

Southeast Volusia Habitat for Humanity Edgewater, Florida



BUILDER PROFILE

Southeast Volusia Co. Habitat for Humanity
New Smyrna Beach, Florida
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FEATURED HOME/DEVELOPMENT

Project Data

- Name: 1st DOE Zero Energy Ready Home
- Location: Edgewater, Florida
- Layout: 3 bedrooms, 2 baths, 1 floor, no basement
- Conditioned Space: 1,250 ft²
- Completion: August 2013
- Climate Zone: IECC Zone 2
- Category: affordable, single-family

Modeled Performance Data

- HERS Index, without PV: 49
- HERS Index, with PV: NA
- Projected total annual energy cost savings (compared to a similar house built to the 2006 IECC): \$655
- Projected annual utility costs: without PV: \$758
- Annual PV production revenue: NA
- Annual energy savings: without PV 5,480 kWh
- Builder's added cost over builder's standard (ENERGY STAR 3.1) = <\$7,000 (includes cost of solar water heater)

In August 2013, Southeast Volusia County Habitat for Humanity (Volusia Habitat) completed its first U.S. Department of Energy (DOE) Zero Energy Ready Home in Edgewater, on the Atlantic coast of central Florida. This 1,250-ft², 3-bedroom, 2-bath home achieved a Home Energy Rating System (HERS) score of 49. That is 70 points better than typical existing homes, which have an average HERS score of 120 or higher. And it means substantially lower utility bills for the Habitat affiliate's homeowners.

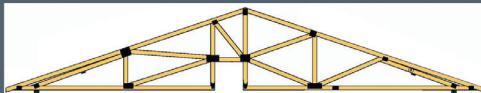
Volusia Habitat has been building progressively more energy-efficient homes over the last several years thanks to an ongoing relationship with the Florida Solar Energy Center, a DOE Building America research partner.

"We build about 8 to 10 homes a year," said Rosemary Walker, executive director for the Habitat affiliate. "We started doing ENERGY STAR about 5 years ago, and DOE Builders Challenge 3 years ago, and then DOE Zero Energy Ready Home this year." Volusia Habitat builds all of its homes to meet ENERGY STAR Version 3.1 at a minimum. "Our goal really is not energy efficiency per se; it is really the long-term sustainability of the family in the home," said Walker. Before Volusia Habitat started building energy-efficient homes, it was not uncommon for families to spend more for their monthly utilities than for their mortgage (which typically costs \$250 to \$300 per month). "Our families brag about their utility bills now," said Walker.

For construction supervisor Ray Allnutt, the key to successfully building high-performing, affordable homes is to get the air sealing and moisture management details right while remembering that these details impact the way the house operates as a system.



DOE Zero Energy Ready Home builders are in the top 1% of builders in the country, meeting the extraordinary levels of excellence and quality specified by the U.S. Department of Energy. Every DOE Zero Energy Ready Home starts with ENERGY STAR for Homes Version 3 for an energy-efficient home built on a solid foundation of building science research. Then, even more advanced technologies are designed in for a home that goes above and beyond current code to give you the superior quality construction, HVAC, appliances, indoor air quality, safety, durability, comfort, and solar-ready components along with ultra-low or no utility bills. This provides homeowners with a quality home that will last for generations to come.



Rather than intrude into the home's compact 8-ft interior, Volusia Habitat ordered specially designed roof trusses with a 2-ft by 2-ft notch that allowed them to tuck the duct chase up into the ceiling. Two layers of rigid foam form the top and sides of the duct chase. The 2-inch-thick R-10 sheets were cut to fit, glued together, and caulked at the staggered seams. The first layer was held in place with 2x4s that were screwed to the trusses and served as a ledge for the second layer of foam.



DOE ZERO ENERGY READY HOME CERTIFIED

1 BASELINE
certified ENERGY STAR for Homes Version 3.0

2 ENVELOPE
meets or exceeds 2012 IECC levels

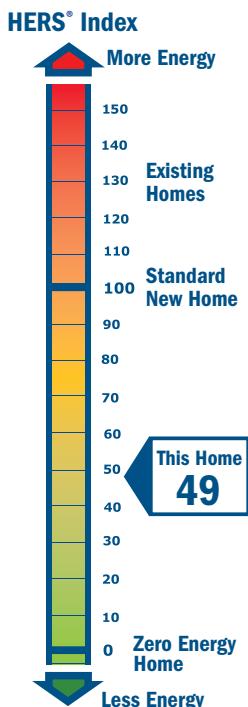
3 DUCT SYSTEM
located with the home's thermal boundary

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 connection between the wood-framed walls and the concrete slab foundation is carefully designed to keep foundation moisture from seeping up into the walls. Some builders lay the 2x4 or 2x6 sill plate flush with the edge of the slab then attach the plywood or OSB sheathing so that it hangs down over the sill plate and rests against the foundation, where it can absorb moisture from the concrete. Allnutt has his framers set the sill plate in a half inch, then hang the sheathing a half inch up from the concrete to provide a gap that prevents moisture migration up into the wood. The bottom edge of the plywood is also painted with primer before hanging for additional protection and the sill plate itself sits on a strip of sill seal foam, which acts as a moisture barrier between the framing and the foundation.

The walls are built of 2x4s set 16 inches on center and sheathed with 1/2-inch CDX plywood for structural strength in this hurricane-prone climate. Over the housewrap, volunteers attach 4x8 sheets of R-3-rated 1/2-inch-thick rigid foam insulation, which is taped at all seams and corners. The bottom edge of the foam hangs down over the foundation wall 1/2 inch, covering the air gap left below the sheathing. The foam is covered with fiber cement siding.

