HERS Index Target Procedure for National Program Requirements ENERGY STAR Certified Homes, Version 3.1 (Rev. 07)

This document provides instructions for determining the ENERGY STAR HERS Index Target, the highest numerical HERS Index value that each rated home may achieve to earn the ENERGY STAR. Note that, in addition to meeting the ENERGY STAR HERS Index Target, homes shall also meet all Mandatory Requirements for All Certified Homes in Exhibit 2 of the ENERGY STAR Certified Homes Version 3.1 National Program Requirements.

A RESNET-accredited Home Energy Rating software program shall automatically determine (i.e., without relying on a user-configured ENERGY STAR Reference Design) this target for each rated home using the following procedure:

1. The software shall configure the ENERGY STAR Reference Design Home in accordance with Exhibit 2, the Expanded ENERGY STAR Reference Design Definition, and calculate its associated HERS Index value.

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

   $$SAF = [CFA_{Benchmark\ Home} / CFA_{Home\ To\ Be\ Built}]^{0.083}, \text{ not to exceed } 1.0$$

   Where:

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

   $CFA_{Home\ to\ be\ Built}$ = Conditioned Floor Area of the Home to be Built

   For the purposes of this step, the software shall 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. [1] Because the SAF cannot exceed 1.0, it only modifies the HERS Index Target 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. The software shall calculate the ENERGY STAR HERS Index Target, rounded to the nearest whole number:

   ENERGY STAR HERS Index Target = HERS Index of ENERGY STAR Reference Design Home x SAF

Exhibit 1: Benchmark Home Size [2,3]

Bedrooms in Home to be Built	0	1	2	3	4	5	6	7	8
Conditioned Floor Area $_{Benchmark\ Home}$	1,000	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 [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: • Crawlspaces 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 [5]
	Insulation: [6, 7] Choose appropriate insulation level below: • Basement Wall Assembly U-factor only applies to conditioned bsmt.'s; if applicable, insulation shall be located on interior side of walls • Floor assemblies above crawlspace foundations shall be configured to meet the applicable floor assembly U-factor listed in the building component section for Floors Over Unconditioned Spaces • 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

Climate Zone:	**CZ 1**	**CZ 2**	**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
Basement Wall Assembly U-Factor:	0.360	0.360	0.091	0.059	0.050	0.050	0.050	0.050

Building Component	Expanded ENERGY STAR Reference Design Definition [4]
Floors Over Unconditioned Spaces:	Construction Type: Wood frame
	Gross Area: Same as Rated Home
	Insulation: [6, 7]

Climate Zone:	**CZ 1**	**CZ 2**	**CZ 3**	**CZ 4**	**CZ 4 C & 5**	**CZ 6**	**CZ 7**	**CZ 8**
Floor Assembly U-Factor:	0.064	0.064	0.047	0.047	0.033	0.033	0.028	0.028

Building Component	Expanded ENERGY STAR Reference Design Definition [4]
Above-Grade Walls:	Interior and Exterior Construction Type: Wood frame
	Gross Area: Same as Rated Home
	Solar Absorptance = 0.75
	Emittance = 0.90
	Insulation: [6]

Climate Zone:	**CZ 1**	**CZ 2**	**CZ 3**	**CZ 4**	**CZ 4 C & 5**	**CZ 6**	**CZ 7**	**CZ 8**
Wall Assembly U-Factor:	0.082	0.082	0.057	0.057	0.057	0.048	0.048	0.048

Building Component	Expanded ENERGY STAR Reference Design Definition [4]
Thermally Isolated Sunrooms:	None
Doors:	Area: Same as Rated Home
	Orientation: Same as Rated Home
	U-Values and SHGCs, based on ENERGY STAR doors: [8]

Door Type:	**Opaque**	**≤ 1/2-Lite**	**> 1/2-Lite CZ 1-3**	**> 1/2-Lite CZ 4-8**
U-Value:	0.17	0.25	0.30	0.30
SHGC:	N/A	0.25	0.25	0.40

Building Component	Expanded ENERGY STAR Reference Design Definition [4]
Glazing:	Total Area: (except in homes with conditioned basements and attached homes [9]) • Same as Rated Home, where Rated Home glazing area is less than 15% of conditioned floor area; OR • 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 [10]
	External Shading: None
	U-Values and SHGCs, based on ENERGY STAR Windows: [8]

