ENERGY STAR®
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Historical Document

This document is provided for reference because it has been superseded by a more recent Version or Revision.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.

National ERI Target Procedure
ENERGY STAR Certified Homes, Version 3.1 (Rev. 10)

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

An EPA-recognized Verification Oversight Organization's Approved Software Rating Tool shall automatically determine (i.e., without relying on a user-configured ENERGY STAR Reference Design) this target for each rated home. This shall be done by configuring the ENERGY STAR Reference Design Home in accordance with Exhibit 1, the Expanded ENERGY STAR Reference Design Definition, and calculating its associated ERI value. The ERI value shall be calculated using ANSI / RESNET / ICC Standard 301 including all Addenda and Normative Appendices, with new versions and Addenda implemented according to the Effective Date and Transition Period End Date defined by RESNET. RESNET interpretations of Standard 301 shall also be followed. Any exceptions shall be approved by EPA and reported at www.energystar.gov/ERIExceptions. This value, rounded to the nearest whole number, shall equal the ENERGY STAR ERI Target.

National ERI Target Procedure
ENERGY STAR Certified Homes, Version 3.1 (Rev. 10)

Exhibit 1: Expanded ENERGY STAR Reference Design Definition

Building Component	Expanded ENERGY STAR Reference Design Definition [1]							
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 [2]							
	Insulation: [3, 4] 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
Floors Over Unconditioned Spaces:	Construction Type: Wood frame							
	Gross Area: Same as Rated Home							
	Insulation: [3, 4] **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
Above-Grade Walls:	Interior and Exterior Construction Type: Wood frame							
	Gross Area: Same as Rated Home							
	Solar Absorptance = 0.75							
	Emittance = 0.90							
	Insulation: [3] **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
Thermally Isolated Sunrooms:	None							
Doors: [5]	Area: Same as Rated Home							
	Orientation: Same as Rated Home							
	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
Glazing: [5]	Total Area: (except in homes with conditioned basements and attached homes [6]) • 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 Energy Rating Reference Home, as defined by ANSI / RESNET / ICC Std. 301							
	External Shading: None							
	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
Skylights:	None							
Ceilings:	Construction Type: Wood frame							
	Gross Area: Same as Rated Home							
	Insulation: [3] **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
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							
Internal Mass:	Same as Energy Rating Reference Home, as defined by ANSI / RESNET / ICC Std. 301.							
	Additional mass specifically designed as a Thermal Storage Element for the Rated Home shall be excluded.							

Exhibit 1: Expanded ENERGY STAR Reference Design Definition (Continued)

Heating Systems:

Heating capacity shall be selected in accordance with ACCA Manual S based on building heating and cooling loads calculated in accordance with ACCA Manual J, Eighth Edition, ASHRAE Handbook of Fundamentals, or an equivalent computation procedure.

Fuel Type: Same as Rated Home [7]

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 air-source or ground-source heat pump, electric strip heat, or electric 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 heat, or electric baseboard heat; applicable efficiency selected from below. [8]

Climate Zone:	CZ 1	CZ 2	CZ 3	CZ 4	CZ 4C & 5	CZ 6	CZ 7	CZ 8
Gas Furn. AFUE:	80	80	80	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

For non-electric warm furnaces and non-electric boilers, the Electric Auxiliary Energy shall be determined in accordance with the methodology for the Energy Rating Reference Home in ANSI / RESNET / ICC Std. 301, using the capacity determined in this Section.

Cooling Systems:

Cooling capacity shall be selected in accordance with ACCA Manual S based on building heating and cooling loads calculated in accordance with ACCA Manual J, Eighth Edition, ASHRAE Handbook of Fundamentals, or an equivalent computation procedure.

Fuel Type: Same as Rated Home [7]

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 air-source or ground-source heat pump, electric strip heat, or electric 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 heat, or electric baseboard heat; applicable efficiency selected from below. [9]

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 Energy Rating Reference Home, as defined by ANSI / RESNET / ICC Std. 301, except for reduced usage resulting from the dishwasher specified in the Lighting, Appliances, & Internal Gains Section. [10]

Tank Temperature: Same as Energy Rating Reference Home, as defined by ANSI / RESNET / ICC Std. 301.

Fuel Type: Same as Rated Home [7]

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 50 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: [11]	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: [11]	**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: [11]	**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 Energy Rating Reference Home, but with offsets for a programmable thermostat, as defined by ANSI / RESNET / ICC Std. 301

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; Runtime: 24 Hours / Day

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:

Lighting: Fraction of qualifying Tier I fixtures to all fixtures in qualifying light fixture locations 90% for interior; 0% for exterior and garage

Refrigerator: 423 kWh per year

Dishwasher: 0.66 EF, Place Setting Capacity Same as Rated Home

Ceiling Fan: 122 CFM per Watt; Quantity = Number of bedrooms + 1 when ceiling fans present in the Rated Home; otherwise Quantity = 0

Clothes Washer and Dryer: Same as Energy Rating Reference Home, as defined by ANSI / RESNET / ICC Std. 301

Internal Gains: Same as Energy Rating Reference Home, as defined by ANSI / RESNET / ICC Std. 301, except for adjustments for the lighting, refrigerator, dishwasher, and ceiling fans specified in this Section.

Footnotes:

1. Any parameter not specified in this exhibit shall be identical to the value entered for the Rated Home.
2. "Same as Rated Home" indicates that the parameter shall be identical to the value entered for the Rated Home.
3. 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.
4. 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.
5. Note that the U-factor requirement applies to all fenestration while the SHGC only applies to the glazed portion.
6. When determining the ENERGY STAR ERI 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:

   $$AG = 0.15 \times CFA \times FA \times F$$

   Where:
   - AG = Total glazing area
   - CFA = Total conditioned floor area
   - FA = (Gross above-grade thermal boundary wall area) / (Gross above-grade thermal boundary wall area + 0.5 x Gross below-grade thermal boundary wall area)
   - F = 1 - 0.44 x (Gross common wall area) / (Gross above-grade thermal boundary wall area + Gross common wall area)

   And where:
   - Thermal boundary wall is any wall that separates Conditioned Space from Unconditioned Space, outdoor environment, or the surrounding soil;
   - Above-grade thermal boundary wall is any portion of a thermal boundary wall not in contact with soil;
   - Below-grade thermal 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.
7. 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.
8. 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.
9. For a Rated Home without a cooling system, the ENERGY STAR Reference Design Home shall be configured with a 13 SEER electric air conditioner.
10. That is to say, representative of standard-flow plumbing fixtures, reference clothes washer gallons per day, standard distribution system water use effectiveness, a hot water piping ratio of 1.0, no pipe insulation, and no drainwater heater recovery.
11. 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).