

# ENERGY STAR<sup>®</sup>

## Residential New Construction Programs

### Historical Document

This document is provided for reference because it has been superseded by a more recent Version or Revision. Please find current program documents on the [Program Requirements](#) webpage.

Use of older Versions and Revisions, such as this document, are typically limited to homes and buildings with a permit date (or, for manufactured homes, a production date) prior to a specified date. Consult the [Implementation Timeline](#) table to assess whether a home or apartment is still eligible to be certified using this document.

For questions or more information, contact us at [energystarhome@energystar.gov](mailto:energystarhome@energystar.gov).



# HERS Index Target Procedure for National Program Requirements ENERGY STAR Certified Homes, Version 3 (Rev. 08)

This document provides detailed instructions for determining the ENERGY STAR HERS Index Target, the highest HERS Index value that a home can achieve and be certified. The Certification Process 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 Certified Homes in Exhibit 2 of the ENERGY STAR Certified Homes Version 3 (Rev. 08) 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 Exhibit 1 of the National Program Requirements. Therefore, EPA suggests that Raters complete a plan take-off of the home to be built, configure it with the Exhibit 1 of the National Program Requirements, 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, triplexes, and quadplexes, 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

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. <sup>1</sup> 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. Calculate the ENERGY STAR HERS Index Target, rounded to the nearest whole number:  

$$ENERGY\ STAR\ HERS\ Index\ Target = HERS\ Index\ of\ ENERGY\ STAR\ Reference\ Design\ Home \times SAF$$
4. Next, proceed with Step 2 of the Certification Process as outlined in the ENERGY STAR National Program Requirements, Version 3 (Rev. 08).

### Exhibit 1: Benchmark Home Size <sup>2,3</sup>

Bedrooms in Home to be Built	0	1	2	3	4	5	6	7	8
Conditioned Floor Area <sub>Benchmark Home</sub>	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 <sup>5,6</sup>										
Foundations:	Construction Type & Structural Mass: Same as Rated Home, except:										
	<ul style="list-style-type: none"> <li>For masonry floor slabs, modeled with 80% of floor area covered by carpet and 20% of floor directly exposed to room air</li> </ul>										
	Conditioning Type: Same as Rated Home, except:										
	<ul style="list-style-type: none"> <li>Crawlspaces shall be modeled as vented with net free vent aperture = 1sq. ft. per 150 sq. ft. of crawlspace floor area</li> </ul>										
	Gross Area: Same as Rated Home										
Foundations:	Insulation: <sup>7,8</sup> Choose appropriate insulation level below;										
	<ul style="list-style-type: none"> <li>Basement Wall Assembly U-factor only applies to conditioned basements; if applicable, insulation shall be located on interior side of walls</li> <li>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</li> <li>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</li> </ul>										
	<b>Climate Zone:</b>	<b>CZ 1</b>	<b>CZ 2</b>	<b>CZ 3</b>	<b>CZ 4</b>	<b>CZ 4 C &amp; 5</b>	<b>CZ 6</b>	<b>CZ 7</b>	<b>CZ 8</b>		
	<b>Slab Insulation R-Value:</b>	0	0	0	10	10	10	10	10		
	<b>Slab Insulation Depth (ft):</b>	0	0	0	2	2	4	4	4		
Foundations:	<b>Basement Wall Assembly U-Factor:</b>	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									
		Insulation: <sup>7,8</sup>									
		<b>Climate Zone:</b>	<b>CZ 1</b>	<b>CZ 2</b>	<b>CZ 3</b>	<b>CZ 4</b>	<b>CZ 4 C &amp; 5</b>	<b>CZ 6</b>	<b>CZ 7</b>	<b>CZ 8</b>	
<b>Floor Assembly U-Factor:</b>		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										
	Insulation: <sup>7</sup>										
Above-Grade Walls:	<b>Climate Zone:</b>	<b>CZ 1</b>	<b>CZ 2</b>	<b>CZ 3</b>	<b>CZ 4</b>	<b>CZ 4 C &amp; 5</b>	<b>CZ 6</b>	<b>CZ 7</b>	<b>CZ 8</b>		
	<b>Wall Assembly U-Factor:</b>	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: <sup>9</sup>											
<b>Door Type:</b>			<b>Opaque</b>			<b>≤ 1/2-Lite</b>		<b>&gt; 1/2-Lite</b>			
<b>U-Value:</b>	0.21			0.27		0.32					
<b>SHGC:</b>	N/A			0.30		0.30					
Glazing:	Total Area: (except in homes with conditioned basements and attached homes <sup>10</sup> )										
	<ul style="list-style-type: none"> <li>Same as Rated Home, where Rated Home glazing area is less than 15% of conditioned floor area; <u>OR</u></li> <li>15% of the conditioned floor area, where the Rated Home glazing area is 15% or more of the conditioned floor area</li> </ul>										
	Orientation: Equally distributed to North, East, South, and West										
	+ Interior Shade Coefficient: Same as HERS Reference Home, as defined by RESNET's standard <sup>11</sup>										
	External Shading: None										
Glazing:	U-Values and SHGCs, based on ENERGY STAR Windows: <sup>9</sup>										
	<b>Climate Zone:</b>	<b>CZ 1</b>	<b>CZ 2</b>	<b>CZ 3</b>	<b>CZ 4</b>	<b>CZ 4 C &amp; 5</b>	<b>CZ 6</b>	<b>CZ 7</b>	<b>CZ 8</b>		
	<b>U-Value:</b>	0.60	0.60	0.35	0.32	0.30	0.30	0.30	0.30		
	<b>SHGC:</b>	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									
		Insulation: <sup>7</sup>									
		<b>Climate Zone:</b>	<b>CZ 1</b>	<b>CZ 2</b>	<b>CZ 3</b>	<b>CZ 4</b>	<b>CZ 4 C &amp; 5</b>	<b>CZ 6</b>	<b>CZ 7</b>	<b>CZ 8</b>	
	<b>Ceiling Assembly U-Factor:</b>	0.035	0.035	0.035	0.030	0.030	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										