Climate Zone:	**CZ 1**	**CZ 2**	**CZ 3**	**CZ 4**	**CZ 4 C & 5**	**CZ 6**	**CZ 7**	**CZ 8**
U-Value:	0.40	0.40	0.30	0.30	0.27	0.27	0.27	0.27
SHGC:	0.25	0.25	0.25	0.40	0.40	0.40	0.40	0.40

Building Component	Expanded ENERGY STAR Reference Design Definition [4]
Skylights:	None
Ceilings:	Construction Type: Wood frame
	Gross Area: Same as Rated Home
	Insulation: [6]

Climate Zone:	**CZ 1**	**CZ 2**	**CZ 3**	**CZ 4**	**CZ 4 C & 5**	**CZ 6**	**CZ 7**	**CZ 8**
Ceiling Assembly U-Factor:	0.035	0.030	0.030	0.026	0.026	0.026	0.026	0.026

Building Component	Expanded ENERGY STAR Reference Design Definition [4]
Attics:	Construction Type: Vented with aperture = 1sq. ft. per 300 sq. ft. ceiling area
	Radiant Barrier: None
Roofs:	Construction Type: Composition shingle on wood sheathing
	Gross Area: Same as Rated Home
	Solar Absorptance = 0.92
	Emittance = 0.90

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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 [11]								
	System Type: Same as Rated Home, except Reference Design shall be configured with air-source heat pump in CZ 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 CZ 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 [12]								
	Climate Zone:	**CZ 1**	**CZ 2**	**CZ 3**	**CZ 4**	**CZ 4C & 5**	**CZ 6**	**CZ 7**	**CZ 8**
	Gas Furn. AFUE:	80	80	90	95	95	95	95	95
	Oil Furn. AFUE:	80	80	80	85	85	85	85	85
	Gas Boiler AFUE:	80	80	80	90	90	90	90	90
	Oil Boiler AFUE:	80	80	80	86	86	86	86	86
	Air-Source Heat Pump HSPF:	8.2	8.2	8.2	8.5	9.25	9.5	n/a	n/a
	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	3.6	3.6
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 [11]								
	System Type: Same as Rated Home, except Reference Design shall be configured with air-source heat pump in CZ 1-6 where Rated Home is modeled with ground-source heat pump and Reference Design shall be configured with ground-source heat pump in CZ 7 & 8 where Rated Home is modeled with air-source or ground-source heat pump; applicable efficiency selected from below.[13]								
	Climate Zone:	**CZ 1**	**CZ 2**	**CZ 3**	**CZ 4**	**CZ 4 C & 5**	**CZ 6**	**CZ 7**	**CZ 8**
	AC SEER:	15	15	15	13	13	13	13	13
	Air-Source Heat Pump SEER:	15	15	15	15	15	15	n/a	n/a
	Ground-Source Heat Pump EER:	n/a	n/a	n/a	n/a	n/a	n/a	17.1	17.1
Service Water Heating Systems:	+ Use (Gallons per Day): Same as HERS Reference Home, as defined by RESNET's standard. [10]								
	+ Tank Temperature: Same as HERS Reference Home, as defined by RESNET's standard. [10]								
	Fuel Type: Same as Rated Home [11]								
	System Type: Conventional storage water heater with tank size equal to that of Rated Home, unless Rated Home uses instantaneous water heater in which case select 40 gallon tank for gas systems and 60 gallon tank for electric systems. Select applicable efficiency from below using tank size of Reference Home.								
	Gas Storage Tank Capacity: [14]	**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		
	Electric Storage Tank Capacity: [14]	**30 Gallon**	**40 Gallon**	**50 Gallon**	**60 Gallon**	**70 Gallon**	**80 Gallon**		
	Electric DHW EF:	0.94	0.93	0.92	0.91	0.90	0.89		
	Oil Storage Tank Capacity: [14]	**30 Gallon**	**40 Gallon**	**50 Gallon**	**60 Gallon**	**70 Gallon**	**80 Gallon**		
	Oil DHW EF:	0.55	0.53	0.51	0.49	0.47	0.45		
Thermal Distribution Systems:	Duct Leakage to Outside: 0 CFM25 per 100 sq. ft. of conditioned floor area								
	Duct Insulation: None, because 100% of ducts are in conditioned space.								
	Duct Surface Area: Same as Rated Home								
	Supply and Return Duct Locations shall be configured according to the table below or, if Rated home does not meet any of the conditions below (e.g. multifamily dwelling unit with conditioned unit below), then duct locations shall be configured to be 100% in conditioned space.								
	Foundation Type:	**Slab**		**Crawlspace**		**Basement**			
	One Story Above Grade:	100% Conditioned		100% Conditioned		100% Conditioned			
	Two Story Above Grade:	100% Conditioned		100% Conditioned		100% Conditioned			
Thermostat:	Type: Programmable								
	+ Temperature Setpoints: Same as HERS Reference Home, with offsets defined by RESNET's standard, [10] Section 303.5.1.2								
Infiltration & Mechanical Ventilation:	Infiltration Rates:								
	Climate Zone:	**CZ 1**	**CZ 2**	**CZ 3**	**CZ 4**	**CZ 4 C & 5**	**CZ 6**	**CZ 7**	**CZ 8**
	ACH50:	4	4	3	3	3	3	3	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 / 2.8 CFM per Watt, where CFM Rate is determined above								
	Climate Zone:	**CZ 1**	**CZ 2**	**CZ 3**	**CZ 4**	**CZ 4 C & 5**	**CZ 6**	**CZ 7**	**CZ 8**
	Ventilation Type:	Supply	Supply	Supply	Supply	Exhaust	Exhaust	Exhaust	Exhaust
Lighting, Appliances, & Internal Gains:	Fluorescent Lighting: 90%								
	Refrigerator: 423 kWh per year								
	Dishwasher: 0.66 EF								
	Ceiling Fan: 122 CFM per Watt; Quantity = Number of bedrooms + 1 when ceiling fans present in the Rated Home; otherwise Quantity = 0								
	+ Internal Gains: Defined by Section 303.5.1.1 of RESNET's standard [10] 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. [10]								
	Additional mass specifically designed as a Thermal Storage Element for the Rated Home shall be excluded.								

