DOE Zero Energy Ready Home for Single Family Homes

National Program Requirements – Version 2 Draft

Summary of Stakeholder Feedback and DOE Actions

May 2023

ZERO
ENERGY READY HOME
U.S. DEPARTMENT OF ENERGY

Contents

Introduction

In November 2021, the U.S. Department of Energy (DOE) released draft Zero Energy Ready Home Single Family Homes National Program Requirements Version 2 (ZERH V2), for a 30-day stakeholder feedback period. The draft specifications were based on analysis to achieve roughly 20% savings beyond the 2021 International Energy Conservation Code (IECC), and were also designed to build upon and harmonize with the requirements of the ENERGY STAR Single Family New Homes Version 3.2 certification (a prerequisite for ZERH V2).

Stakeholder engagement to generate awareness and solicit feedback included multiple email announcements to the ZERH partner database and a broader database of stakeholders maintained by the DOE Building Technologies Office. These announcements were also shared and forwarded to more stakeholders by several allied programs such as Indoor airPLUS. The announcements explained the rationale for the ZERH program update, provided a brief overview of the documents available for review, and encouraged stakeholders to review and comment on the draft requirements. The ZERH program also hosted an informational webinar on ZERH V2 on November 16, 2021 to review the draft program requirements and highlight the opportunity for stakeholder comment. This webinar was highlighted in the announcement emails and was also posted as a recording on the ZERH V2 webpage following the session.

Comments were submitted to DOE through the use a submission form (included in Appendix A) which was emailed to DOE. DOE reviewed all feedback from builders, raters, efficiency organizations, trade associations, and other stakeholders. DOE appreciates the many thoughtful comments and insights provided by stakeholders.

The sections below provide a summary of the comments received, organized by issue using the same structure as the stakeholder feedback submission form. DOE's actions in response to comments are included for each issue, along with the rationale for these actions. In some cases, the DOE action is to keep the ZERH V2 requirement as originally proposed in the November 2021 stakeholder feedback draft.

Summary of Comments and DOE Actions

1. Certified under ENERGY STAR Single Family New Homes Version 3.2

Summary of Comments

Stakeholders generally support the Environmental Protection Agency's (EPA) ENERGY STAR Single Family New Home Version 3.2 (ENERGY STAR V3.2) certification as a mandatory prerequisite for ZERH V2. Several commenters, however, expressed concern that the ENERGY STAR program requirement for HVAC contractor credentialing or the application of HVAC grading present "roadblocks".

Other stakeholder comments included:

- Consider an exception for this requirement. This could be a HERS Target Score of 40 or lower.
- The removal of the Size Adjustment Factor (SAF) within Version 3.2 (and also within ZERH V2) will benefit larger homes.

DOE Actions

- DOE will keep the proposed prerequisite that all ZERH V2 projects shall be certified under ENERGY STAR V3.2.
- DOE will continue to coordinate with EPA to create effective pathways for HVAC contractor credentialing or HVAC grading.
- DOE and EPA agreed to remove the Size Adjustment Factor in ZERH V2 and ENERGY STAR 3.2

Rationale

- The ENERGY STAR Single Family New Homes (ESSFNH) prerequisite in ZERH V2 is important to maintain because it embeds crucial building science provisions such as HVAC design and thermal envelope details. ENERGY STAR V3.2 provides important protections including bulk moisture management and ASHRAE 62.2 ventilation rates, that are vitally important in efficient homes. ZERH V2 builds upon the efficiency of ENERGY STAR V3.2, so it should reference this particular version of the program. DOE is coordinating with EPA to use the same infrastructure and certification process to streamline the federal programs and reduce certification costs.
- EPA introduced the HVAC grading pathway as an option to the current ENERGY STAR HVAC credentialing requirement. DOE recognizes that this pathway can be very important for some stakeholders, and is coordinating with EPA to streamline the rollout of this option.
- DOE has determined that removing the SAF from ZERH V2, consistent with ENERGY STAR V3.2, helps streamline compliance while still requiring larger homes to meet very rigorous energy specifications. The ZERH V2 requirement that the Design Home meet or exceed the Energy Rating Index (ERI) score of a target home results in very high efficiency specifications, regardless of the home's size.

2. Building Envelope

2.1 Ceiling, wall, floor and slab insulation meet or exceed 2021 IECC R, U, or UA levels

Summary of Comments

Stakeholders provided the following feedback on this mandatory requirement:

- A building envelope UA requirement in addition to a whole building ERI requirement seems redundant.
- A majority of states within Climate Zone 3 currently use older versions of the IECC that do not call for slab edge insulation, therefore contractors will be unfamiliar with this practice and code officials may have concerns about termites.

