A Guide to Zero Energy Ready Homes

The Department of Energy (U.S. DOE) Zero Energy Ready Homes (ZERH) Program offers a range of resources to assist homeowners, builders, and other partners understand the criteria, benefits, and pathways to a DOE-certified Zero Energy Ready Home. NEEP encourages states to include alternative compliance paths such as DOE ZERH in building energy codes. The following resource will introduce the benefits and requirements of the ZERH Program. A resource guide for single family homeowners and interested partners is also provided.

Introduction to ZERH

Decreasing energy consumption is widely recognized as the most cost-effective means of reducing greenhouse gas emissions. The building sector accounts for approximately 35 percent of energy end-use carbon emissions as of 2021, making buildings among the top four fossil fuel consuming sectors (U.S. Energy Information Administration, *Energy and the Environment Explained*). The ZERH program builds upon existing programs and building energy code standards, such as the Environmental Protection Agency (EPA) Indoor airPlus program and Energy STAR. The high-performance program increases indoor health and comfort, energy savings, and building resiliency through innovative design, such as:

- Effective thermal envelope, including high performance windows, optimized insulation and comprehensive draft protection.
- Whole house water protection, which prevents leaks and foundational damage by employing top to bottom moisture barrier drainage system
- Heating, ventilation, and air conditioning (HVAC) systems, which provide interior comfort by utilizing high efficiency heating and cooling systems.
- Advanced technology components, such as solar-ready design and wiring, ENERGY STAR®-rated smart appliances and fixtures. Electric vehicle charging and other smart appliances may also be included in building design.

"The Brenner by Insight Homes" is a four-bedroom, three bathroom (1940 ft²) certified ZERH located in Delaware. The annual energy savings of this home is estimated to be $2,450. The Home Energy Rating System index for this home is 53 (without photovoltaics (PV).

As states and jurisdictions continue to advance their commitments to decreasing carbon emissions, the ZERH program serves as an integral pathway to driving buildings towards net zero energy consumption. States within the NEEP region are encouraged to include ZERH criteria as an alternative compliance pathway to base building energy codes to meet future net zero goals.

ZERH are designed to be 40-50 percent more efficient than other newly-constructed homes that adhere to less stringent building energy code requirements. These highly efficient homes are built to be fully electric, eliminating their reliance on fossil fuels. ZERH are designed and built "ready" to become zero energy homes, meaning that some renewable energy systems such as solar panels can be easily installed at a later date. This allows homeowners the affordability and flexibility of obtaining zero energy at their own pace, in contrast to Zero Energy Homes (ZEH), which typically feature renewable energy at the outset.

Zero Energy Home (ZEH): A zero energy home also known as a zero-net energy (ZNE) home, are homes that annually produce an energy output that is equivalent to the annual energy input (renewable energy consumed = renewable energy produced), resulting in a net-zero annual energy use and consequently, a net-zero energy bill.

ZERH Requirements

The ZERH certification requirements vary by building type and building permit timeline. To become a certified ZERH, all requirements to the applicable ZERH Program Version and Revision must be met (see Table 1) for either the prescriptive or performance pathway. The performance pathway provides flexibility to select a combination of measures that meet the performance level of the DOE ZERH Energy Rating Index (ERI) through energy modeling. The prescriptive pathway provides a single set of measures that can be used to construct a DOE ZERH; modeling is not required and tradeoffs are not allowed. Additionally, a home must be constructed by a registered program partner and must be reviewed by a Third-Party Inspection Agency (TPIA) in order to be certified as a ZERH. Builders, contractors, architects, design professionals, third-party verifiers, and sustainability consultants can apply to become program partners. Once approved, program partners are listed online in the geographically-searchable ZERH partner directory for homeowners and other interested parties.

National (except California)

Program Version and Revision Number	Required for Use, if Home's Permit Date is on/after this Date	Project Type
Version 1, Rev. 06	7/20/2017	Single family, multifamily up to 5 stories
Version 1, Rev. 07	6/1/2019	
Version 1, Rev. 08	1/1/2023	
Single Family Version 2	1/1/2024	Single Family
Multifamily Version 2	TBD *(may be optionally used after publication)*	Multifamily, any height

Manufactured Homes

Program Version and Revision Number	Required for Use, if Home's Production Date is on/after this Date	Project Type
Manufactured Homes Version 1 (Pilot)	1/1/2023	Manufactured homes (specifications apply nationally, including California)
Manufactured Homes Version 2	TBD *(may be optionally used after publication)*	

Table 1: DOE ZERH Program Versions and Implementation Timelines

National Program Requirements for Zero Energy Ready Labeled Homes

Version 1, Revision 8 includes:

- **ENERGY STAR Certification**: Projects must be certified under the ENERGY STAR Qualified Homes Program; applicable program versions vary depending on the program requirements of the state and the project's implementation timeline. Projects under the ENERGY STAR Multifamily New Construction program must

follow either the prescriptive path or performance path to obtain DOE ZERH certification. Projects under the ENERGY STAR Multifamily High-Rise Program are not accepted, projects are limited to five stories above grade or less to remain eligible.

