



Habitat for Humanity North Central Connecticut

Cleveland Avenue Home
Hartford, CT



BUILDER PROFILE

Habitat for Humanity North Central
Connecticut, Hartford, CT
www.hfncc.org
Kris McKelvie, 860-541-2208
construction@hfncc.org

FEATURED HOME/DEVELOPMENT:

Project Data:

- Project name: Cleveland Avenue Home
- Location: Hartford, CT
- Layout: 3 bdrm, 1.5 baths, 2 fls + bsmt, 1,396 ft²
- Climate: IECC 5A, cold
- Completed: August 2022
- Category: Affordable

Modeled Performance Data:

- HERS Index: without PV 34
- Annual Energy Costs: without PV \$1,700
- Annual Energy Cost Savings: (vs typical new homes) without PV \$2,150
- Annual Energy Savings: without PV 10,300 kWh
- Savings in the First 30 Years: without PV \$90,250

Class is in session every day on a Habitat for Humanity job site, so it is no surprise that Habitat for Humanity North Central Connecticut (HFHNC) took home the “Class is in Session” Grand Award at the 2023 U.S. Department of Energy’s Zero Energy Ready Home Housing Innovation Awards ceremony.

The organization gets about 5,000 volunteers a year—from corporate, faith, and civic groups to high schools and colleges—making volunteers the largest group HFHNC educates on an annual basis. “Every shift starts with an explanation and demonstration of what, how, and why we do things a certain way,” said Director of Construction Kristopher McKelvie. “There are a lot of conversations about the importance of DOE Zero Energy Ready Home construction and why it benefits our homeowners. Given the extent and diversity of our volunteers, our reach and impact with this group alone is significant in the community.”

HFHNC takes homeowner education seriously as well. As McKelvie explains, “Many of our Habitat homeowners are first-time home buyers and they have a lot to learn, so we start the process early to educate them about their home. Prospective Habitat homeowners must complete 150 hours of sweat equity. They help build walls, install radon pipes, connect duct work for the ERV unit, and so much more. The hands-on experience helps them understand the function of each component. Once the home is completed, we provide a thorough in-person walk-through. We show them where filters are located, how they are cleaned or replaced, how to monitor and maintain each system, and the importance of simple behaviors like keeping windows and doors closed to allow the ERV to control the interior air quality. I developed an educational training video based on the DOE Zero Energy Ready homeowners’ manual. The video reviews all the information from their in-person walk-through and critical information about owning a DOE Zero Energy Ready home,” said McKelvie. Homeowners have access to this and other online training and can contact Habitat directly with any questions or concerns as they ease into their new home.



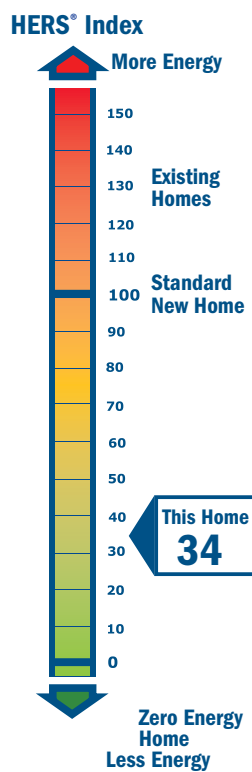
The U.S. Department of Energy invites home builders across the country to meet the extraordinary levels of excellence and quality specified in DOE’s Zero Energy Ready Home program. Every DOE Zero Energy Ready Home starts with ENERGY STAR Certified Homes Version 3.0/3.1/3.2 for an energy-efficient home 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.

The Habitat for Humanity affiliate of North Central Connecticut built this 3-bedroom, 1.5-bath, 1,396-ft² home with basement to the performance criteria of the DOE Zero Energy Ready Home (ZERH) program. Homeowners can expect utility bills of less than \$150 per month. A 50-gallon ENERGY STAR-labeled heat pump water heater provides water heating to the home with an efficiency of 3.45 EF (energy factor). ENERGY STAR-labeled lighting and appliances add to energy savings.



What makes a home a DOE ZERO ENERGY READY HOME?

- 1 **BASELINE**
ENERGY STAR Certified Homes Version 3.0/3.1
- 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.



Before families move into their new home, Habitat North Central CT hosts a home dedication event, which creates another opportunity for the affiliate to educate the greater community on sustainable homebuilding methods. “Everyone involved in the construction of the home, neighbors, sponsors, and anyone from the general public can meet the family, tour the home, and learn more about what DOE Zero Energy Ready construction involves. These events always garner media attention, which often leads to further inquiries from home builders and curious individuals into how we achieve DOE Zero Energy Ready Home standards and what that entails,” said McKelvie.