DOE Actions

- DOE will require that ZERH V2 program homes meet the insulation levels of the 2021 IECC based on R, U, or UA compliance, as initially proposed. Homes will also need to meet or exceed an ERI Target value.
- DOE incorporated a provision in ZERH V2 that adjusts the building envelope requirements if a code official in the project's jurisdiction has designated the jurisdiction as very heavy termite infestation risk. If this condition exists, then for the purpose of a building envelope UA analysis of the Rated Home, the ERI Design Home will be assumed to have slab edge insulation

equivalent to the insulation level as the Rated Home. This allowance is based on Section R402.2.9 of the 2021 IECC. Determination of the ZERH V2 ERI Target value will still incorporate the slab edge insulation level based on the 2021 IECC, so the home's overall efficiency will not be reduced, but the omission of slab edge insulation can be made up using numerous different measures that factor into the home's ERI.

Rationale

- A well-insulated building envelope is critical for energy savings, thermal comfort, and increased resilience during power outages (increased "Hours of Safety"). In addition, building envelope components are less likely to be improved or replaced over time so the opportunity cost is greater. For these reasons, meeting or exceeding the latest model code envelope requirements (i.e., IECC 2021) continues to be a core requirement of the DOE ZERH program. The ERI Target required for ZERH certification is also important and compliments the envelope requirements. The ERI Target ensures that the overall energy efficiency of the home, accounting for heating/cooling, ventilation, water heating, and lighting/appliances substantially exceeds the targets of the latest model code. Together, the UA requirement (including the UA tradeoff pathway explained in the End Note) and the ERI Target requirement provide design flexibility for both the envelope and the mechanical systems, while ensuring a high level of performance (i.e., "backstops").
- DOE acknowledges that the 2021 IECC is the first edition of the IECC to require slab edge insulation in Climate Zone 3, where the possible complication of very heavy termite infestation risk exists. DOE has developed an exception to the slab edge insulation requirements that provides flexibility for projects in areas designated as having a very heavy termite infestation risk, while still ensuring that the home's overall efficiency meets the ZERH V2 ERI Target.

2.2 Above Grade Walls in Mixed and Cold Climates provide thermal breaks

Summary of Comments

Most stakeholder comments on this issue were in opposition to this new mandatory requirement. They commented that ZERH V2 is already requiring that the overall building envelope meet the 2021 IECC insulation values (based on R, U, or UA), so an additional requirement for a thermal break is not needed.

Other stakeholder comments:

- Include a minimum R-value for the thermal break.
- Consider an exception for high wind zones in Climate Zone 3.
- This thermal break provision is in line with PHIUS requirements.

DOE Actions

- The ZERH V2 program requirements will not include the initially proposed requirement for thermal breaks in above grade walls in Climate Zones 4 and higher.
- No action is needed to address Climate Zone 3, as the initially proposed requirements only applied to Climate Zones 4 and higher.

Rationale

Based on modeling analyses, many designs in Climate Zone 4 and colder will need to incorporate some form of thermal break to achieve compliance with the 2021 IECC envelope requirements, so in most cases an additional prescriptive thermal break requirement will not be necessary. It is possible that some designs could achieve the ZERH V2 requirement for an envelope meeting the 2021 IECC insulation requirements with cavity-only insulation by incorporating very high-performance windows. Both approaches will create a very robust building envelope, representing a significant improvement relative to ZERH Version 1, and therefore DOE is willing to remove the proposed prescriptive thermal break requirement.

2.3 Windows meet high performance requirements based on climate zone

Summary of Comments

Stakeholder feedback on this mandatory requirement included multiple suggestions that the combinations of U and SHGC values proposed for Climate Zones 4C and 5 should be reduced to just a U value requirement of 0.27, without allowing a U/SHGC alternative. Similarly, one stakeholder suggested that the specifications for Climate Zones 6-8 should be U 0.27, consistent with Version 6.0 of the ENERGY STAR Residential Window Product Specifications.

Other stakeholder comments:

- Align with the 2021 IECC prescriptive window requirements instead of ENERGY STAR Residential Window Product Specifications.
- Projects in high elevations are constrained by availability and the impacts of shipping of windows below U 0.30 to these sites.
- More clarity is needed on whether the U and SHGC values in ZERH V2 are minimum or maximum values.
- DOE should monitor the development of Version 7.0 of the ENERGY STAR Residential Window Product Specifications, especially in the context of supply chain issues.
- DOE should solicit stakeholder feedback before the program references Version 7.0 ENERGY STAR Residential Window Specifications.

DOE Actions

- The ZERH V2 program requirements will reference the ENERGY STAR V6.0 Residential Window Product Specifications for Climate Zones 1-5, as initially proposed. DOE will monitor the implementation of the ENERGY STAR Residential Window Product Specifications (V7.0) criteria in anticipation of including these specifications in a future program update.
- The ZERH V2 program requirements will include an allowance for the use of windows with a maximum U factor of 0.30 (with any SHGC) for projects in Climate Zones 5 – 8 that are located at an elevation ≥ 5,000 feet above sea level.
- DOE updated ZERH V2 program documents to clarify whether the window specification values are minimum or maximum values.
- DOE plans to adopt the ENERGY STAR Residential V7.0 Window Specifications (possibly for Cold and Very Cold climate zones initially) in a future program version update, and will allow for stakeholder feedback on any proposed changes

