



Posted on: October 12, 2023



Code-Built vs. Zero Energy Ready

What's the difference?

By [Nicole Tysvaer](#)

In This Series

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[Queen of Zero: Paying Homage to a Bygone Era of American Homebuilding](#)

Construction has begun on JLC's [Queen of Zero](#) case-study-home project, a new custom single-family Victorian in Maryland that will be a certified Zero Energy Ready Home (ZERH) by the U.S. Department of Energy.

In this article, I breakdown some of the key differences between building a custom ZERH, as compared to a standard code-built home in this suburb of Washington, DC. While not an exhaustive list of program components which can vary based on climate zone and other factors, I offer some pointers for contractors on how to navigate both the unique process and practices for building to a net zero ready standard.

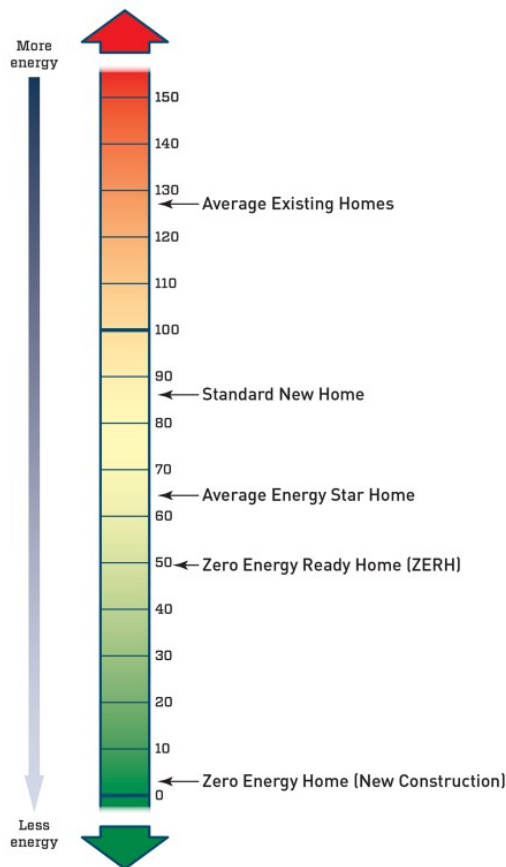
What is ZERH?

Launched in 2012, the US Department of Energy [Zero Energy Ready Home](#) (ZERH) certification program provides standards for the design and construction of single-family and multi-family properties that achieve a level of performance whereby the home's energy consumption could be offset almost entirely by renewable sources. In addition to the exceptional level of energy efficiency, ZERH standards boost the durability and resiliency of buildings, while lowering maintenance costs and increasing occupant comfort and wellbeing.

You can think of ZERH as the Energy Star program "on steroids." To meet the ZERH standard, a home must comply with the requirements for [Energy Star Version 3.1](#), [EPA Indoor AirPLUS](#), [EPA WaterSense](#), [EPA Renewable Energy Ready Home](#), and the [Energy Star Water Management Checklist](#). And that's just the beginning!

ZERH homes are designed to achieve a [HERS](#) (Home Energy Rating System) score of 50 or less, which is at least 50% more efficient than a standard reference home, and about 25% more efficient than the average Energy Star certified home (see image below). Builders of ZERH homes are eligible for the [45L federal tax credit](#) of \$5,000 per unit.

Home Energy Rating System (HERS) Index



Code-Built vs. ZERH: Implementation Process

The process for building to a ZERH standard begins in the schematic design phase of a project. Critical implementation steps for the builder include:

(1) Register as a [ZERH builder partner](#); identify the applicable ZERH version based on your location, building and permit date; and review the [program requirements](#).

Setting Up for ZERH Success Notes from a Sustainability Consultant

Smita Chandra Thomas, CEO of [Energy Shrink, LLC](#), provides sustainability consulting services for the design and construction of net zero homes including energy modeling and green certification. Thomas explains the benefits of engaging a consultant early in the planning phase for a net zero home:

“At the schematic design stage, we can guide the orientation of the home, the roof specifications, the size and position of windows” to maximize solar production and minimize solar heat gain.” During design development, we take into consideration not only the electric loads, but also the lifestyle habits” of occupants such as time spent in different areas of the home. To be precise as possible with her energy modeling, Thomas will “make a list of every piece of electric appliance that the occupants use and the number of hours each week.” Thomas likes to assure her clients, “building science is not rocket science.” In other words, the requirements are not overly complicated, but do require a level of detailed planning and intentionality that can make all the difference in ensuring the home will operate at net zero energy capacity.

(2) Engage a [third-party certified green energy rater](#) (aka “sustainability consultant”) as early as possible-- preferably during the project’s schematic design phase. A qualified green rater will help the team navigate through ZERH standards and provide valuable input to ensure the home meets your efficiency goals (see sidebar at left).