- **ENERGY STAR Appliances and Lighting Requirements**: All refrigerators, dishwashers, and clothes washers, installed bathroom ventilation and ceiling fans are ENERGY STAR Qualified.
- **Indoor Air Quality**: Projects must meet criteria for certification through the Environmental Protection Agency (EPA) Indoor airPLUS program.
- **Insulation and Windows**: Insulation levels must meet or exceed 2015 International Energy Conservation Codes (IECC) levels.
- **Ducts and HVAC Air Handlers:** Ducts and HVAC air handlers shall be located in conditioned spaces. Duct systems can be located in other optimized locations to achieve comparable performance
- **Efficiency Requirements for Water Heaters:** Single family homes and multifamily dwellings with independent water heaters shall meet the minimum efficiency criteria for the Energy Factor (EF) or the Uniform Energy Factor (UEF). All showerheads and bathroom sink faucets shall be WaterSense labeled.
- **Renewable Energy Readiness:** All provisions of the DOE Zero Energy Ready Home PV-Ready Checklist are completed in single family homes. In multifamily buildings, PV-ready provisions are not required to apply to each dwelling space. The PV-Ready Checklist does not apply to some homes, but these homes can still qualify for the DOE ZERH certification if all other program requirements are met. Additionally, homes that use renewable resources on a contractual basis may also be exempt from meeting the PV-Ready provisions.

Looking Ahead: Version 2 includes:

National program requirements for Version 2 of Zero Energy Ready labeled homes will be required for homes permitted on or after January 1, 2024. Version two includes additional ready provisions for:

- Electric Vehicles: A powered receptacle must be included in each parking space per dwelling unit. The receptacle is installed in a garage or within the driveway or designated parking space; homes without a private driveway or garage are exempt from this requirement. The branch circuit will be identified by the electric service panel as “electric vehicle charging”.
- Heat Pump Water Heater Ready: There shall be a minimum space close to the installed fossil fuel water heater to allow for future heat pump water heater installation. An individual branch circuit shall be installed, energized, and terminated nearby each installed fossil fuel water heater. Homes equipped with an electric water heater are exempt from this requirement.
- Space Heating: An individual branch circuit outlet or code compliant conduit is installed to facilitate wiring for heat pump installation at a later date. The installed circuit or conduit is labeled as “for future heat pump”, and shall terminate nearby any fossil fuel space heater.

Incentives and Benefits of ZERH

Federal incentives released in the 2022 Inflation Reduction Act invest $1 billion in zero energy code adoption, with $670 million allocated to assist states and local governments to adopt zero energy provisions in the 2021 IECC building codes. Furthermore, the Internal Revenue Code section 45L offers tax credit rewards for homes certified through the DOE ZERH Program as of January 1, 2023, with funding extending to 2032. Certified multifamily units are eligible for a credit between $1,000 to $5,000, and certified single-family homes are eligible to receive up to $5,000.

Crown Street by Hanes Construction is a three-bedroom, three bathroom (1000 ft²) certified ZERH located in Connecticut. The building is part of the municipality's affordable housing program. The annual energy savings of this home are estimated at $2,950. The HERS index for this home is 31 (without PV).

The ZERH Program also aids states and local governments to support low-income housing programs with goals of ZERH being affordable and accessible. The Qualified Allocation Plan (QAP) can be found within states Low-Income Housing Tax Credit portfolios. The QAP tool determines state eligibility and outlines the criteria associated with federal tax credits for affordable housing properties. Energy efficiency is a required item in the QAP selection criteria, which allows builders and developers to earn additional points by certifying affordable ZERH properties.

Regional Overview

As of January 31, 2023 over 10,000 homes have received a ZERH certification nationally. States within the NEEP region represent over 35 percent of these certifications. The below table shows the number of certified ZEHR homes within the NEEP region.

Connecticut: 485 Homes	**New Jersey: 1,260 Homes**
Maryland: 156 Homes	**Pennsylvania**: 1,024 Homes
Delaware: 674 Homes	**New York**: 227 Homes
Massachusetts: 149 Homes	**Vermont:** 85 Homes
Rhode Island: 38 Homes	**New Hampshire:** 161 Homes
Maine: 34 Homes	**District of Columbia**: Four Homes

Table 2: Homes with ZERH Certifications in the NEEP Region

ZERH Resources for Home Owners and Partners

Below are resources available for homeowners and partners.

Home-Owners	*What is a ZERH*	The informational video introduces homeowners to features of ZERHs.
	ZERH Benefits	The following brochure showcases the high-performance package of every ZERH; ZERHs, Energy Star certified homes, and existing homes are compared here.
	DOE ZERH Tour	Take a virtual tour of certified ZERH around the nation.
	Energy Efficiency	The homeowner's manual details the seven advanced systems included in every ZERH.
	Cost and Savings	The following report provides a cost-benefit analysis for homeowners interested in ZERH.
	Locate a Partner	The DOE partner locator utilizes an interactive map that allows homeowners to view partners around the nation.
	Program Resources	The following webpage provides resources, trainings, and webinars for the ZERH program.
	Program Criteria	View program requirements, waivers, and checklists specific to state and date of permit issue.
Partners	*Become a Partner*	The partner central webpage provides information regarding partnership orientation, enlistment and recognition.
	State Incentives	Summary of the incentive programs of 17 states and jurisdictions participating in the ZERH program.
	Multi-Family	The following resource provides information on the experimental integrated ZER retrofit solution for cost effective multifamily renovations.
	Costs	The cost analysis provided by the DOE gives partners an understanding of incremental costs in relation to energy savings.