Rationale

- ZERH V2 will align with the currently in effect ENERGY STAR Residential Window Product Specifications (V6.0), which allows DOE to leverage this companion federal program. DOE acknowledges that this approach allows for three alternate U/SHGC window combinations in Climate Zones 4C and 5, as defined in Version 6.0 specifications. These options provide ZERH partners with some flexibility, however the ERI Target for ZERH certification in this climate zone is still based on a U 0.27, so any efficiency loss from a slightly higher U factor window will be made up for elsewhere in the building design. Looking forward, DOE anticipates continuing to recognize the U-factor / SHGC "tradeoffs" as they are implemented in the V7.0 window specifications. Recognizing these windows with U/SHGC tradeoffs under the V6.0 product specifications sets this precedent.
- Regarding high elevation applications, DOE acknowledges product availability challenges that can occur in some markets. The allowance for the use of a maximum 0.30 U Factor window (any SHGC) for projects in Climate Zones 5-8 and located above 5,000' in elevation provides some flexibility but does not sacrifice whole-house energy efficiency. When this allowance applies, the project must still achieve the ZERH ERI Target score that is based on a 0.27 U Factor window for Climate Zone 5 or a 0.25 U Factor window for Climate Zones 6 – 8.

3. All ducts and heating and cooling air-handling equipment are located within the thermal and air barrier boundary

Summary of Comments

DOE received very limited stakeholder feedback on this provision, and no comments that directly supported, opposed, or requested clarification on the proposed requirement. This provision for duct and air-handler equipment location is very similar to the language found in Version 1 of the DOE ZERH program.

DOE Actions

DOE will maintain the duct and air-handling equipment location provision as it was initially proposed for ZERH V2.

Rationale

There was no stakeholder feedback suggesting changes to this provision.

4. Hot water delivery systems meet efficient design requirements - or - water heater and fixtures meet efficiency criteria

Summary of Comments

DOE received the following comments on this mandatory requirement:

- Since residential water heater manufacturers must test and label their products in terms of Uniform Energy Factor (UEF), DOE should state water heater efficiency metrics in terms of UEF instead of Energy Factor (EF) within the program requirements.

- Would like to see water heater efficiency requirements specifically for multifamily projects.

DOE Actions

- The ZERH V2 program requirements for water heaters will be stated in terms of UEF.
- The ZERH V2 program requirements will maintain the initially proposed water heater requirements, but stated in terms of UEF, which are applicable to detached dwelling units and not multifamily dwellings.

Rationale

- Stating water heater efficiency metrics in terms of UEF within the ZERH V2 program requirements keeps this metric consistent with the federally required testing and labeling of this equipment.
- ZERH V2 applies to single family homes, duplexes and townhomes, but not to dwellings in multifamily buildings. Eligible multifamily projects may continue to certify under DOE ZERH Version 1 until a new DOE ZERH-Multifamily V2 program is developed and launched.

5. Lighting & Appliances

5.1 95% of builder-installed lighting fixtures are ENERGY STAR qualified or ENERGY STAR lamps (bulbs) in minimum 95% of sockets

Summary of Comments

Stakeholder feedback on this mandatory requirement included:

- ZERH V2 should require LED lighting rather than specifying ENERGY STAR qualified fixtures and bulbs, since it is difficult for raters to verify (bulbs are not labeled), this requirement limits product choices, and it offers minimal efficiency gains.
- This provision should be 100% high efficiency lighting instead of 95%.

DOE Actions

- DOE will continue to recommend ENERGY STAR lighting and modify the mandatory lighting provision to require that 100% of lighting fixtures are LEDs, consistent with the ANSI / RESNET / ICC Standard 301 definition of high efficiency lighting. An allowance for up to 5% of lighting to be non-LED lighting will be provided. However, the ERI Target for the home will assume the use of 100% LED lighting so this allowance does not give up any whole-house energy efficiency.

Rationale

- Defining high efficiency lighting as LEDs in a way that is consistent with ANSI / RESNET / ICC Standard 301 will help to address the stated concerns. This approach is also consistent with the treatment of high efficiency lighting under the ENERGY STAR Residential New Construction program.
- ZERH V2 is designed to allow for a small amount of flexibility in the use of high efficiency lighting. The Target ERI for ZERH V2 is also set to 100% high efficiency lighting, so a project must meet the equivalent efficiency of a home using 100% high efficiency lighting even if the home uses slightly less than 100%. A small amount of flexibility is provided with the mandatory

provision set at 100% with an allowance for up to 5% to be exempt for task or decorative lighting.

5.2 All installed refrigerators, dishwashers, clothes washers, and clothes dryers are ENERGY STAR qualified

Summary of Comments

Stakeholder feedback on this mandatory requirement included two questions about how these requirements apply when a home buyer (and not the builder) is supplying an appliance.

Other stakeholder comments:

- Consider Consortium for Energy Efficiency (CEE) appliance tiers.
- Eliminate an exception that allows the use of a non-ENERGY STAR qualified refrigerator if the home's overall efficiency target is still satisfied.
- Require that all appliances (e.g., cooking equipment) in the home be electric.
- Accommodate commercial ENERGY STAR laundry equipment for multifamily projects.