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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 <sup>12</sup>								
	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 <sup>13</sup>								
	<b>Climate Zone:</b>	<b>CZ 1</b>	<b>CZ 2</b>	<b>CZ 3</b>	<b>CZ 4</b>	<b>CZ 4 C &amp; 5</b>	<b>CZ 6</b>	<b>CZ 7</b>	<b>CZ 8</b>
	<b>Gas Furn. AFUE:</b>	80	80	80	90	90	90	90	90
	<b>Oil Furn. AFUE:</b>	80	80	80	85	85	85	85	85
<b>Gas / Oil Boiler AFUE:</b>	80	80	80	85	85	85	85	85	
<b>Air-Source Heat Pump HSPF:</b>	8.2	8.2	8.2	8.5	9.25	9.5	n/a	n/a	
<b>Air-Source Heat Pump Backup:</b>	Electric	Electric	Electric	Electric	Electric	Electric	n/a	n/a	
<b>Ground-Source Heat Pump COP:</b>	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 <sup>12</sup>								
	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 <sup>14</sup>								
	<b>Climate Zone:</b>	<b>CZ 1</b>	<b>CZ 2</b>	<b>CZ 3</b>	<b>CZ 4</b>	<b>CZ 4 C &amp; 5</b>	<b>CZ 6</b>	<b>CZ 7</b>	<b>CZ 8</b>
	<b>AC SEER:</b>	14.5	14.5	14.5	13	13	13	13	13
	<b>Air-Source Heat Pump SEER:</b>	14.5	14.5	14.5	14.5	14.5	14.5	n/a	n/a
<b>Ground-Source Heat Pump EER:</b>	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. <sup>11</sup>								
	+ Tank Temperature: Same as HERS Reference Home, as defined by RESNET's standard. <sup>11</sup>								
	Fuel Type: Same as Rated Home <sup>12</sup>								
	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.								
	<b>Gas Storage Tank Capacity:</b> <sup>15</sup>	<b>30 Gallon</b>	<b>40 Gallon</b>	<b>50 Gallon</b>	<b>60 Gallon</b>	<b>70 Gallon</b>	<b>80 Gallon</b>		
	<b>Gas DHW EF:</b>	0.63	0.61	0.59	0.57	0.55	0.53		
	<b>Electric Storage Tank Capacity:</b> <sup>15</sup>	<b>30 Gallon</b>	<b>40 Gallon</b>	<b>50 Gallon</b>	<b>60 Gallon</b>	<b>70 Gallon</b>	<b>80 Gallon</b>		
	<b>Electric DHW EF:</b>	0.94	0.93	0.92	0.91	0.90	0.89		
<b>Oil Storage Tank Capacity:</b> <sup>15</sup>	<b>30 Gallon</b>	<b>40 Gallon</b>	<b>50 Gallon</b>	<b>60 Gallon</b>	<b>70 Gallon</b>	<b>80 Gallon</b>			
<b>Oil DHW EF:</b>	0.55	0.53	0.51	0.49	0.47	0.45			
Thermal Distribution Systems:	Duct Leakage to Outside: The greater of 4 CFM25 per 100 sq. ft. of conditioned floor area or $\leq 40$ CFM25.								
	Duct Insulation: • 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 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 attic space.								
	<b>Foundation Type:</b>	<b>Slab</b>			<b>Crawlspace</b>		<b>Basement</b>		
	<b>One Story Above-Grade:</b>	100% Attic			100% Crawlspace		100% Basement		
<b>Two Story Above-Grade:</b>	75% Attic / 25% Conditioned			50% Attic / 50% Crawlspace		50% Attic / 50% Basement			
Thermostat:	Type: Programmable								
	+ Temperature Setpoints: Same as HERS Reference Home, with offsets defined by RESNET's standard, <sup>11</sup> Section 303.5.1.2								
Infiltration & Mechanical Ventilation:	Infiltration Rates:								
	<b>Climate Zone:</b>	<b>CZ 1</b>	<b>CZ 2</b>	<b>CZ 3</b>	<b>CZ 4</b>	<b>CZ 4 C &amp; 5</b>	<b>CZ 6</b>	<b>CZ 7</b>	<b>CZ 8</b>
	<b>ACH50:</b>	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								
	<b>Climate Zone:</b>	<b>CZ 1</b>	<b>CZ 2</b>	<b>CZ 3</b>	<b>CZ 4</b>	<b>CZ 4 C &amp; 5</b>	<b>CZ 6</b>	<b>CZ 7</b>	<b>CZ 8</b>
<b>Ventilation Type:</b>	Supply	Supply	Supply	Supply	Exhaust	Exhaust	Exhaust	Exhaust	
Lighting, Appliances, & Internal Gains:	Fluorescent Lighting: 80%								
	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 Rated home; otherwise Quantity = 0								
	+ Internal Gains: Defined by Section 303.5.1.1 of RESNET's standard <sup>11</sup> 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. <sup>11</sup>								
	Additional mass specifically designed as a Thermal Storage Element for the Rated Home shall be excluded.								



