U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

DOE ZERO ENERGY READY HOME™

U.S. DOE ZERO ENERGY READY HOME 2016 WINNER Housing Innovation Awards

Habitat for Humanity of Catawba Valley

The Julia Plan
Hickory, NC

BUILDER PROFILE

Habitat for Humanity of Catawba Valley
Hickory, NC
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FEATURED HOME/DEVELOPMENT:

Project Data:

- Name: The Julia Plan
- Location: Hickory, NC
- Layout: 4 bdrm, 2 bath, 1 fl, 1,340 ft²
- Climate Zone: IECC 4A, mixed-humid
- Completion: February 2016
- Category: affordable

Modeled Performance Data:

- HERS Index: without PV 44
- Projected Annual Energy Costs: without PV $838
- Projected Annual Energy Cost Savings (vs home built to 2009 IECC): without PV $791
- Projected Annual Energy Savings: without PV 8,785 kWh
- Added Construction Cost: without PV $6,000

Habitat for Humanity of Catawba Valley takes great pride in building high-performance homes that are not only affordable to purchase, but also affordable to operate and maintain.

"We believe that affordability and sustainability go hand-in-hand," said Derek Ross, Construction Supervisor for Catawba Valley Habitat for Humanity, in explaining why his affiliate has made a commitment to build all of its future homes to the high-performance criteria of the U.S. Department of Energy (DOE) Zero Energy Ready Home (ZERH) program.

The affiliate constructed its first home to the DOE Zero Energy Ready Home criteria at its Northstone site in Hickory, North Carolina, and has plans to build 18 more certified homes at the site.

Habitat for Humanity of Catawba Valley is no stranger to energy-efficient construction. The affiliate began building energy-efficient homes in 2001. In 2005 it built the first net-zero energy home in the state of North Carolina, in partnership with Appalachian State University; this home earned an Energy Value Housing Award from the National Association of Home Builders. The affiliate also partners with SystemVision, an energy efficiency program for affordable housing run by Advanced Energy and North Carolina Housing Finance Agency.

The affiliate's first DOE Zero Energy Ready home is a relatively simple, one-level, four-bedroom, two-bath, 1,340-ft² home based on the "Julia" floor plan and designed by Tightlines Designs in Raleigh, North Carolina. Ross describes the home as a traditional craftsman-style, stick-framed bungalow with an open floor plan. It has large windows that provide natural daylight to all areas of the home. Habitat for Humanity program managers requested that Tightlines modify the Julia plan to accommodate universal design features for aging in place.

ZERO ENERGY READY HOME U.S. DEPARTMENT OF ENERGY

The U.S. Department of Energy invites home builders across the country to meet the extraordinary levels of excellence and quality specified in DOE's Zero Energy Ready Home program (formerly known as Challenge Home). Every DOE Zero Energy Ready Home starts with ENERGY STAR Certified Homes Version 3.0 for an energy-efficient home built on a solid foundation of building science research. Advanced technologies are designed in to give you superior construction, durability, and comfort; healthy indoor air; high-performance HVAC, lighting, and appliances; and solar-ready components for low or no utility bills in a quality home that will last for generations to come.

Habitat for Humanity of Catawba Valley built this 1,340-ft² home in Hickory, North Carolina, to the performance criteria of the DOE Zero Energy Ready Home (ZERH) program.

What makes a home a DOE ZERO ENERGY READY HOME?

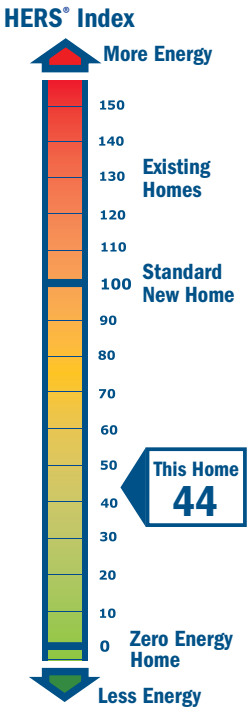
1 **BASELINE**
ENERGY STAR Certified Homes Version 3.0

2 **ENVELOPE**
meets or exceeds 2012 IECC levels

3 **DUCT SYSTEM**
located within the home's thermal boundary

4 **WATER EFFICIENCY**
meets or exceeds the EPA WaterSense Section 3.3 specs

5 **LIGHTING AND APPLIANCES**
ENERGY STAR qualified



6 **INDOOR AIR QUALITY**
meets or exceeds the EPA Indoor airPLUS Verification Checklist

7 **RENEWABLE READY**
meets EPA Renewable Energy-Ready Home.