DOE Actions

- DOE will modify the requirement language to more clearly exempt appliances not supplied by the builder.
- The ZERH program will retain the remainder of this provision, as proposed, in the ZERH V2 requirements.

Rationale

- DOE intended for this requirement to apply only to builder-supplied and -installed appliances. Additional language will be added for clarification.
- Regarding the use of CEE tiers, the ZERH program will continue referencing the appropriate ENERGY STAR specifications for residential appliances as these criteria are widely used within the industry and straightforward to apply. Builder partners are able to use even higher efficiency appliances that may be listed under the CEE tier system and may benefit from such product selections in the home's ERI score which can help gain ZERH certification.
- In response to ongoing supply chain issues, DOE plans to temporarily offer an exception allowing the use of a non-ENERGY STAR refrigerator if the home still achieves the required Energy Rating Index (ERI) value for certification. DOE has heard from numerous stakeholders that this single barrier is an obstacle to program certification.
- DOE is planning for electric readiness provisions for certain building systems. This topic is discussed further in the section on Building Electrification measures.
- The use of commercial ENERGY STAR laundry equipment in multifamily projects is not in the DOE ZERH V2 scope since the specifications will apply only to single-family homes and not multifamily buildings. Eligible multifamily projects may certify under DOE ZERH Version 1 and will migrate to the DOE ZERH-Multifamily program as it is developed and launched.

5.3 All installed bathroom ventilation and ceiling fans are ENERGY STAR qualified

Summary of Comments

DOE received one comment on this mandatory requirement. A stakeholder noted that in some projects bathroom exhaust ventilation is provided by the exhaust side of an H/ERV, and that these systems are currently not covered by the ENERGY STAR program in the U.S. The concern is that the ENERGY STAR equipment requirement could be interpreted as applying to the H/ERV when this is not viable since it is not an ENERGY STAR-labeled product category.

DOE Actions

DOE will update this requirement to include an end note stating that this provision does not apply to H/ERVs that are used to provide exhaust ventilation for bathrooms.

Rationale

DOE ZERH V2 requires ENERGY STAR qualified bathroom exhaust fans and is not intended to apply to unlabeled product categories including H/ERVs.

6. Indoor Air Quality

6.1 Certified under EPA Indoor airPLUS

Summary of Comments

The draft ZERH V2 requirements stated that through at least 12/31/2022, certification under EPA Indoor airPLUS Version 1 will be required and that DOE will consider a revision adding a future requirement that references an updated version of Indoor airPLUS (EPA is in the process of updating its program requirements).

Multiple stakeholders agreed with this approach, and noted that they will want to see how the Indoor airPLUS (IAP) program is updated before agreeing that it should be referenced in a future update to the ZERH program.

Another stakeholder commented that IAP certification is a good idea, but it should not be a mandatory ZERH requirement because it is not relevant to energy and is a barrier to program participation.

DOE Actions

- DOE will update this provision to extend the requirement to use IAP Version 1 provisions until at least 12/31/2023. This is a one-year extension of the initial approach.
- DOE will continue to coordinate with EPA as the IAP program specifications evolve.
- DOE will communicate to its partners when updated IAP program specifications are available for review and comment.

Rationale

- DOE recognizes the importance of providing partners with the opportunity to review and comment on major changes to program requirements, and the importance of providing predictable phase-in periods. The Indoor airPLUS program has continued to consider updates to program requirements which has required significant time. With the release of DOE ZERH

Version 2 to occur near the end of 2022, there is the need to extend the use of IAP Version 1 requirements within the ZERH program for at least another year.

- Continuing to require IAP certification under ZERH V2 is crucial to recognizing that ZERH program homes that are not only energy efficient, but are also designed to provide IAQ protections that can enhance the resident's experience.

6.2 MERV 13 (minimum) filter installed on all ducted heating and cooling systems

Summary of Comments

Stakeholder feedback on this provision included opposition as well as suggestions for improvements and alternatives.

Numerous stakeholders addressed the implications of this provision on HVAC design and equipment selection. Several comments noted the static pressure drop associated with a MERV 13 filter. Stakeholders were concerned that this would increase fan energy or eliminate the possibility of using some high efficiency heat pumps. They made suggestions to instead require a MERV 8 or a MERV 11 filter. Some stakeholders were also concerned about the implications of a pressure drop on mini-split systems. A commenter suggested adding a requirement to use a larger filter media box that would improve filter longevity and reduce the static pressure drop as compared to a thinner 1" MERV 13 filter.

Other stakeholder comments:

- MERV 13 filters are not mainstream. Availability and higher costs may be issues.
- Provide a provision for a MERV 8 (minimum) filter on the supply side of the whole-house mechanical ventilation (WHMV) system.
- Include this requirement on a ZERH field verification checklist.

DOE Actions

After reviewing comments on this proposed new requirement, and consulting with the EPA IAP program team, DOE has decided not to change filtration requirements for ZERH V2 until the next IAP program update is finalized and released.