Participation in the DOE Housing Innovation Awards has also helped the affiliate increase awareness about sustainable construction and the DOE Zero Energy Ready Home Program. The Habitat affiliate won their first DOE Housing Innovation Grand Award in 2020 after building their first certified DOE Zero Energy Ready Home. The success of that build motivated the affiliate to commit to building all their new homes to the DOE Zero Energy Ready Home standard. They have certified 10 homes and won three Housing Innovation Awards plus two Grand Awards. “The media attention we garnered after completing our first Zero Energy Ready home generated great interest locally and nationally. We received requests for personalized tours, copies of our house plans, and cost breakdowns from other affiliates, home builders, architects, and schools. We found ourselves speaking frequently with local news outlets, presenting at conferences, and providing case study data to help other builders construct to DOE Zero Energy Ready. These interactions provided us with a great opportunity to discuss the benefits of DOE certifications for both the builder and homeowner,” said McKelvie.

McKelvie shared that the affiliate now has four different house plans that have been modified to meet DOE Zero Energy Ready Home certification. As they expand into different neighborhoods they will continue to improve upon and modify their designs. They are committed to showing that DOE Zero Energy Ready home construction is valuable and needed.

“DOE Zero Energy Ready homes significantly reduce utility costs and provide healthier indoor air and comfortable climate control for families,” McKelvie explains. “As a builder there are incentives and rebates to help offset expenses.” The affiliate estimates it costs them about \$10,000 more to meet the DOE ZERH criteria than just building to code. Current energy incentives in their state cover the additional expenses.

Every home certified through the DOE Zero Energy Ready program must meet the criteria of ENERGY STAR Certified Homes Version 3.1 or 3.2 and the U.S.



The use of insulated concrete forms (ICFs) provided a solid air seal in the walls from the footings to the underside of the roof. Possible air leaks were limited to penetrations around windows, doors, and conduits, which were sealed with spray foam and tape. After drywall, all trim around openings was caulked. Using the double-insulated ICF walls and triple-pane windows made for a quieter home, a definite plus for the owners of this home, which was located on a corner lot with a bus stop just a few feet from the kitchen window.

Environmental Protection Agency's Indoor airPLUS program. Builders must also meet other efficiency requirements like the hot water distribution requirements of the EPA's WaterSense program; the insulation requirements of the 2015 International Energy Conservation Code; HVAC and water heating efficiencies; third-party verified air sealing targets; installation of ENERGY STAR appliances, windows, and lighting; and ducts in conditioned space. In addition, homes are required to have photovoltaic (PV) panels installed or have the conduit and electrical panel space in place for future installation.

The DOE program offers considerable leeway in what building assembly methods the builder can choose to meet the insulation requirements. The North Central CT Habitat affiliate typically builds stick-frame construction, but for this project they used ICFs for all of the exterior walls. The National Concrete Ready Mix Association and the CT Concrete Promotion Council donated concrete, forms, and training. McKelvie was happy with the ICF construction, but noted it took longer due to coordination with contractors, suppliers, and city inspectors.

Construction Project Manager Diana Gasca said the volunteers were excited to try the ICF blocks, which consist of two rigid foam panels 8 feet long, 18 inches tall, and 2.625 inches thick, held apart by plastic spacers to form hollow blocks 11 inches wide. The blocks are stacked like bricks, steel rebar is laid across the spacers horizontally and vertically, then the hollow wall is filled with concrete that hardens in place to form a very sturdy mold-, pest-, fire-, and wind-resistant wall. "It's like adult Legos," said Gasca. "I would give a quick demo in the morning. Then we would jump into it. The volunteers did everything. They put the walls together, cutting them to size where needed, reinforcing the forms, and putting together the alignment system for pouring the concrete. They sealed the seams with canned foam where needed but they didn't need to seal most of the seams because the ICF product forms very tight seams," said Gasca. A subcontractor installed a spray-on polymer-modified asphalt liquid-applied membrane and an insulated protective drainage panel over the exterior surface of the below-grade ICF foundation walls. The exposed area between the ground and the vinyl siding was covered with a parge coating that looks like concrete. The vinyl siding was attached directly to the ICFs at the integrated vertical 1.5-inch fastening strips located every 8 inches across the ICF wall.

The vented attic was air sealed around light boxes and drywall seams before 17 inches (R-60) of cellulose was blown in over the attic floor. Raised-heel trusses allow 14 inches of insulation over the top plates. A strip of sill gasket was stapled

HOME CERTIFICATIONS

ENERGY STAR Certified Homes
Version 3.1

EPA Indoor airPLUS

DOE Zero Energy Ready Home Program
- 100% Commitment

EPA WaterSense

IBHS Fortified Home, Gold

Energize Connecticut, All Electric
Home Program

"The future of safe, environmentally conscious, self-sufficient, and affordable home building is here."

