DOE Zero Energy Ready Home California Program Requirements (Version 1, Rev. 08)

December 1, 2022

These Program Requirements shall only be used in the State of California.

To qualify as a DOE Zero Energy Ready Home, a home shall meet the minimum requirements specified below, be verified and field-tested by a verifier working under an EPA-recognized Home Certification Organization (HCO) operating in California, and meet all applicable codes.[1]

The following homes and building types are eligible to participate in the DOE Zero Energy Ready Home program using the Version 1 – California program requirements:

- Site-built or modular[2] dwellings[3] (e.g., single-family homes, duplexes) and townhomes[4];
- Site-built or modular multifamily and mixed-use buildings with dwelling or sleeping units[5] no taller than 5 stories above grade[6], where the dwelling units and common space exceed 50% of the building's square footage.[7] Parking garage square footage is excluded from this calculation.

Dwellings in eligible multifamily buildings as listed above may be served by central heating, cooling, or hot water systems. Partners are also advised that DOE is developing a revised program design for California multifamily buildings of any height, consistent with the ENERGY STAR Multifamily New Construction program.

Note that compliance with these program requirements is not intended to imply compliance with all local code requirements that may be applicable to the home to be built.

Partners must determine the required version and revision of DOE Zero Energy Ready Home program requirements based on a project's building type, location, plan approval and permit date[8], posted on the DOE ZERH Program Requirements webpage. Partners are advised to check the DOE ZERH website and IRS Guidance on the 45L tax credit for further information about tax credit eligibility. Also note 45L tax credit eligibility is based on a project's Acquisition Date.

DOE Zero Energy Ready Home Performance Path

While all mandatory requirements for labeled homes in Exhibit 1 shall be met, the performance path provides flexibility to select a custom combination of measures to meet the required level of energy efficiency beyond California's 2016 Building Energy Efficiency Standards.

1. Select one of the two following performance targets:
   - A Compliance Total with ≥15% savings above the Compliance Total of the Standard Design corresponding to the home, as determined by a CEC-approved software program.[9] On-site power generation may not be used to meet the above-code performance target, though it is permitted to be used to satisfy code, in accordance with the 2016 Building Energy Efficiency Standards.
   - A Delta Energy Design Rating (Delta EDR) of ≥ 4 points, as determined by a CEC-approved software program. On-site power generation may not be used to meet the performance target and must be demonstrated using the EDR score that excludes photovoltaics.

2. Configure the preferred set of efficiency measures for the home to be certified and verify that the resulting performance meets or exceeds the applicable performance target using the applicable software program, as determined in Step 1. Note that, regardless of the measures selected, the Mandatory Requirements for all DOE ZERH Certified Homes in Exhibit 1 are also required and impose certain constraints on the efficiency measures selected (e.g., insulation levels, window performance, etc.).

   Note that PV is not required for compliance, and homes may qualify using only efficiency to meet either of the performance targets noted above.

3. Construct the home using the measures selected in Step 2 and the Mandatory Requirements in Exhibit 1.

4. Using a Rater, verify that all requirements have been met in accordance with the Mandatory Requirements and with Data Input requirements and On-Site Inspection Procedures for California HERS Ratings.[10] [11]

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All homes certified through the Performance Path shall be submitted to DOE by submitting the compliance verification report to zerh@doe.gov..

Exhibit 1: DOE Zero Energy Ready Home Mandatory Requirements for All Labeled California Homes

