



# DOE Zero Energy Ready Home California Program Requirements (Rev. 07) July 11, 2018

**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 in accordance with HERS Standards by an approved verifier, and meet all applicable codes.<sup>1 2</sup>

The following homes are eligible for DOE Zero Energy Ready Home qualification:

- Detached dwelling units<sup>3</sup> (e.g. single family homes)
- Dwelling units<sup>3</sup> in any multifamily building with 4 units or fewer
- Dwelling units<sup>3</sup> in multifamily buildings with 3 stories or fewer above-grade<sup>4</sup>
- Dwelling units<sup>3</sup> in multifamily buildings with 4 or 5 stories above-grade<sup>4</sup> where dwelling units occupy 80% or more of the occupiable square footage of the building. When evaluating mixed-use buildings for eligibility, exclude commercial / retail space when assessing whether the 80% threshold has been met.

Dwellings in eligible multifamily buildings as listed above may be served by central heating, cooling, or hot water<sup>5, 6</sup> systems. In these projects use of the RESNET Guidelines for Multifamily Ratings for modeling the specified central system(s) is recommended.

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

## **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 (e.g., Title 24-2016).

1. Select one of the two following performance targets:

- A Compliance Total with  $\geq 15\%$  savings above the Compliance Total of the Standard Design corresponding to the home, as determined by a CEC-approved software program.<sup>7</sup> 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  $\geq 4$  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.

3. Construct the home using the measures selected in Step 2 and the Mandatory Requirements for All DOE ZERH Certified Homes, Exhibit 1.
4. Using a Rater, verify that all requirements have been met in accordance with the Mandatory Requirements for All DOE ZERH Certified Homes and with Data Input requirements and On-Site Inspection Procedures for California HERS Ratings.<sup>8</sup>



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All homes certified through the Performance Path shall be submitted to DOE by submitting the compliance verification report to [zero@newportpartnersllc.com](mailto:zero@newportpartnersllc.com).

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

Area of Improvement	Mandatory Requirements
<b>1. ENERGY STAR for Homes Baseline</b>	<input type="checkbox"/> Certified under ENERGY STAR Qualified Homes Version 3.2 program requirements applicable for homes in the State of California <sup>9</sup> .
<b>2. Envelope<sup>10</sup></b>	<input type="checkbox"/> Fenestration shall meet or exceed ENERGY STAR requirements or California 2016 Building Energy Efficiency Standards window requirements in Table 150.1-A, <i>whichever is more stringent</i> <sup>11, 12</sup> <input type="checkbox"/> Ceiling, wall, floor, and slab insulation shall meet or exceed 2015 IECC levels or California 2016 Building Energy Efficiency Standards insulation requirements in table 150.1-A, <i>whichever is more stringent</i> . <sup>13</sup>
<b>3. Duct System</b>	<input type="checkbox"/> Duct distribution systems located within the home's thermal and air barrier boundary or an optimized location to achieve comparable performance <sup>14</sup>
<b>4. Water Efficiency</b>	<input type="checkbox"/> Hot water delivery systems shall meet efficient design requirements <sup>15</sup>
<b>5. Lighting &amp; Appliances<sup>16</sup></b>	<input type="checkbox"/> All installed refrigerators, dishwashers, and clothes washers are ENERGY STAR qualified. <input type="checkbox"/> 90% of lighting fixtures are ENERGY STAR qualified or ENERGY STAR lamps (bulbs) in minimum 90% of sockets <input type="checkbox"/> All installed bathroom ventilation and ceiling fans are ENERGY STAR qualified
<b>6. Indoor Air Quality</b>	<input type="checkbox"/> Certified under EPA Indoor airPLUS <sup>17</sup>
<b>7. Renewable Ready</b>	<input type="checkbox"/> Provisions of the DOE Zero Energy Ready Home PV-Ready Checklist are Completed <sup>18</sup>

### Footnotes:

<sup>1</sup> Where requirements of the local codes, covenants, manufacturers' installation instructions, or engineering documents overlap with the requirements of these guidelines, DOE offers the following guidance:

- In cases where the overlapping requirements exceed the DOE Zero Energy Ready Home guidelines, these overlapping requirements shall be met;
- In cases where overlapping requirements conflict with a requirement of these DOE Zero Energy Ready Home guidelines, then the home is exempt from conflicting requirement within these guidelines. 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 these DOE Zero Energy Ready Home guidelines. Note that, under the Performance Path, a home must still meet the Target Home HERS Index Target. Therefore, other efficiency measures may be needed to compensate for the omission of the conflicting requirement.