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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.

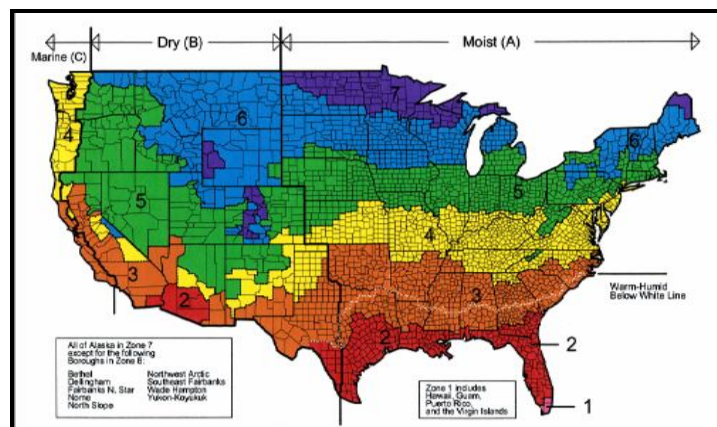
An egress window, as defined in 2009 IRC section R310, shall refer to any operable window that provides for a means of escape and access for rescue in the event of an emergency. The egress window definition has been summarized for convenience. The egress window shall:

- have a sill height of not more than 44 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. 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.

4. 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 where 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.
5. Any parameter not specified in this exhibit shall be set to "Same as Rated Home".
6. 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.



7. 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.
8. 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.
9. 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](http://www.energystar.gov/windows), except that SHGC values have been assumed for CZ 4 C & 5-8. Note that the U-factor requirement applies to all fenestration while the SHGC only applies to the glazed portion.



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10. 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 =  $1 - 0.44 \times (\text{Common wall area}) / (\text{Above-grade thermal boundary wall area} + \text{Common wall area})$

And where:

- Thermal boundary wall is any wall that separates directly or indirectly 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.

11. RESNET's 2006 Mortgage Industry National Home Energy Rating Systems Standard.

12. 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 multiple systems.

13. 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.

14. For a Rated Home without a cooling system, the ENERGY STAR Reference Design Home shall be configured with a 13 SEER electric air conditioner.

15. 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  $\geq 0.61 - (0.002 \times \text{Tank Gallon Capacity})$ .