



ENERGY STAR Qualified Homes, Version 3 (Rev. 01) HERS Index Target Procedure For National Program Requirements

This document provides detailed instructions for determining the ENERGY STAR HERS Index Target, the highest HERS Index value that a home can achieve and qualify under the performance path of the program. The performance path provides flexibility to select a custom combination of measures through energy modeling that achieves the required ENERGY STAR HERS Index Target. Note, however, that regardless of the measures selected, the Mandatory Requirements for All Qualified Homes in Exhibit 2 of the ENERGY STAR Qualified Homes Version 3 (Rev. 01) National Program Requirements shall be met.

Follow these steps using any RESNET-accredited software program to calculate the ENERGY STAR HERS Index Target:

1. Determine the HERS Index of the ENERGY STAR Reference Design Home. To accomplish this, use Exhibit 2 below, Expanded ENERGY STAR Reference Design Definition, to model the Reference Design Home and determine its associated HERS Index value. For Raters configuring the ENERGY STAR Reference Design manually, EPA provides the following guidance:
 - a. The ENERGY STAR Reference Design Home is virtually identical to the home that would have been built using the minimum requirements of the prescriptive path. Therefore, EPA suggests that Raters complete a plan take-off of the home to be built, configure it with the minimum requirements of the prescriptive path, and then review Exhibit 2 of this document for any remaining items that need to be changed.
 - b. Any item in Exhibit 2 that states "Same as Rated Home" means that the parameter should be identical to the rated home. Therefore, if the Rater follows the guidance in item a), these parameters don't need to be further adjusted when calculating the ENERGY STAR HERS Index Target.
 - c. RESNET requires that all accredited software automatically configure certain parameters when calculating a HERS index value (e.g., internal gains, thermostat setpoints, water heater temp.). Any item in Exhibit 2 that begins with a plus (+) and is shaded gray will be automatically configured by the software, indicating that the Rater need not do anything to comply with these items when calculating the HERS Index Target.
 - d. In Exhibit 2, slab insulation R-values represent nominal insulation levels; U-factors and SHGC coefficients for windows and doors apply to the entire assembly; and assembly U-factors for foundations, floors, walls, and ceilings represent the overall U-value of the assembly, inclusive of exterior sheathing materials, cavity insulation and installation quality, framing, and interior finishes. To create an assembly that meets the required U-factor, Raters may wish to start with the nominal insulation R-values indicated in the county-level Reference Design applicable to the Rated Home, and then modify the assembly details until the U-factor aligns.

Note that EPA will provide modified Mandatory Requirements and ENERGY STAR Reference Design specifications for states with energy codes significantly more rigorous than the 2009 IECC. Once published, these modified specifications shall be used after a specified transition period, typically 60 days, to determine the ENERGY STAR HERS Index Target in these states.

2. For all single-family detached homes, townhomes, rowhomes, duplexes, and triplexes, calculate the Size Adjustment Factor (SAF) using the following equation:

$$SAF = [CFA_{\text{Benchmark Home}} / CFA_{\text{Home To Be Built}}]^{0.25}, \text{ not to exceed } 1.0$$

Where:

$CFA_{\text{Benchmark Home}}$ = Conditioned Floor Area of the Benchmark Home, using Exhibit 1 below

$CFA_{\text{Home to be Built}}$ = Conditioned Floor Area of the Home to be Built, as calculated using RESNET Standards

Because the SAF cannot exceed 1.0, it only modifies the HERS Index for homes with conditioned floor area greater than the Benchmark Home. For condos and apartments in multi-family buildings the SAF shall always equal 1.0.

3. Calculate the ENERGY STAR HERS Index Target, rounded to the nearest whole number:

$$\text{ENERGY STAR HERS Index Target} = \text{HERS Index of ENERGY STAR Reference Design Home} \times \text{SAF}$$

4. Next, proceed with Step 2 of the performance path as outlined in the ENERGY STAR National Program Requirements Version, 3 (Rev. 01).