Rationale

- DOE will continue to coordinate with EPA on filter requirements for WHMV systems in updates to the Indoor airPLUS program. The current version of Indoor airPLUS (Version 1, Rev.04) includes an Advisory on filtration for the inlet side of whole-house mechanical ventilation systems.
- DOE will consider the ample evidence that there are a range of pressure drops for filters. MERV is only one of the variables that affect pressure drop and though it is possible to get a lower pressure drop MERV13 filter, this feature may impact the cost.

6.3 Energy efficient balanced ventilation (HRV or ERV) provided in CZs 6-8

Summary of Comments

Stakeholders were generally in support of the mandatory requirement to utilize an HRV or ERV in Climate Zones 6 – 8, rated at ≥ 65% SRE and ≥ 1.2 CFM/Watt.

Multiple stakeholders suggested applying this provision to all climate zones. One commenter recommended balanced ventilation in all climate zones, although it was not clear if this meant balanced systems with or without heat exchange. Another commenter recommended more focus on well designed and installed ventilation systems within homes.

DOE Actions

- DOE will maintain this provision as proposed in the draft ZERH V2 specifications released 11/2/2021.

Rationale

- This requirement mandates the use of H/ERVs in Climate Zones 6 – 8 for the first time in ZERH V2, where these technologies offer the most significant heat recovery benefits.
- The ZERH Target Home for Version 2 assumes the use of an H/ERV in setting the ERI Target for homes located in Climate Zones 4C and 5 – 8. This provision ensures that projects will either incorporate an H/ERV or make up for any loss in energy efficiency by applying other measures if this technology is not used.

7. Renewable Ready

Summary of Comments

Stakeholders offered several comments on the PV Ready measures within the ZERH program. Multiple commenters mentioned the Solar Ready Appendix in the International Energy Conservation Code (IECC). One commenter suggested that complying with this appendix could be considered equivalent to the DOE ZERH PV Ready Checklist; another suggested aligning the ZERH PV Ready Checklist with the provisions in the IECC Solar Ready Appendix; and another noted that the exceptions permitted in the IECC Solar Ready Appendix RB should also be allowed within the ZERH PV Ready Checklist.

Other stakeholder comments:

- Requiring a minimum amount of roof area facing true south (plus or minus a certain azimuth span) would be too restrictive for homes without a suitable orientation and would prevent production builders from participating in the ZERH program.
- Consider the California 2019 Building Energy Efficiency Standards language on minimum solar zone areas.
- The PV Ready checklist exception for sites with less than 5 kWh/m2/day average daily solar radiation, which is being phased out in Version 2, should be kept in place. If PV is not installed the “ready” measures would be an unnecessary expense.
- Add alternative methods to the use of 1” EMT conduit for array mounted microinverter systems that will use AC wiring.

DOE Actions

- DOE will modify the ZERH V2 PV Ready Checklist provisions to align with the minimum roof area provisions found in the 2021 IECC Appendix RB Section 103.1. For the ZERH V2 PV Ready checklist to apply, a home will need to have at least 600 square feet of roof area oriented between 110 degrees and 270 degrees of true north.
- All other requirements in the ZERH PV Ready Checklist will remain as proposed in the 11/2/2021 Version 2 draft.

Rationale

- Amending the minimum roof area provision (which triggers when the ZERH PV Ready checklist applies) to align with 2021 IECC Appendix RB, Section RB103.1 is a reasonable update to the ZERH program requirements. This update to the ZERH V2 PV Ready Checklist will provide a simpler applicability provision based on a single roof area threshold of 600 ft^2, rather than tiers of roof areas based on home size. At the same time this adjustment to the ZERH V2 program requirements will increase alignment with 2021 IECC Appendix RB, and there will not be a significant change in the applicability of PV Ready measures based on this update.
- There is significant overlap between the 2021 IECC Appendix RB's solar-ready provisions and the ZERH V2 PV Ready Checklist. This overlap eases the ability of a partner who is meeting Appendix RB to also comply with the ZERH PV Ready Checklist. However, there are several important details that warrant maintaining the ZERH V2 PV Ready checklist provisions as the program requirement.

  DOE maintains that there is significant value in requiring the installation of EMT wiring conduit in a home to facilitate a future PV installation. This measure is required under the ZERH V2 PV Ready checklist but is not an explicit requirement in the 2021 IECC Appendix RB. Additionally, the ZERH program does not mandate (unlike 2021 IECC Appendix RB) that a wiring sleeve penetrate the roof. The location of this penetration may not be suitably located for a future PV installation and can be accomplished equally or more effectively at the time of PV system installation. Also, the exception for the application of Appendix RB based on shading (2021 IECC, Section RB103.1, Exception #2) cites that the exception applies when certain areas of the roof are in full or partial shade for more than 70 percent of daylight hours annually. Documenting that this exception applies would require a shading analysis which adds cost and complexity, and no provisions are provided detailing how this value should be determined. The ZERH PV Ready Checklist also includes a shading-based exception which does not require a shading analysis.