Area of Improvement	Mandatory Requirements
1. ENERGY STAR Residential New Construction Baseline	☐ Certified under ENERGY STAR Single-Family New Homes California Program Requirements Version 3.3 or the ENERGY STAR Multifamily New Construction California Program Requirements Version 1.3
2. Envelope	☐ Fenestration shall meet or exceed minimum performance requirements [12, 13]
3. Duct System	☐ Duct distribution systems located within the home's thermal and air barrier boundary or an optimized location to achieve comparable performance [14]
4. Water Efficiency	☐ Hot water delivery systems shall meet efficient design requirements[15] ***or*** ☐ Water heaters and fixtures shall meet efficiency criteria[16]
5. Lighting & Appliances[17]	☐ All installed refrigerators, dishwashers, and clothes washers are ENERGY STAR qualified.[18] ☐ 90% of lighting fixtures are LEDs or LED lamps (bulbs) in minimum 90% of sockets ☐ All installed bathroom ventilation and ceiling fans are ENERGY STAR qualified
6. Indoor Air Quality	☐ Certified under EPA Indoor airPLUS Version 1 [19]
7. Renewable Ready	☐ Provisions of the DOE Zero Energy Ready Home PV-Ready Checklist are Completed [20]

Footnotes:

[1] Where requirements of the local codes, covenants, manufacturers' installation instructions, or engineering documents overlap with these requirements, DOE offers the following guidance:

a. In cases where the overlapping requirements exceed the DOE Zero Energy Ready Home requirements, these overlapping requirements shall be met;
b. In cases where overlapping requirements conflict with a requirement of the DOE Zero Energy Ready Home program, then the home is exempt from the conflicting requirement within this document. However, certification 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 the DOE Zero Energy Ready Home program. Note that a home must still meet its performance target. Therefore, other efficiency measures may be needed to compensate for the omission of the conflicting requirement.

[2] A modular home is a prefabricated home that is made of multiple modules or sections that are manufactured and substantially assembled in a manufacturing plant. These pre-built sections are transported to the building site and constructed by a builder to meet all applicable building codes for site-built homes.

[3] A dwelling, as defined by ANSI / RESNET / ICC 301, is any building that contains one or two Dwelling Units used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes. ANSI / RESNET / ICC 301 defines a Dwelling Unit as a single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking, and sanitation.

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[4] A townhome, as defined by ANSI/RESNET/ICC 301, is a single-family dwelling unit constructed in a group of three or more attached units in which each unit extends from the foundation to roof and with open space on at least two sides.

[5] A 'sleeping unit', as defined by ANSI / RESNET / ICC 301, is a room or space in which people sleep, which can also include permanent provisions for living, eating, and either sanitation or kitchen facilities but not both.

[6] 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. 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.

[7] Buildings that do not contain dwelling or sleeping units are not eligible for certification under DOE ZERH. The term 'building' refers to a structure that encompasses dwelling/sleeping units and (if present) common spaces, sharing one or more of the following attributes: a common street address, a common entrance or exit, central/shared mechanical systems, or structurally interdependent wall or roof systems. A skyway or a breezeway that connects two structures is not considered a common entrance or exit. For the purposes of eligibility, hotels, motels, and senior care facilities are not considered multifamily buildings.

The term 'common space' refers to any spaces in the building being certified that serve a function in support of the residential part of the building that is not part of a dwelling or sleeping unit. This includes spaces used by residents, such as corridors, stairs, lobbies, laundry rooms, exercise rooms, residential recreation rooms, and dining halls, as well as offices and other spaces used by building management, administration or maintenance in support of the residents.

Eligible multifamily building types for these ZERH program requirements are the same as those for the ENERGY STAR Multifamily New Construction program (CA Program Requirements, Version 1.3), with the exception that ZERH currently limits participation to such buildings no taller than 5 stories above grade. More information on the eligibility for dormitories, residence halls, and other building types is found here:
https://www.energystar.gov/partner_resources/residential_new/program_reqs/mfnc_building_eligibility

[8] The 'plan approval date' is the date that a jurisdiction approves a home plan and its efficiency features for use on a specific lot or tract. 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 (defined below) have discretion to estimate permit dates based on other construction schedule factors. These assumptions should be both defensible and documented. As an exception, if a new plan is added to a specific tract's existing plan set and the new plan is subject to the same version of the energy code as the existing plan set, then the 'plan approval date' is considered to be the existing plan set's original plan approval date.

[9] CEC approved computer programs can be found at:
www.energy.ca.gov/title24/2016standards/2016_computer_prog_list.html. Any measure that contributes to the Efficiency EDR or Compliance Margin, as recognized by CEC-approved computer programs, is permitted to be used to meet these performance targets.