Exhibit 1: Benchmark Home Size^{1,2}

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



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Exhibit 2: Expanded ENERGY STAR Reference Design Definition

Building Component	Expanded ENERGY STAR Reference Design Definition ^{3,4}																																																						
Foundations:	Construction Type & Structural Mass: Same as Rated Home, except: • For masonry floor slabs, modeled with 80% of floor area covered by carpet and 20% of floor directly exposed to room air																																																						
	Conditioning Type: Same as Rated Home, except: • Crawlspace shall be modeled as vented with net free vent aperture = 1sq. ft. per 150 sq. ft. of crawlspace floor area																																																						
	Gross Area: Same as Rated Home																																																						
	Insulation: ⁵ Choose appropriate insulation level below; • Wall U-Factors only apply to conditioned basements and unvented crawlspaces; if applicable, insulation shall be located on interior side of walls • Slab floors with a floor surface less than 12" below grade shall be insulated to the Slab Insulation R-value. The insulation shall extend downward from the top of the slab on the outside of the foundation wall and then vertically below-grade to the Slab Insulation Depth																																																						
	<table border="1"> <thead> <tr> <th>Climate Zone:</th> <th>CZ 1</th> <th>CZ2</th> <th>CZ 3</th> <th>CZ 4</th> <th>CZ 4 C & 5</th> <th>CZ 6</th> <th>CZ 7</th> <th>CZ 8</th> </tr> </thead> <tbody> <tr> <td>Slab Insulation R-Value:</td> <td>0</td> <td>0</td> <td>0</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> </tr> <tr> <td>Slab Insulation Depth (ft):</td> <td>0</td> <td>0</td> <td>0</td> <td>2</td> <td>2</td> <td>4</td> <td>4</td> <td>4</td> </tr> <tr> <td>Crawlspace Wall Assembly U-Factor:</td> <td>0.477</td> <td>0.477</td> <td>0.136</td> <td>0.065</td> <td>0.065</td> <td>0.065</td> <td>0.065</td> <td>0.065</td> </tr> <tr> <td>Basement Wall Assembly U-Factor:</td> <td>0.360</td> <td>0.360</td> <td>0.091</td> <td>0.059</td> <td>0.059</td> <td>0.050</td> <td>0.050</td> <td>0.050</td> </tr> </tbody> </table>										Climate Zone:	CZ 1	CZ2	CZ 3	CZ 4	CZ 4 C & 5	CZ 6	CZ 7	CZ 8	Slab Insulation R-Value:	0	0	0	10	10	10	10	10	Slab Insulation Depth (ft):	0	0	0	2	2	4	4	4	Crawlspace Wall Assembly U-Factor:	0.477	0.477	0.136	0.065	0.065	0.065	0.065	0.065	Basement Wall Assembly U-Factor:	0.360	0.360	0.091	0.059	0.059	0.050	0.050	0.050
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Basement Wall Assembly U-Factor:	0.360	0.360	0.091	0.059	0.059	0.050	0.050	0.050																																															
Floors Over Unconditioned Spaces:	Construction Type: Wood frame																																																						
	Gross Area: Same as Rated Home																																																						
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Floor Assembly U-Factor:	0.064	0.064	0.047	0.047	0.033	0.033	0.028	0.028																																															
Above-Grade Walls:	Interior and Exterior Construction Type: Wood frame																																																						
	Gross Area: Same as Rated Home																																																						