Notes:

1. 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 and Size Adjustment Factor. The full conditioned floor area, per RESNET's standards, should be used when rating the home (e.g., determining compliance with duct leakage requirements).
2. The average-size home with a specific number of bedrooms is termed the "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 2012 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 in. 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.
3. 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. by 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.
4. Any parameter not specified in this exhibit shall be identical to the value entered for the Rated Home.
5. "Same as Rated Home" indicates that the parameter shall be identical to the value entered for the Rated Home.
6. Slab insulation R-values represent nominal insulation levels; and assembly U-factors for foundations, floors, walls, and ceilings represent the overall assembly, inclusive of sheathing materials, cavity insulation, installation quality, framing, and interior finishes.
7. If software allows the user to specify the thermal boundary location independent of the conditioned space boundary in the basement of the rated home, then the thermal boundary of the ENERGY STAR Reference Design shall be aligned with this boundary. For example, if the thermal boundary is located at the walls, then the wall insulation shall be configured as if it was a conditioned basement. If the thermal boundary is located at the floor above the basement, then the floor insulation shall be configured as if it was a floor over an unconditioned space.
8. 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 6.0 as outlined at www.energystar.gov/windows, except that SHGC values have been assumed for CZ 4C & 5-8. Note that the U-factor requirement applies to all fenestration while the SHGC only applies to the glazed portion.
9. When determining the ENERGY STAR HERS Index Target for homes with conditioned basements and for attached homes, 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 x (Common wall area) / (Above-grade thermal boundary wall area + 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.
10. RESNET's 2006 Mortgage Industry National Home Energy Rating Systems Standard requires that all RESNET-accredited Home Energy Rating software programs automatically configure this parameter when calculating a HERS index value.
11. 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 multiple systems.

12. For a Rated Home without a heating system, the ENERGY STAR Reference Design Home shall be configured with a 78% AFUE gas furnace system, unless the Rated home has no access to natural gas or fossil fuel delivery. In such cases, the ENERGY STAR Reference Design Home shall be configured with a 7.7 HSPF air-source heat pump.
13. For a Rated Home without a cooling system, the ENERGY STAR Reference Design Home shall be configured with a 13 SEER electric air conditioner.
14. To determine domestic hot water (DHW) EF requirements for additional tank sizes, use 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).