[10] The term 'Rater' refers to the person completing the third-party inspections required for certification. This party must be a Certified Rater, defined as an individual who has become qualified to conduct California HERS Ratings through certification under an HCO recognized by EPA to implement an ENERGY STAR certification program in California. EPA-recognized HCOs are listed here:
https://www.energystar.gov/partner_resources/residential_new/working/other_participants/hco .
Note that Raters must become DOE ZERH Verifier Partners at the DOE ZERH website www.buildings.energy.gov/zero.

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[11] In the event that a Rater is not able to determine whether an item is consistent with the intent of a provision, (e.g., an alternative method of meeting a checklist requirement has been proposed), then the Rater shall consult their Provider. The term 'Provider' refers to an Approved Rating Provider, defined as an Approved entity responsible for the certification of raters working under its auspices and who is responsible for the Quality Assurance of such Certified Raters and for the Quality Assurance of Energy Ratings produced by such Certified Raters. If the Provider also cannot make this determination, then the Rater or Provider shall report the issue to DOE prior to project completion at: zerh@doe.gov and will typically receive an initial response within 10 business days. If DOE believes the current program requirements are sufficiently clear to determine whether the intent has been met, then this guidance will be provided to the Partner and enforced beginning with the house in question. However, if DOE believes the program requirements require revisions to make the intent clear, then this guidance will be provided to the Partner but only enforced for homes permitted after a specified transition period after the release of the revised program requirements. This process will allow DOE to make formal policy decisions as Partner questions arise and to disseminate these policy decisions through the periodic release of revised program documents to ensure consistent application of the program requirements.

Approved shall mean approved by an HCO recognized by EPA to implement an ENERGY STAR certification program in California.

Quality Assurance is defined as the systematic processes intended to ensure reliable compliance with applicable standards.

A Certified Rater is defined as an individual who has become qualified to conduct California HERS Ratings through certification under an HCO recognized by EPA to implement an ENERGY STAR certification program in California.

[12] Windows shall meet the product criteria (based on ENERGY STAR v5.0 and V6.0 Window Specifications) listed in this table.

Window Specs Required for DOE Zero Energy Ready Home Projects	**Hot Climates IECC CZ 1-2**		**Mixed Climates IECC CZ 3-4 except 4C (Marine)**		**Cold Climates IECC CZ 5-8 and 4C (Marine)**	
	U-Value	SHGC	U-value	SHGC	U-Value	SHGC
	0.40	0.25	[CZ 3] 0.30 [CZ 4] 0.30	[CZ 3] 0.25 [CZ 4] 0.40	0.30 0.31 0.32	Any ≥0.35 ≥0.40

[13] Fenestration shall meet the applicable U and SHGC criteria listed above with the following exceptions:

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 ≥ 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°F 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.

[14] Exceptions and alternative compliance paths to locating 100% of forced-air ducts in home's thermal and air barrier boundary are:

a. Up to 10' of total duct length is permitted to be outside of the home's thermal and air barrier boundary.
b. Ducts are located in an unvented attic, regardless of whether this space is conditioned with a supply register
c. Ducts are located in a vented attic with all of the following characteristics:
    a. In Moist climates (Zones 1A, 2A, 3A, 4A, 5A, 6A and 7A per 2012 IECC Figure R301.1) and Marine climates (all "C" Zones per 2012 IECC Figure R301.1), minimum R-8 duct insulation with an additional minimum 1.5" of closed-cell spray foam insulation encapsulating the ducts; duct leakage to outdoors ≤ 3 CFM25 per 100 ft^2 of conditioned floor area (in addition to meeting *total* duct leakage requirements from Section 4.1 of the ENERGY STAR HVAC Rater checklist); and ductwork buried under at least 2" of blown-in insulation.
    b. In Dry climates (all "B" Zones per 2012 IECC Figure R301.1), minimum R-8 duct insulation; duct leakage to outdoors ≤ 3 CFM25 per 100 ft^2 of conditioned floor area (in addition to meeting *total* duct leakage requirements from Section 4.1 of the ENERGY STAR HVAC Rater checklist); and ductwork buried under at least 3.5" of blown-in insulation.