The home is also packed with energy-efficiency details that are expected to reduce energy bills to about $838 per year, or roughly $70 per month, for a savings of $791 annually compared to a home built to code, which is the 2009 International Energy Conservation Code in North Carolina. The home achieved a Home Energy Rating System (HERS) score of 44 (without roof-mounted solar panels). Most new code-built homes earn HERS scores ranging from 80 to100.

The Catawba Valley Habitat achieved this high level of efficiency by meeting the construction requirements of the DOE Zero Energy Ready Home program. Every home is certified to ENERGY STAR Certified Homes Version 3.0 and the U.S. Environmental Protection Agency's Indoor airPLUS program. Each home meets the hot water distribution requirements of the EPA's WaterSense program and the insulation requirements of the 2012 International Energy Conservation Code. In addition, homes are required to have solar electric panels installed or have the conduit and electrical panel space in place for future PV installation.

The Catawba Valley home includes advanced framing details such as insulated corners, insulated headers over windows and doors, and ladder blocking where interior walls intersect with exterior walls to allow more space for insulation. The 2x4 exterior walls are filled with R-15 of blown-in fiberglass then covered with a coated OSB sheathing product. In addition, R-10 of rigid extruded polystyrene (XPS) foam covers the sheathing. The XPS envelopes the house in a continuous air barrier and thermal break. The rigid foam is also taped at the seams to serve as a drainage plane. Furring strips consisting of 2x4s are installed vertically over the rigid foam to provide a ventilating air gap behind the engineered wood siding.

The vented attic is insulated with R-50 worth of blown fiberglass, which is applied on top of the ceiling deck. Trusses were built with a two-foot overhang to better protect windows and exterior doors from the sun and rain and a coated OSB roof sheathing was installed with all sheathing seams taped for added durability and disaster resistance.

The home is built over an unvented crawl space consisting of concrete block foundation walls. The crawl space walls are lined along the inside with R-10 of rigid XPS foam and the floor is covered with a 12-mil-thick polyethylene vapor barrier that is lapped up the piers and fastened to the walls to keep soil gasses out of the home.

The 2x4 exterior walls are filled with R-15 of blown-in fiberglass then covered with OSB sheathing. Over the OSB the builder installed R-10 of rigid extruded polystyrene (XPS) that is taped at the seams to provide a continuous air barrier, thermal barrier, and drainage plane. Furring strips were installed over the rigid foam to provide a ventilating air gap behind the engineered wood siding.

Other features that help to ensure indoor air quality in the tightly air sealed home include an energy recovery ventilator, which operates continuously to bring filtered fresh air into the home, a passive radon venting system, and low-VOC paints and finishes.

A mini-split heat pump provides cooling and heating with a cooling efficiency of 18 SEER and heating efficiency of 10 HSPF. The mini-split heat pump is located in the sealed and insulated crawl space. The heat pump is ducted with flex ducts that are insulated to R-8. All of the ducts are located within the insulated conditioned crawl space. A heat pump water heater provides hot water.

All of the light fixtures use LED bulbs. ENERGY STAR ceiling fans are installed in all bedrooms. An ENERGY STAR exhaust fan is installed in each bathroom. ENERGY STAR appliances were installed including an ENERGY STAR refrigerator, dishwasher, clothes washer, and dryer.

EPA WaterSense-rated fixtures add to energy and water savings in the efficient home. The home also has high-performance vinyl-framed double-pane windows with an insulation U factor of 0.30 and a solar heat gain coefficient (SHGC) of 0.22. Low-emissivity coatings on the windows help to reduce heat gains and losses and 2-foot overhangs help block out summer sun. A local nursery donated native plants for shade and landscaping that requires minimal irrigation.

Solar panels were not installed because the DOE ZER home was not ideally oriented for solar gain; however, conduit was installed and space was left in the panel for future installation of photovoltaic panels. The lot is in the North Stone neighborhood, which was a previously foreclosed development purchased by the affiliate with all of the infrastructure in place, leaving little control over the layout; thus, many of the lots in the 18-home community were not well oriented for solar gain.