  While there is overlap between the two sets of PV Ready provisions, the ZERH program's PV Ready Checklist has a few important distinctions and will be maintained as the program requirement.

- Regarding the comment that exceptions permitted in the IECC Appendix RB should also be allowed as exceptions with the ZERH PV Ready Checklist, the two exceptions under Section RB103.1 are actually the same as or more restrictive than the exceptions recognized by the ZERH V2 PV Ready Checklist.

- The ZERH V2 PV Ready provisions are adapted from EPA's Renewable Energy Ready Home Solar Photovoltaic Specification Guide. The provisions anticipate that some homes may not be good candidates for PV due to shading (i.e., from trees or nearby buildings) or orientation, and provide exceptions for such homes while still allowing for their certification under the ZERH

program. Production builders are still able to participate in the ZERH program if one of the PV Ready Checklist exceptions applies, including the exception that is based on roof area.

- Integrating language from the California Building Energy Efficiency Standards would not be effective for the ZERH V2 National Program Requirements for Single Family Homes since homes in California must follow the ZERH-California program requirements.
- DOE has observed that there are many project locations just slightly below 5 kWh/m2/day average daily solar radiation that could benefit from a PV system. At the same time, there has been a 64% reduction in the cost of residential PV systems since 2010[1] making these systems increasingly attractive. Given these factors and the modest cost of adding PV Ready measures, it is reasonable to sunset the PV Ready checklist exception for locations below 5 kWh/m2/day average daily solar radiation in ZERH V2.
- Regarding the suggestion to allow for alternatives to 1" EMT conduit for future array mounted microinverter systems that will use AC wiring, it is not a certainty that this type of PV system will eventually be installed in a home.

8. DOE Zero Energy Ready Home Target Home Specifications

Summary of Comments

Stakeholder feedback varied based on the section of the Target Home specifications being reviewed. A summary of the comments, broken down by the category of specifications, is provided below.

HVAC-Related Comments

- HVAC efficiency levels are too stringent.
- HVAC efficiency levels are not stringent enough.
- HVAC Grading should be phased in over 1-2 years before becoming mandatory, allowing time for these measures to become established.

Insulation and Infiltration Comments

- A compartmentalization tightness metric in terms of CFM50 per square foot of enclosure area should be used in the Target Home for attached dwellings and small dwellings, similar to the IECC's provisions.
- What is the Target Home's tightness metric for dwelling units in multifamily buildings?

Other Target Home Specifications

- 100% ENERGY STAR or LED lighting should be used for the Target Home
- Best possible efficiency levels should be used for other components like insulation, infiltration, and mechanical systems.
- Allow the use of the 2021 IECC's Zero Energy appendix as an alternative compliance path

DOE Actions

HVAC-Related Comments

- DOE will maintain the ZERH Target Home's HVAC specifications as proposed in the draft Version 2 specifications released 11/2/2021.

[1] Source: NREL Documenting a Decade of Cost Decline for PV Systems, 2021.

- DOE will maintain the ZERH Target Home's HVAC Grading specifications as proposed in the draft Version 2 specifications released 11/2/2021.

Insulation and Infiltration Comments

- DOE will maintain the 3.0 ACH50 target for attached homes that is included in the draft Version 2 specifications.
- DOE ZERH V2 program requirements will not include a tightness metric for dwellings in multifamily buildings, as this building type is not eligible under Version 2.

Other Target Home Specifications

- DOE will keep the ZERH Target Home specifications for lighting and other components, as proposed in the draft Version 2 specifications released 11/2/2021.
- DOE will add language to the V2 program requirements noting that the Appendix RC ERI target (without renewables) must be met in addition to the ZERH ERI Target where the appendix has been adopted as a code requirement for a jurisdiction. Compliance with Appendix RC will not be recognized as an alternate compliance path for V2.

Rationale

HVAC-Related Comments

- HVAC efficiency levels in the ZERH Target Home (Exhibit 2 in the National Program Requirements) have been developed to achieve roughly 20% savings relative to 2021 IECC while still being attainable. The exact efficiency level for a piece of equipment in a particular climate zone is not a mandatory provision, and an actual project can utilize an efficiency higher or lower than the Target Home specification which provides flexibility. The ZERH Version 2 Target Home specifications result in ERI scores in the low to upper-40s, which is an aggressive but attainable ERI range for the DOE ZERH V2 program.
- DOE agrees with comments noting that HVAC Grading should be phased-in as these field measurements become more widely used for ERI ratings and as a strategy for compliance with ENERGY STAR Single Family New Homes. HVAC Grading metrics are included in the ZERH V2 Target Design because Version 2 of ZERH will start to be used by industry over the next 1-2 years, which is the same timeframe suggested by commenters for a phase-in of HVAC Grading. The different HVAC Grades for airflow deviation, watt draw, and refrigerant listed for the ZERH ERI Target Home are targets only, and actual homes can achieve different levels.