    Note that in either of these designs the HVAC equipment must still be located within the home's thermal and air barrier boundary.
d. Jump ducts which do not directly deliver conditioned air from the HVAC unit may be located in attics if all joints, including boot-to-drywall, are fully air sealed with mastic or foam, and the jump duct is fully buried under the attic insulation.
e. Ducts are located within an unvented crawl space
f. Ducts are located in a basement which is within the home's thermal boundary
g. Ductless HVAC system is used
h. High Performance Attics: Air handlers and/or ducts are allowed to be in ventilated attic spaces when the roof and ceiling insulation levels meet Option A or B in Table 150.1-A in the 2016 California Building Energy Efficiency Standards. Duct insulation levels shall also meet the requirements in Table 150.1-A of the 2016 California Building Energy Efficiency Standards.

[15] Hot water delivery systems **in single family homes and distributed (individual water heater) systems in multifamily buildings** meet the following efficiency requirements.

To minimize water wasted while waiting for hot water, the hot water distribution system shall store no more than 0.5 gallons (1.9 liters) of water in any piping/manifold between the hot water source and any hot water fixture. In the case of on-demand recirculation systems, the 0.5 gallon (1.9 liter) storage limit shall be measured from the point where the branch feeding the fixture branches off the recirculation loop, to the fixture itself. To verify that the system stores no more than 0.5 gallons (1.9 liters), verifiers shall calculate the stored volume using the piping or tubing inside diameter and the length of the piping/tubing. System options include manifold-fed systems; structured plumbing systems; core plumbing layouts, and on-demand recirculation systems. The following requirements apply to recirculation systems:

a. Recirculation systems must be based on an occupant-controlled switch or an occupancy sensor, installed in each bathroom which is located beyond a 0.5 gallon stored-volume range from the water heater.
b. Recirculation systems which operate based on "adaptive" scheduling, meaning that they "learn" the hot water demand profile in the home and adapt their operation to anticipate this profile, are permitted at this time, and do not require the use of occupant-controlled switches or occupancy sensors.
c. Recirculation systems that are activated based **solely** on a timer and/or temperature sensor are not eligible.

No more than 0.6 gallons (2.3 liters) of water shall be collected from the hot water fixture before hot water is delivered. Only the fixture with the greatest stored volume between the fixture and the hot water source (or recirculation loop) needs to be tested. To field verify that the system meets the 0.6 gallon (2.3 liter) limit, verifiers shall first initiate operation of on-demand recirculation systems, if present, and let such systems run for at least 40 seconds. If an Adaptive Scheduling system cannot be "forced" into recirculation mode, contact DOE for further guidance. Next, a bucket or flow measuring bag (pre-marked for 0.6 gallons) shall be placed under the hot water fixture. The hot water shall be turned on completely and a digital temperature sensor used to record the initial temperature of the water flow. Once the water reaches the pre-marked line at 0.6 gallons (approximately 24 seconds for a lavatory faucet), the water shall be turned off and the ending temperature of the water flow (not the collection bucket) shall be recorded. The temperature of the water flow must increase by ≥ 10 °F. Under the DOE Zero Energy Ready Home program, the approved verifier may confirm compliance with these requirements.

Central hot water delivery systems in multifamily buildings must include on-demand recirculation which operates based on both a demand indicator and the loop water temperature. For qualifying central systems, verifiers must confirm that the pump is installed with flow in the correct direction and that the system's temperature sensors are installed.

[16] Water heaters and fixtures in single family homes and in multifamily dwellings with their own independent water heater meet the following efficiency criteria:

a. Gas water heaters, if present, shall have an Energy Factor ≥ 0.90 or a Uniform Energy Factor ≥ 0.87
b. Electric water heaters, if present, shall have an Energy Factor ≥ 2.2 or a Uniform Energy Factor ≥ 2.2
c. All showerheads and bathroom sink faucets shall be WaterSense labeled.
d. The hot water distribution system shall store no more than 1.2 gallons between the hot water source and the furthest fixture. This shall be verified by either 1) a calculation using the piping or tubing interior diameter and the system length based on plans, or 2) by a field verification test, using the protocol described in Endnote 15, which demonstrates a minimum temperature rise of 10 °F by the time 1.4 gallons of water is delivered to the furthest hot water fixture.