<sup>2</sup> 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. If the Provider also cannot make this determination, then the Rater or Provider shall report the issue to DOE prior to project completion at: [zero@newportpartnersllc.com](mailto:zero@newportpartnersllc.com) and will typically receive an initial response within 5 business days. If DOE believes the current program guidelines 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



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program guidelines 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 guidelines, typically 60 days in length. 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 guidelines.

<sup>3</sup> A dwelling unit, as defined by the 2012 IECC, is a single unit that provides complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking, and sanitation.

<sup>4</sup> 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. Per ASHRAE 62.2-2010, 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.

<sup>5</sup> Central systems for domestic hot water are allowed in multifamily buildings. Such central systems must include on-demand recirculation which operates based on both a demand indicator and the loop temperature. Central systems in multifamily buildings do not have a stored volume limit at this time (see Advisory under footnote 15).

<sup>6</sup> DOE Zero Energy Ready Home no longer requires that multifamily buildings with central hot water systems use solar energy to provide at least 50% of the domestic hot water demand for the dwelling units.

<sup>7</sup> Information on the Delta EDR can be found at [www.cahp-pge.com/how-to-generate-your-delta-energy-design-rating/](http://www.cahp-pge.com/how-to-generate-your-delta-energy-design-rating/). CEC approved computer programs can be found at: [www.energy.ca.gov/title24/2016standards/2016\\_computer\\_prog\\_list.html](http://www.energy.ca.gov/title24/2016standards/2016_computer_prog_list.html).

<sup>8</sup> The term 'Rater' refers to the person completing the third-party inspections required for certification. This person shall be a certified Home Energy Rater, Rating Field Inspector, or an equivalent designation as determined by a Verification Oversight Organization such as RESNET. Note that Raters must become DOE ZERH Verifier Partners at the DOE ZERH website [www.buildings.energy.gov/zero](http://www.buildings.energy.gov/zero).

<sup>9</sup> Consistent with the ENERGY STAR for Homes V3 allowance for sampling, the Thermal Enclosure System Rater Checklist and the HVAC System Quality Installation Rater Checklist shall be permitted to be completed for a batch of homes using a RESNET-approved sampling protocol or Title 24 Sampling protocol. The Indoor airPLUS Verification Checklist may also be completed using a RESNET-approved sampling protocol. Sampling shall not be permitted to complete the HVAC System Quality Installation Contractor Checklist.

With respect to Provision 2.2 within the ENERGY STAR Qualified Homes, Version 3 (REV07) Thermal Enclosure System Rater Checklist: where ceiling, wall, or floor assembly insulation is installed "blind" between layers of sheathing and therefore cannot be visually inspected, such assemblies are deemed equivalent to a RESNET-defined Grade 1 installation if the assembly insulation level is at least 50% greater than the specified value for the DOE Zero Energy Ready Home Target Home, based on nominal R-value.

<sup>10</sup> Building envelope assemblies, including exterior walls and unvented attic assemblies (where used), shall comply with the relevant vapor retarder provisions of the 2012 International Residential Code.



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<sup>11</sup> The applicable ENERGY STAR Window Product Criteria are listed in this table. Note that the Cold Climate U and SHGC values shown below are based on the older ENERGY STAR v5.0 Window Specifications. DOE will periodically review the feasibility of adopting ENERGY STAR v6.0 Window Specifications for the Cold Climate Zones, which entail lower U values. Any program update to require the v6.0 window specs in Cold Climates will be announced with a minimum 1-year phase-in.

Window Specs Required for DOE Zero Energy Ready Home Projects	Hot Climates IECC CZ 1-2		Mixed Climates IECC CZ 3-4 except Marine		Cold Climates IECC CZ 5-8 and 4 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

<sup>12</sup> Fenestration shall meet the applicable ENERGY STAR Window Product Criteria for U and SHGC, or the 2016 California Building Energy Efficiency Standards Table 150.1-A (whichever is more stringent), with the following exceptions:

- An area-weighted average of fenestration products shall be permitted to satisfy the U-factor requirements;
- An area-weighted average of fenestration products ≥ 50% glazed shall be permitted to satisfy the SHGC requirements;
- 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;
- 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;
- 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<sup>3</sup>·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.

For homes achieving PHIUS+ certification where triple glazed window assemblies with thermal breaks/spacers between the panes are used, such windows are deemed to meet this requirement.

<sup>13</sup> Insulation levels in a home shall meet or exceed the component insulation requirements in the 2015 International Energy Conservation Code (IECC) - Table R402.1.1 or the insulation requirements in California 2016 Building Energy Efficiency Standards, Table 150.1-A (whichever is more stringent). The following exceptions apply:

- Steel-frame ceilings, walls, and floors shall meet the insulation requirements of the 2015 IECC – Table 402.2.6 or the insulation requirements in the California 2016 Building Energy Efficiency Standards, Table 150.1-A (whichever is more stringent).