-Kristopher McKelvie, Director of
Construction, Habitat for Humanity North
Central Connecticut.



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 air-source ductless mini-split heat pump has one outdoor variable-speed compressor and two indoor air handlers and provides very efficient heating and cooling (14 HSPF, 33 SEER).

Volunteers installed the windows under the supervision of Gasca or one of the three experienced volunteer crew leads on site. The windows were installed in 2x12 window bucks and set flush with the exterior walls then sealed with flashing tape and a high-performance polyurethane sealant around and over the nailing flange. At the encouragement of their energy rater, the affiliate chose triple-pane windows. The vinyl-framed windows were made in Maine and had an insulation value of U-0.22. "Going from double pane to triple pane, we got better HERS scores and it made it quieter inside the home," said McKelvie.

The ICFs provided a solid air barrier and contributed to the overall air tightness of the home, which had only 1.48 air changes per hour at 50 Pascals pressure differential of air leakage. To provide fresh air to the home, an energy recovery ventilator (ERV) was installed with volunteer labor. The ERV draws in fresh outside air that is warmed by heat transferred from outgoing air. The incoming air passes through a MERV 8 or 13 filter before being distributed throughout the home.

A ductless mini-split heat pump provides very efficient heating and cooling to the home at a heating efficiency of 14.0 HSPF and a cooling efficiency of 33 SEER. The heat pump has one outdoor compressor and two indoor air handlers, one for each floor of the home. In-wall transfer fans located over bedroom doors pull heated and cooled air into the bedrooms at the flip of a switch when doors are closed.

Building energy-efficient and durable homes has always been a priority for the North Central CT affiliate. After considering several certification programs, the affiliate adopted DOE's Zero Energy Ready program as their new standard because "DOE did the initial hard work of analyzing and recommending best practices to achieve an air-tight and high-performance home," said McKelvie. "What we discovered was that simple changes to our designs and thoughtful use of materials and equipment would allow us to achieve the DOE Zero Energy Ready certifications without having to drastically modify our building style, house plans, or budgets," McKelvie explained.

McKelvie notes that homeowners "certainly have been extremely appreciative. It's more comfortable living. It's less drafty and it's easier to maintain a consistent temperature in the house. Because we've switched to heat pumps, the homes now have air conditioning in the summer. Also, many families with kids have seen greatly reduced allergy and asthma symptoms," said McKelvie.

The affiliate is in the process of constructing a cluster of 10 DOE Zero Energy certified homes on a single land parcel in East Hartford. They broke ground in June 2023 and plan to have all ten homes completed by the end of 2025.

into the corner formed by the top plates and ceiling trusses to air seal the corners before installing ceiling and wall drywall.

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KEY FEATURES

- **Walls:** ICF. R-25 total: 11.25" ICF blocks;, vinyl siding with integral 0.5" EPS.
- **Roof:** Gable truss roof, IBHS Fortified, ½" coated OSB sheathing with seams taped, two rows of self-adhered membrane at eaves. Drip edge. Architectural asphalt shingles. Roof trusses engineered for heavy snow load and solar panels.
- **Attic:** Vented, R-60 total: 17" blown cellulose, 14" raised-heel trusses.
- **Foundation:** Insulated basement, R-27.14 total: 11.25" R-24 ICF walls, spray-applied waterproofing membrane; ¾" R-3.1 insulated drain board, ¼" parging. Passive radon mitigation system installed with wiring in place for future fan if needed.
- **Windows:** Triple-pane, U=0.22, SHGC=0.23, low-e, argon fill, vinyl-framed, double-hung.
- **Air Sealing:** 1.48 ACH 50, ICF walls, all penetrations taped or foam sealed.
- **Ventilation:** ERV, 50 cfm continuous, MERV 8 or 13 filters. SRE 75%; ASRE 75%; ATRE 40%.
- **HVAC:** Ductless minisplit air-source heat pump; 14 HSPF, 33 SEER, 2 indoor air handlers, 1 outdoor compressor. Variable-speed compressor. 14.0 Btu. Transfer fans over bedroom doors pull conditioned air into room when door is closed.
- **Hot Water:** Heat pump water heater, 50-gallons, COP 3.45. Compact plumbing distribution.
- **Lighting and Appliances:** LED lighting; ENERGY STAR appliances, all electric.
- **Solar:** No PV installed. Solar ready: conduit to roof, ample electric panel space, and roof orientation to maximize future solar.
- **Energy Management System:** None.
- **Other:** All electric, EV charging pedestal.

Photos courtesy of Habitat for Humanity North Central Connecticut