	Solar Absorptance = 0.75																																																						
	Emittance = 0.90																																																						
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Wall Assembly U-Factor:	0.082	0.082	0.082	0.082	0.057	0.057	0.057	0.057																																															
Thermally Isolated Sunrooms:	None																																																						
Doors:	Area: Same as Rated Home																																																						
	Orientation: Same as Rated Home																																																						
	U-Values and SHGCs, based on ENERGY STAR doors: ⁶																																																						
	<table border="1"> <thead> <tr> <th>Climate Zone:</th> <th colspan="2">Opaque</th> <th colspan="2">≤ 1/2-Lite</th> <th colspan="2">> 1/2-Lite</th> </tr> </thead> <tbody> <tr> <td>U-Value:</td> <td colspan="2">0.21</td> <td colspan="2">0.27</td> <td colspan="2">0.32</td> </tr> <tr> <td>SHGC:</td> <td colspan="2">N/A</td> <td colspan="2">0.30</td> <td colspan="2">0.30</td> </tr> </tbody> </table>										Climate Zone:	Opaque		≤ 1/2-Lite		> 1/2-Lite		U-Value:	0.21		0.27		0.32		SHGC:	N/A		0.30		0.30																									
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U-Value:	0.21		0.27		0.32																																																		
SHGC:	N/A		0.30		0.30																																																		
Glazing:	Total Area: (except in homes with conditioned basements and multifamily attached homes ⁷) • Same as Rated Home, where Rated Home glazing area is less than 15% of conditioned floor area; <u>OR</u> • 15% of the conditioned floor area, where the Rated Home glazing area is 15% or more of the conditioned floor area																																																						
	Orientation: Equally distributed to North, East, South, and West																																																						
	+ Interior Shade Coefficient: Same as HERS Reference Home, as defined by RESNET's standard ⁸																																																						
	External Shading: None																																																						
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SHGC:	0.27	0.27	0.30	0.40	0.40	0.40	0.40	0.40																																															
Skylights:	None																																																						
Ceilings:	Construction Type: Wood frame																																																						
	Gross Area: Same as Rated Home																																																						
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Ceiling Assembly U-Factor:	0.035	0.035	0.035	0.03	0.03	0.026	0.026	0.026																																															
Attics:	Construction Type: Vented with aperture = 1sq. ft. per 300 sq. ft. ceiling area																																																						
	Radiant Barrier: In climate zones 1-3, if > 10 linear ft. of ductwork are located in unconditioned attic																																																						
Roofs:	Construction Type: Composition shingle on wood sheathing																																																						
	Gross Area: Same as Rated Home																																																						
	Solar Absorptance = 0.92																																																						
	Emittance = 0.90																																																						