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- b. For ceilings with attic spaces, R-30 shall satisfy the requirement for R-38 and R-38 shall satisfy the requirement for R-49 wherever the full height of uncompressed insulation at the lower R-value extends over the wall top plate at the eaves. This exemption shall not apply if the alternative calculations in d) are used;
- c. For ceilings without attic spaces, R-30 shall satisfy the requirement for any required value above R-30 if the design of the roof / ceiling assembly does not provide sufficient space for the required insulation value. This exemption shall be limited to 500 sq. ft. or 20% of the total insulated ceiling area, whichever is less. This exemption shall not apply if the alternative calculations in d) are used;
- d. An alternative equivalent U-factor or total UA calculation may also be used to demonstrate compliance, as follows: An assembly with a U-factor equal or less than specified in 2015 IECC Table 402.1.3 complies, or in California 2016 Building Energy Efficiency Standards Table 150.1-A (whichever is more stringent). A total building thermal envelope UA that is less than or equal to the total UA resulting from the U-factors in Table 402.1.3, or in California 2016 Building Energy Efficiency Standards Table 150.1-A (whichever is more stringent), also complies. The insulation levels of fenestration, ceilings, walls, floors, and slabs can be traded off using the UA approach. Also, note that while ceiling and slab insulation can be included in trade-off calculations, Items 4.1 through 4.3 of the ENERGY STAR for Homes V3 Thermal Enclosure System Rater Checklist shall be met regardless of the UA tradeoffs calculated. The UA calculation shall be done using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials. The calculation for a steel-frame envelope assembly shall use the ASHRAE zone method or a method providing equivalent results, and not a series-parallel path calculation method.

<sup>14</sup> 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  $\leq 3$  CFM25 per 100 ft<sup>2</sup> 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  $\leq 3$  CFM25 per 100 ft<sup>2</sup> 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.





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<sup>15</sup> Hot water delivery systems **in single family homes and distributed (individual water heater) systems in multifamily buildings** shall meet efficiency requirements found in Section 3.3 of the EPA WaterSense Single-Family New Home Specification along with the following added provisions and allowances.

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; 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. To 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  $\geq 10$  °F. Only the fixture with the greatest stored volume between the fixture and the hot water source (or recirculation loop) needs to be tested. 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.

#### Advisories:

- On-demand central systems in multifamily buildings do not currently have a stored volume limit. DOE encourages partners to design central hot water distribution systems in multifamily buildings to limit the stored volume between the recirculation loop and the furthest fixture to 1.0 gallons.
- Piping for central system recirculation loops in multifamily buildings should be insulated per the local code requirements. DOE encourages the use of R-4 pipe insulation on recirculation loop piping.
- DOE encourages that the recirculation pump for central systems be set to operate at a temperature which is at least 5°F less than the water heater set point temperature.



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DOE will evaluate the possibility of making these recommendations into requirements in future updates to these specifications.

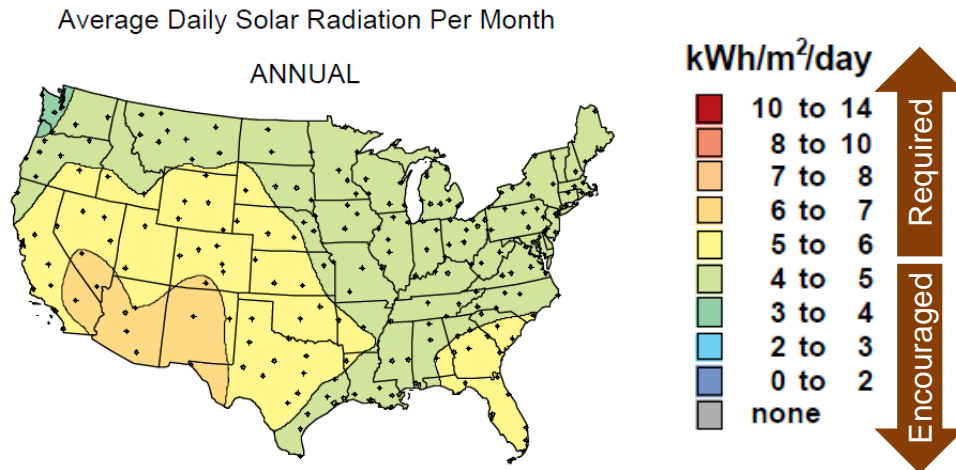
<sup>16</sup> Further efficiency and savings can be achieved by installing ENERGY STAR qualified products in addition to those required.

<sup>17</sup> 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.

<sup>18</sup> 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
- b. Location, based on zip code, has at least 5 kWh/m<sup>2</sup>/day average daily solar radiation based on annual solar insolation using this online tool: <http://pvwatts.nrel.gov/>



- 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.



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