Attention to detail helps the Habitat affiliate achieve exceptional performance. "We know that 'the devil is in the details' when it comes to quality construction," said Ross. "We hold our staff, industry partners, subcontractors, and volunteers to a high standard of performance. We have a great relationship with our HERS rater who provides an additional level of quality assurance. Our architect provides a very detailed set of construction documents. We also use checklists, such as those required for ENERGY STAR and Indoor airPLUS, to keep everything on track and ensure that we meet all of the program requirements."

HOME CERTIFICATIONS

DOE Zero Energy Ready Home Program, 100% commitment

ENERGY STAR Certified Homes Version 3.0

EPA Indoor airPLUS

Every DOE Zero Energy Ready Home combines a building science baseline specified by ENERGY STAR Certified Homes with advanced technologies and practices from DOE's Building America research program.

The home's conditioned crawl space is insulated along the interior walls with rigid foam. A thick vapor barrier covers the floor and is sealed to walls and pipes like this radon ventilation stack.

Although Habitat for Humanity of Catawba County staff have found that it can be challenging to get subcontractors to fully participate in sustainable design approaches, they remain committed to the DOE ZERH program. They are also just as committed to training home owners as they are to training volunteers. "We provide a comprehensive home owner education program to help our partner families take full advantage of the special features of their home." said Ross. "This begins with a home owner training class that covers the ZERH program, the construction process, the mechanical equipment, etc. We also address healthy homes information from HUD. The next phase of training is at the walk-through when we go over operation and maintenance of all of the systems in the home. The third phase is continuing education through a two-year monitoring and maintenance agreement. We make home visits at six-month intervals along with the HVAC contractor to be certain that all of the mechanical systems are working correctly and being properly maintained. We also utilize the free marketing materials from DOE to educate consumers, builders, realtors, lenders, and appraisers about the value of a ZERH. As a result, we have received significant media attention such as newspaper articles and a radio interview on a local national public radio station."

"We measure success by the number of families that we serve with sustainable, affordable homes," states Ross. "We also find that building ZERH certified homes is meaningful to our board members, donors, and volunteers. The biggest reward is building a home that is not only affordable to purchase, but also affordable to own and operate."

The family that bought and helped to build this Habitat home would happily agree. Said the father of the family, "the thing that amazes me the most about this house is the fact that we have so much more space, but we pay a fraction of the cost in utilities. Before we moved, we were living in an 800-square-foot residence and often paying over $200-$225 for utilities. Here, we have more space (over 1,300 square feet) but our utility bill is less than $100. To me, this speaks volumes about the quality of construction that went into this house. We are so happy to be here!"

Photos courtesy of Habitat for Humanity of Catawba Valley

KEY FEATURES

- **DOE Zero Energy Ready Home Path:** Performance.
- **Walls:** 2x4 16″ o.c., OSB sheathing; advanced framing, R-15 blown fiberglass, R-10 XPS exterior rigid foam with taped seams, 2x4 furring strips, engineered wood lap siding.
- **Roof:** Coated OSB sheathing with taped seams, 30-year architectural shingles.
- **Attic:** Vented attic, R-50 blown fiberglass.
- **Foundation:** Unvented crawl space of concrete block with R-10 XPS on inside of walls and 12-mil reinforced liner.
- **Windows:** Double-pane, low-e vinyl-framed windows, U=0.30, SHGC=0.22.
- **Air Sealing:** 3 ACH 50.
- **Ventilation:** Continuous ERV.
- **HVAC:** Ducted mini-split heat pump in closed crawl space, 18 SEER, 10 HSPF, R-8 flex duct.
- **Hot Water:** Heat pump water heater 3.39 EF.
- **Lighting:** 100% LED lighting, ENERGY STAR ceiling fans.
- **Appliances:** ENERGY STAR refrigerator, dishwasher, washer & dryer.
- **Solar:** None.
- **Water Conservation Features:** WaterSense plumbing fixtures.
- **Energy Management System:** None.
- **Other:** Low-VOC paint, passive radon ventilation system, indoor return air vents; universal design wider doorways and hallway.

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