ENERGY STAR Qualified Homes, Version 3 (Rev. 01)

HERS Index Target Procedure

For National Program Requirements

Exhibit 2: Expanded ENERGY STAR Reference Design Definition (Continued)

Heating Systems:	Heating loads may be calculated and equipment capacity selected according to the latest edition of ACCA Manual J, ASHRAE 2009 Handbook of Fundamentals, or a substantively equivalent procedure; otherwise, same as Rated Home.																																																																							
	Fuel Type: Same as Rated Home ⁹																																																																							
	System Type: Same as Rated Home, except Reference Design shall be configured with air-source heat pump in climate zones 1-6 where Rated Home is modeled with ground-source heat pump, electric strip or baseboard heat, and Reference Design shall be configured with ground-source heat pump in climate zones 7 & 8 where Rated Home is modeled with air-source or ground-source heat pump, electric strip or baseboard heat; applicable efficiency selected from below																																																																							
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	Climate Zone:	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8																																																															
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Air-Source Heat Pump Backup:	Electric	Electric	Electric	Electric	Electric	Electric	n/a	n/a																																																																
Ground-Source Heat Pump COP:	n/a	n/a	n/a	n/a	n/a	n/a	3.5	3.5																																																																
Cooling Systems:	Cooling loads may be calculated and equipment capacity selected according to the latest edition of ACCA Manual J, ASHRAE 2009 Handbook of Fundamentals, or a substantively equivalent procedure; otherwise, same as Rated Home.																																																																							
	Fuel Type: Same as Rated Home																																																																							
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Ground-Source Heat Pump EER:	n/a	n/a	n/a	n/a	n/a	n/a	16.1	16.1																																																																
Service Water Heating Systems:	+ Use (Gallons per Day): Same as HERS Reference Home, as defined by RESNET's standard ⁸ .																																																																							
	+ Tank Temperature: Same as HERS Reference Home, as defined by RESNET's standard ⁸ .																																																																							
	Fuel Type: Same as Rated Home																																																																							
	System Type: Conventional storage water heater. Select applicable efficiency from below using tank size of Rated Home. If Rated Home uses instantaneous water heater, then select the efficiency of the 40 gallon tank for gas systems and 60 gallon tank for electric systems.																																																																							
	<table border="1"> <thead> <tr> <th>Gas Storage Tank Capacity:¹⁰</th> <th>30 Gallon</th> <th>40 Gallon</th> <th>50 Gallon</th> <th>60 Gallon</th> <th>70 Gallon</th> <th>80 Gallon</th> </tr> </thead> <tbody> <tr> <td>Gas DHW EF:</td> <td>0.63</td> <td>0.61</td> <td>0.59</td> <td>0.57</td> <td>0.55</td> <td>0.53</td> </tr> </tbody> </table>									Gas Storage Tank Capacity: ¹⁰	30 Gallon	40 Gallon	50 Gallon	60 Gallon	70 Gallon	80 Gallon	Gas DHW EF:	0.63	0.61	0.59	0.57	0.55	0.53																																																	
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Thermal Distribution Systems:	Duct Leakage to Outside: 4 CFM25 per 100 sq. ft. of conditioned floor area																																																																							
	Duct Insulation:																																																																							
	<ul style="list-style-type: none"> R-8 on supply ducts located in unconditioned attic R-6 on all other ducts located in unconditioned spaces 																																																																							
	Duct Surface Area: Same as Rated Home																																																																							
	Supply and Return Duct Locations:																																																																							
Thermostat:	Type: Programmable																																																																							
	+ Temperature Setpoints: Same as HERS Reference Home, with offsets defined by RESNET's standard ⁸ , section 303.5.1.2																																																																							
Infiltration & Mechanical Ventilation:	Infiltration Rates:																																																																							
	<table border="1"> <thead> <tr> <th>Climate Zone:</th> <th>CZ 1</th> <th>CZ 2</th> <th>CZ 3</th> <th>CZ 4</th> <th>CZ 5</th> <th>CZ 6</th> <th>CZ 7</th> <th>CZ 8</th> </tr> </thead> <tbody> <tr> <td>ACH50:</td> <td>6</td> <td>6</td> <td>5</td> <td>5</td> <td>4</td> <td>4</td> <td>4</td> <td>3</td> </tr> </tbody> </table>									Climate Zone:	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8	ACH50:	6	6	5	5	4	4	4	3																																													
	Climate Zone:	CZ 1	CZ 2	CZ 3	CZ 4	CZ 5	CZ 6	CZ 7	CZ 8																																																															
	ACH50:	6	6	5	5	4	4	4	3																																																															
	Mechanical ventilation system without heat recovery																																																																							
	Rate: CFM = 0.01 * CFA + 7.5 * (Nbr + 1), where CFA = Conditioned Floor Area and Nbr = Number of Bedrooms																																																																							
	Hours per Day: 24																																																																							
Fan Watts: Watts = CFM Rate / 2.2 CFM per Watt, where CFM Rate is determined above																																																																								
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Lighting, Appliances, & Internal Gains:	Fluorescent Lighting: 80%																																																																							
	Refrigerator: 423 kWh per year																																																																							
	Dishwasher: 0.66 EF																																																																							
	Ceiling Fan: 122 CFM per Watt																																																																							
	+ Internal Gains: Defined by Section 303.5.1.1 of RESNET's standard ⁸ and adjusted for internal gains from the high-efficiency lighting and appliances listed above, as provided by Section 303.4.1.7.																																																																							
Internal Mass:	+ Same as HERS Reference Home, as defined by RESNET's standard ⁸ .																																																																							
	Additional mass specifically designed as a Thermal Storage Element for the Rated Home shall be excluded.																																																																							



ENERGY STAR Qualified Homes, Version 3 (Rev. 01) HERS Index Target Procedure For National Program Requirements

Notes:

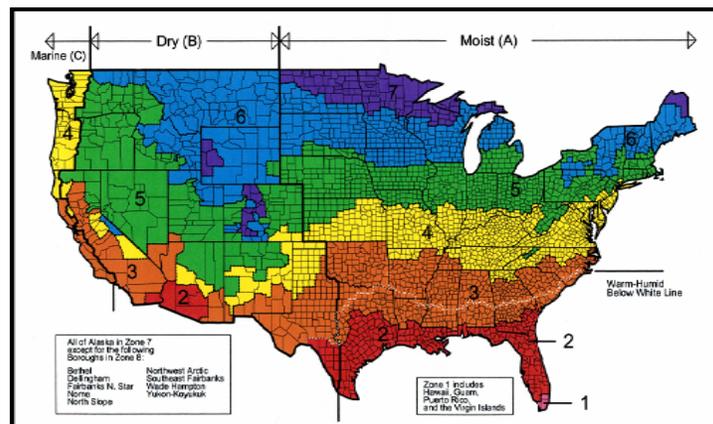
1. The average-size home with a specific number of bedrooms is termed "Benchmark Home". A bedroom is defined by RESNET as a room or space 70 sq. ft. or greater size, with egress window and closet, used or intended to be used for sleeping. A "den", "library", or "home office" with a closet, egress window, 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 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
2. The conditioned floor area of a Benchmark Home (CFA Benchmark Home) is determined by selecting the appropriate value from Exhibit 1. 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.

3. Any parameter not specified in this exhibit shall be set to "Same as Rated Home".
4. 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.



5. For informative purposes, assembly U-factors are meant to correlate to typical assemblies containing the nominal R-values as listed in 2009 IECC Table 402.1.1.
6. All Reference Design window and door U-value and SHGC requirements are based on the ENERGY STAR Program Requirements for Residential Windows, Doors, and Skylights – Version 5.0 as outlined at www.energystar.gov/windows, except that SHGC values have been assumed for CZ 4 C & 5-8. Note that the U-value and SHGC for doors apply to the whole door, not just to the glazing portion.



ENERGY STAR Qualified Homes, Version 3 (Rev. 01) HERS Index Target Procedure For National Program Requirements

7. When determining the ENERGY STAR HERS Index Target for homes with conditioned basements and for multi-family attached homes under the performance path, the following formula shall be used to determine total window area of the ENERGY STAR Reference Design:

$$AF = 0.15 \times AFL \times FA \times F$$

Where:

- AF = Total fenestration area
- AFL = Total floor area of directly conditioned space
- FA = (Above-grade thermal boundary gross wall area) / (Above-grade boundary wall area + 0.5 x Below-grade boundary wall area)
- F = $1 - 0.44 \times (\text{Common wall area}) / (\text{Above-grade thermal boundary wall area} + \text{Common wall area})$

And where:

- Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions;
- Above-grade thermal boundary wall is any portion of a thermal boundary wall not in contact with soil;
- Below-grade boundary wall is any portion of a thermal boundary wall in soil contact; and
- Common wall is the total wall area of walls adjacent to another conditioned living unit, not including foundation walls.

8. RESNET's 2006 Mortgage Industry National Home Energy Rating Systems Standard.
9. In the ENERGY STAR Reference Design, fuel type(s) shall be same as Rated Home, including any dual-fuel equipment where applicable. For a Rated Home with multiple heating, cooling, or water heating systems using different fuel types, the applicable system capacities and fuel types shall be weighted in accordance with the loads distribution (as calculated by accepted engineering practice for that equipment and fuel type) of the subject multiple systems.
10. To determine domestic hot water (DHW) EF requirements for additional tank sizes, use the following equations: Gas DHW EF $\geq 0.69 - (0.002 \times \text{Tank Gallon Capacity})$; Electric DHW EF $\geq 0.97 - (0.001 \times \text{Tank Gallon Capacity})$; Oil DHW EF $\geq 0.61 - (0.002 \times \text{Tank Gallon Capacity})$.