(3) Model the projected energy use and potential solar production. Although energy models are not required for ZERH Version 1 projects following the [Prescriptive Path](#), a well-developed model can be an essential tool for planning and designing a home that will ultimately produce as much as energy as it consumes over the course of a year. Update the

model frequently throughout the design process including when appliance and equipment selections are finalized.

(4) Hire an HVAC provider with [Energy Star credentials](#). Include the relevant ZERH certification requirements in the HVAC contractor's scope of work including:

- (a) producing mechanical design documents (Model J, D, S);
- (b) preparing and passing the pre-drywall duct leakage test (<4% total duct leakage);
- (c) completing the Energy Star [HVAC Design Report](#) and [Commissioning Checklist](#).

(5) Work closely with your green rater to schedule and prepare for ZERH inspections at pre-drywall and final (see checklist). Although not required, I recommend that builders conduct their own diagnostic testing of air leakage at strategic time points throughout construction.

(6) Review the requirements for [EPA Indoor AirPLUS](#) certification, which is a pre-requisite of ZERH. Note that Indoor AirPLUS has specifications for reducing airborne contaminants during construction, including a prescriptive procedure for ventilating the home prior to occupancy.

(7) Manage homeowner expectations. Kelly Ross Gillespie of [Kelly Green Energy Raters](#), a certified third-party ZERH consultant, says one of the challenges for builders is "setting realistic expectations... if a homeowner wishes to build a very large home, it may be difficult to offset the entire load of the home (especially if it is all electric) with the amount of roof area available for solar panels."

It Takes a Village to Build a ZERH

According to ZERH builder Matt Kulp, "there are many more requirements and details to pay attention to in a Net Zero build which takes a lot of collaboration from top to bottom." Kulp explains that everyone from the owner to architect to the trades and insulation contractor should understand the expectations of building to a ZERH standard. "The challenge is putting the right team together," says Kulp. "Once you have a team of like-minded people with the same goals, you are good to go."

Code-Built vs. ZERH: Construction Practices

As codes in many jurisdictions have become increasingly stringent over the years, the gap between building a ZERH versus conventional construction has narrowed. Thus, ZERH construction compliance becomes more of a nuanced approach to maximizing energy and water efficiency, tightening the envelope, achieving superior indoor air quality, and preparing the house for solar production. Examples of ZERH practices over and above typical code requirements include:

- **Foundation and site work** – Crawlspace floors and sub-slab capillary break material complies with the [Energy Star Water Management Builder Checklist](#); [IECC 2018](#) concrete slab horizontal and vertical rigid insulation; prep for radon mitigation pipe if needed (see [EPA Map of Radon Zones](#)).
- **Heating, cooling and ventilation** – Energy Star certified bath exhaust fans; mechanical fresh air ventilation that meets [ASHRAE 62.2 standards](#); all ducts and HVAC equipment located within the thermal boundary.
- **Plumbing** – Lavatory faucets, showerheads and toilets are EPA [WaterSense certified](#); water heaters meet Energy Star standards; hot water distribution meets [EPA WaterSense](#) standard for an efficient delivery system.
- **Electric** – All-LED light fixtures and ceiling fans are Energy Star qualified; complete preparations for future solar array as per the [EPA PV Ready Checklist](#).
- **Air sealing & insulation** – Sill gasketing between foundation and bottom plate; caulk or foam sill plates to subfloor when adjacent to unconditioned spaces; [insulation](#) meets or exceeds [IECC 2015 requirements](#).
- **Appliances** – Refrigerators, dishwashers, clothes washers and dryers are Energy Star qualified.

Preparing for a ZERH Pre-Drywall Inspection

Use this checklist to help ensure a successful ZERH pre-drywall inspection:

- All insulation and air sealing completed.
- Exterior penetrations are caulked or foamed.
- HVAC system fully installed – duct work is complete and equipment is operational.

- Provide photo documentation of any concealed items such as slab insulation and sill plate gaskets.
 - Home should be vacant during duct testing with the exception of the builder representative and an HVAC tech. Ideally, *no* construction work during the test.
 - Hold off on drywall delivery until after the inspection (drywall sheets often obstruct areas that need to be inspected).
 - If duct leakage is above 4%, HVAC tech should be ready to help identify and remedy any leaky areas.
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ZERH Advantages for Builders

Despite the learning curve associated with building a “beyond code” ZERH home, the benefits for contractors can outweigh the challenges. In addition to the federal 45L tax credit, ZERH builders have a competitive advantage in the marketplace, as there are few contractors with experience constructing high performance homes and demand is rising. Also, as Gillespie explains, “builders are motivated by the quality and durability of the ZERH product – which means fewer call backs post-construction.”

Additional Resource

EEBA Webinar “Voice of the Builder: DOE Zero Energy Ready Home” available [on YouTube here](#).

About the Author

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