Insulation and Infiltration Comments

- DOE will maintain the 3.0 ACH50 target for attached homes because this same specification has been used effectively within ZERH Version 1 to reflect that very aggressive air sealing targets can be more challenging for attached homes. This target maintains an attainable air sealing level for attached homes while still achieving a high level of energy efficiency in the ERI Target Home Design. Referring to the 2021 IECC compartmentalization spec of 0.30 CFM50/square foot of enclosure area would model the Target Design with significantly more air leakage and reduce the target efficiency.

Other Target Home Specifications

- The current ERI Target Home Design specifies the use of 100% ENERGY STAR / LED lighting. Other Target Home specifications establish high efficiency levels in order to achieve ERI Target Scores in the 40s, while providing some design flexibility in how builders achieve these levels.
- Regarding the suggestion to allow Appendix RC of the 2021 IECC as an alternate compliance pathway, the ZERH program ERI thresholds are based on the ZERH Target Home. This Target Home is based on the Design Home's geometry, layout, and location, with its specifications (i.e., HVAC efficiency) set to the values found in Exhibits 1 and 2 of the V2 program requirements. The rating software generates a specific ERI Target score for each home that must be achieved to meet the ZERH program's efficiency requirement. This approach isolates the ERI requirement in the ZERH program from scoring differences that can occur across software tools, unexpected impacts on ERI scores when the rating standards are updated, or other inconsistencies in the determination of an ERI score. In the event that the ERI Target from Appendix RC is more stringent than the V2 ERI Target in a jurisdiction that has adopted the appendix, then the project must meet both ERI target scores. In contrast, Appendix RC uses a static ERI scoring target which is subject to these inconsistencies and therefore introduces significant variability and inconsistency in compliance. Additionally, allowing Appendix RC as an alternate compliance path for ZERH V2 would bypass numerous program requirements for thermal bypass measures, indoor air quality provisions, installation quality, etc. Rather than this appendix serving as an alternate to the ZERH V2 program requirements, DOE views Appendix RC as a strong complement to ZERH certification, to achieve net zero energy (i.e., solar powered) homes.

9. Integration of High Efficiency Electric Technologies

9.1 Should DOE consider offering two types of DOE Zero Energy Ready Home certifications under Version 2 -- a basic version and a version that includes the ENERGY STAR NextGen certification requirements?

Summary of Comments

Stakeholder feedback on this question presented in the Version 2 draft program requirements included several perspectives. Opposing comments were slightly more common than supportive comments, but there were several different viewpoints.

Stakeholders who opposed this concept noted: the extra certification would be confusing to the marketplace (multiple comments); there is not yet adequate data to support this new certification; and DOE should instead consider Zero Ready and Zero Energy as two certification levels.

Stakeholders who supported the concept of multiple DOE ZERH certifications included general support for making the NextGen certification an *optional* distinction (similar to how the ZERH program recognizes EPA Water Sense certification); and general support with the request that DOE make the development of ZERH - Multifamily provisions a higher priority.

DOE Actions

- DOE will continue to coordinate with EPA on the development and implementation of the ENERGY STAR NextGen program.

- In Version 2 DOE will include three new targeted electrification requirements: Electric Vehicle (EV) Readiness; Heat Pump Water Heater (HPWH) Readiness; and Heat Pump Space Heating Readiness. EV Ready requires one EV charging receptacle per dwelling; HPWH Ready requires a circuit and space for a future HPWH installation; and Heat Pump Space Heating Ready calls for a circuit or conduit to facilitate a future heat pump installation. These requirements are based on provisions under development for the 2024 IECC as well as the NextGen program. More details of these requirements and exceptions are noted in the V2 National Program Requirements.

Rationale

- The readiness level for new homes to shift to greater use of high efficiency electric technologies varies greatly. DOE will continue to coordinate with EPA as the NextGen program is implemented in 2023 and beyond to gauge the most effective manner for potential integration with the ZERH program.
- The three electrification requirements planned for addition to V2 are EV Readiness, Heat Pump Water Heater Readiness, and Heat Pump Space Heating Readiness. The EV Ready provision is based on the ENERGY STAR NextGen requirement for EV Charging, while the water heating and space heating heat pump ready requirements lay the groundwork for the future installation of electric technologies. Feedback from builder partners indicated that many builders are already incorporating these measures (or equivalents such as using a heat pump) driven by local codes or their typical designs.

9.2 Should DOE consider requiring the new ENERGY STAR NextGen certification for DOE Zero Energy Ready Home V2?

Summary of Comments

Opposing stakeholder comments on whether DOE should consider requiring the new ENERGY STAR NextGen certification in ZERH V2 outweighed supportive comments.

Comments supportive of this program direction included encouragement for DOE ZERH to require the ENERGY STAR new certification when it becomes available.

Opposing commenters expressed concern for design situations where the NextGen design provisions will not work; waiting until there is more experience with the new certification before considering integrating it into ZERH; and concern about marketplace confusion. Multiple stakeholders also suggested that the NextGen certification be considered as an option or an add-on “badge” under ZERH, similar to how the ZERH program recognizes certification under Water Sense or the Fortified Home program.