These provisions do not apply to multifamily buildings with central hot water delivery systems. These project types must instead satisfy the Efficient Hot Water Distribution provision instead.

[17] Further efficiency and savings can be achieved by installing ENERGY STAR qualified products in addition to those required.

[18] Products in categories which are not covered by ENERGY STAR product criteria, such as combination all-in-one clothes washer-dryers, are exempt from this requirement.

[19] For homes achieving PHIUS+ certification, DOE will allow compliance with the 2012 IRC kitchen ventilation airflow rates (M 1507.4) as an alternative to those specified within ASHRAE 62.2. This alternative will remain in effect while DOE works to develop an ASHRAE 62.2-compliant solution optimized for very low-load homes. However, this exception does not supersede California State requirements for ASHRAE 62.2 compliance.

[20] DOE Zero Energy Ready Home requires that the provisions of the PV-Ready Checklist are completed based on the requirements and allowances in this end note. DOE encourages, but does not require, the use of the Solar Water Heating-Ready provisions.

The PV-Ready Checklist only applies when all of the following conditions a through d below are satisfied. Homes for which the PV-Ready Checklist does not apply based on these criteria may still qualify for DOE Zero Energy Ready Home if all other program requirements are satisfied.

a. The home does not already include a PV system

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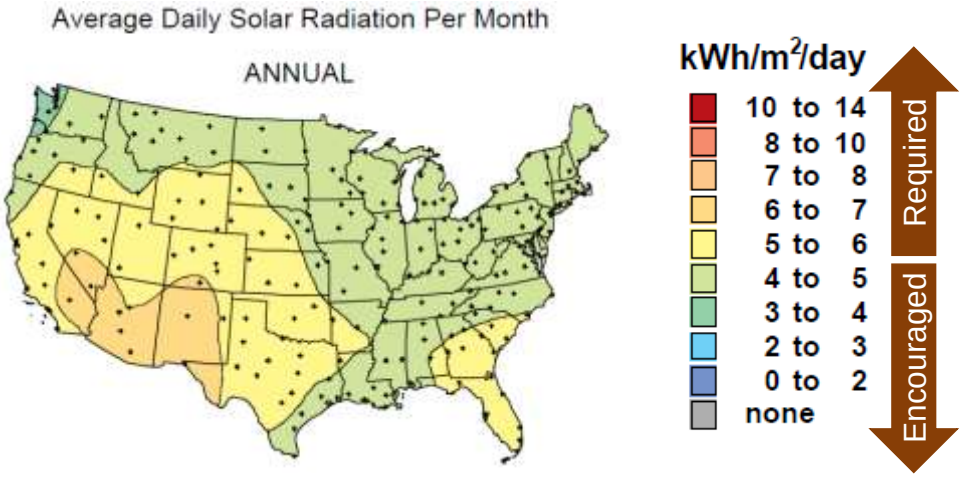
b. Location, based on zip code, has at least 5 kWh/m^2/day average daily solar radiation based on annual solar insolation using this online tool: https://pvwatts.nrel.gov/ . Users should enter the project location zip code, use the System Info default settings, and then proceed to the "Results" tab on the tool to see the Average Annual Solar Radiation value in kWh/m^2/day.



c. Location does not have significant natural shading (e.g., trees, tall buildings on the south-facing roof).
d. Home as designed has the minimum free roof area within +/- 45° of true south as noted in the table below.

Conditioned Floor Area of House (ft^2)	Minimum Roof Area within +/- 45° of True South for PV-Ready Checklist to Apply (ft^2)
≤ 2000	110
≤ 4000	220
≤ 6000	330
>6000	440