technology to prevent the excessive use of electric back-up heating.

22. Duct leakage shall be determined and documented by a Rater using a RESNET-approved testing protocol only after all components of the system have been installed (e.g., air handler and register grilles). Leakage limits shall be assessed on a per-system, rather than

per-home, basis. Testing of duct leakage to the outside can be waived if all ducts & air handling equipment are located within the home's air and thermal barriers AND envelope leakage has been tested to be less than or equal to half of the Prescriptive Path infiltration limit for the Climate Zone where the home is to be built.

23. For all homes that have less than 1,200 sq. ft. of conditioned floor area (CFA), total measured duct leakage shall be $\leq$ 8 CFM25 per 100 sq. ft. of CFA and measured duct leakage to outdoors shall be $\leq$ 5 CFM25 per 100 sq. ft. of CFA.
24. If total duct leakage is $\leq$ 4 CFM25 per 100 sq. ft. of conditioned floor area, or $\leq$ 5 CFM25 per 100 sq. ft. of conditioned floor area for homes that have less than 1,200 sq. ft. of conditioned floor area, then leakage to outdoors need not be tested.
25. This only applies where refrigerators, dishwashers, ceiling fans, or exhaust fans are installed. All exhaust fans shall be ENERGY STAR qualified, except in half bathrooms. A half bathroom is any bathroom that does not contain a bathtub, shower, spa, or similar source of moisture.
26. This requirement applies to RESNET-defined Qualifying Light Fixture Locations. Also note that the ENERGY STAR Advanced Lighting Package (ALP), which requires a minimum of 60% ENERGY STAR qualified hard-wired fixtures and 100% ENERGY STAR qualified ceiling fans, where installed, may also be used to comply with the lighting requirements.