DOE Actions

- DOE will continue coordination with EPA on the development and implementation of NextGen. DOE leadership will determine how and when the ZERH program will reference the certification or specific measures from it, as a requirement or an optional distinction.
- In Version 2 DOE will include three new targeted electrification requirements: Electric Vehicle Readiness (same provision as NextGen); Heat Pump Water Heater Readiness; and Heat Pump Space Heater Readiness.

Rationale

- The rationale for these actions is the same as for the prior item in Section 9.1.

10. Certification Oversight Requirements

Summary of Comments

DOE did not receive specific feedback on certification oversight requirements as they were illustrated in the public comment draft. While this topic was not highlighted in the comment form, reviewers were able to submit comments on these provisions using the section for general feedback on the program requirements. This topic is included in this document to highlight changes to the public comment draft of Version 2.

DOE Actions

- Under the DOE Zero Energy Ready Home Program, Version 2 for Single Family Homes, ZERH certifications must be overseen by a DOE-approved certification organization. These organizations are called Home Certification Organizations for the Zero Energy Ready Home program (HCOs for ZERH).

Rationale

- The ZERH program relies on third-party verification of homes to determine ZERH certification. An HCO for ZERH is defined as an independent organization that is recognized by DOE to implement a ZERH certification program that complies with the Zero Energy Ready Home Certification System, where single-family and multifamily homes are certified using the Energy Rating Index (ERI). These organizations are responsible for exercising authority over decisions related to ZERH certifications, including the credentialing, oversight, and quality assurance of raters that verify homes to earn ZERH certification. The HCO for ZERH framework supports the program's integrity by including provisions such as training of raters and QA of ZERH certifications. DOE is in the process of launching this framework and anticipates having DOE-recognized HCOs for ZERH in 2023.

Next Steps

DOE published the final ZERH for Single Family Homes National Program Requirements, Version 2 (December 2022). This document was subsequently published as a record of the public comment management process. Additionally, DOE has updated the implementation timeline for Version 2 on the DOE ZERH program website.

DOE will also coordinate with software developers on the integration of the Version 2 Target Design into rating software as soon as practicable, to enable modeling homes for Version 2 compliance.

Appendix A – Public Comment Form

U.S. DOE Zero Energy Ready Home
National Program Requirements for Single Family Homes
Version 2 *Draft* - Public Comment Form

INSTRUCTIONS: Please use the space below to provide comments, feedback, or questions regarding any of the proposed Zero Energy Ready Homes Version 2 draft requirements. Feedback on specific items is preferred (as opposed to general sections), but do not feel obligated to comment on all the proposed requirements. Upon completion, please email this form to zero@newportpartnersllc.com with the subject "DOE ZERH V2 Public Comment Response."

Partner Type: ☐ **Builder** ☐ **Rater/Verifier** ☐ **Manufacturer** ☐ **Organization** ☐ **Other** ☐ **Not Currently a Partner**

ZERH V2 Draft Specification Item	Comment / Feedback / Questions
Mandatory Requirements (Exhibit 1)	
1. ENERGY STAR V3.2	
2. Envelope	
1.1 Ceiling, wall, and slab insulation	
1.2 Above Grade Walls in Mixed and Cold Climates provide thermal breaks	
1.3 Windows meet high performance requirements based on climate zone	
3. Duct System	

4. Water Heating Efficiency	
4.1 Hot water delivery systems meet efficient design requirements	
4.2 Water heater and fixtures meet efficiency	
5. Lighting and Appliances	
5.1 All installed refrigerators, dishwashers, clothes washers, and clothes dryers are ENERGY STAR qualified	
5.2 95% pf builder-installed lighting fixtures are ENERGY STAR qualified or ENERGY STAR lamps (bulbs) in minimum 95% of sockets	
6. Indoor Air Quality	
6.1 Certified under EPA Indoor airPLUS	
6.2 MERV 13 (minimum) filter installed on all ducted heating and cooling systems	
6.3 Energy efficient balanced ventilation (HRV or ERV) provided in CZs 6-8	
7. Renewable Ready. DOE ZERH PV Ready Checklist Version 2 measures.	
DOE Zero Energy Ready Home Target Home Specifications (Exhibit 2)	
A. HVAC Equipment	
B. HVAC Grading	
C. Insulation and Infiltration	
D. Windows & Doors	
E. Water Heater	
F. Ducts & Thermostat	

G. Lighting & Appliances	
Other Comments, Feedback, or Questions	
Comments on DOE Zero Energy Ready Home Version 2.0 & ENERGY STAR New Certification Label to Accelerate Construction of the Next Generation of Homes and Apartments *DOE is interested in comments on the following questions:*	
1) Should DOE consider requiring the new ENERGY STAR next generation certification for DOE Zero Energy Ready Home V2?	
2) Should DOE consider offering two types of DOE Zero Energy Ready Home certifications under Version 2 -- a basic version and a "next gen" version that includes the ENERGY STAR next generation certification requirements?	