Any holes through the exterior walls for plumbing or electrical wiring are sealed with high-expanding, fire-rated foam to prevent air leaks. Volunteers install R-13 fiberglass batt insulation in the stud cavities. Allnutt employs an airtight drywall approach by installing a continuous bead of low-density foam along the face of the top and bottom plates and corner framing. This bead is compressed when the drywall is hung to form an airtight seal around the wall. All drywall joints are taped and mudded, which provides additional air sealing.

Quality windows complete the walls. Before the windows are installed, each window opening is carefully flashed with a flexible peel-and-stick membrane to ensure air and water vapor do not penetrate between the opening and frame. The home's 10 windows are vinyl framed and dual pane with an argon gas between the two layers of glass to help prevent moisture-laden air from leaking into the window. The windows have an insulation U-factor of 0.33. They also have a low-emissivity coating on the glass and a solar heat gain coefficient of 0.18, which means they do a good job of reducing heat gain from the sun.



The affiliate's homes are constructed with vented attics that are insulated on the attic floor with 14 inches of blown cellulose for an insulation value of R-38. The homes use a hip roof design, which is more hurricane-resistant than a gable roof design. The trusses are covered with 4x8 sheets of foil-faced CDX plywood. The plywood is covered with 30-pound felt as an underlayment. An additional 6-inch strip of 90-pound underlayment ice and snow shield is adhered to the edge of the roof. To prevent the asphalt shingles along the roof's edge from being torn off in a hurricane, Allnutt's team then covers the bottom six inches of the roof with tar to help glue down the shingles, which are also nailed to the roof.

Volusia Habitat uses a raised heel roof truss (also known as an energy truss) to provide more insulation at the attic perimeter. The team installs pieces of rigid foam as baffles in each truss bay, which help to maintain the full depth of 8 inches of insulation over the top plates while preventing the insulation from spilling into the soffit vents. In addition to soffitt vents, the roof has a screened and capped ridge vent running the length of the horizontal peak.

DOE Zero Energy Ready Home requires that builders locate the home's HVAC system within the thermal boundary (or insulation layer) of the home. Some builders opt to keep their heating and cooling system and ducts in the attic and make the attic a conditioned space by insulating along the underside of the roof with spray foam. Volusia Habitat felt the spray foam was beyond their budget and they were concerned about roof leaks. Another option used by some builders is to locate the ducts in a dropped ceiling. This technique, sometimes referred to as a "fur-down" approach, keeps the ducts in conditioned space but also decreases the ceiling height so it may be less than ideal in homes with 8-foot ceilings.

With assistance from the Florida Solar Energy Center, Volusia developed another approach, which they referred to as the fur-up duct chase. Allnutt worked with Habitat's truss manufacturer and HVAC contractor to design roof trusses with a 2-foot by 2-foot notch coming up from the ceiling rafter on one side of the king post. This notch allowed space for a duct chase that would be above the ceiling plane but was insulated to keep it within the thermal boundary of the home. Nearly all of the rooms in the home are positioned along this center line, enabling registers to be mounted directly along the main duct or off very short branch ducts.

After the rigid foam sides were installed, the rectangular fiberboard duct was lifted into place and supported with 2x4 blocking. Most of the duct registers came directly off the main trunk and boots were installed before raising the duct. The rigid foam chase was further covered with R-11 of unfaced batt for a total chase insulation value of R-31. After the ceiling drywall was installed, R-38 of blown cellulose was blown onto the attic floor around the chase.

HOME CERTIFICATIONS:

DOE Zero Energy Ready Home

ENERGY STAR Version 3

Florida Green Building Coalition
Green Home

"Volusia Habitat is in the vanguard of building affordable, sustainable, and efficient housing for their clients. It has been a joy to help Volusia Habitat and watch them solve the many challenges of DOE Zero Energy Ready Homes. If Habitat can build DOE Zero Energy Ready Homes simply and inexpensively, anyone can and should," said David Beal, a research analyst with the Florida Solar Energy Center.



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



Solar thermal panels, mounted on the south-facing rear roof, provide plenty of hot water at a cost of only \$121 a year to run, compared to \$282 a year for a conventional 80-gallon, 89%-efficient water heater.

The air handler for the energy-efficient heat pump (SEER 15; HSPF 8) is centrally located in a separate closet in the master bedroom.

Volusia Habitat used donated rigid foam but Florida Solar Energy Center estimated that the fur-up duct chase would cost a for-profit builder about \$1,890, or \$1.51 ft² for labor and materials.

To provide needed ventilation in the airtight home, it was equipped with an energy recovery ventilator. Energy recovery ventilators draw fresh air into the home while exhausting an equal amount of stale air to the outside. The two airstreams cross paths in a heat exchanger, which transfers heat from the hotter air to the cooler air while filtering the incoming air. It also transfers some of the water vapor. Thus, the incoming air arrives cooler, filtered, and with less humidity.

While ERVs are sometimes installed as part of the HVAC duct system, Volusia Habitat chose to install the ERV as an independent unit that is located in the living room ceiling with exhaust and intake ducts located 8 feet apart on opposite sides of the large living room window.

A grant from Florida Power and Light provided a free 80-gallon solar hot water heater. The water heater tank is located in the laundry room. The 40-ft² solar collector is positioned on the roof directly above the water tank to limit pipe runs. The tank has a backup electric heating element. For this house, the estimated annual energy cost for the solar water heater is \$121 (compared to a conventional 80-gallon, 89% efficient water heater at \$282 a year).

"Affordability and sustainability go hand in hand with DOE Zero Energy Ready Home," said Walker. "When people tell me it is too expensive to do this, I say 'it is too expensive NOT to do this.'"

KEY FEATURES

- **DOE Zero Energy Ready Home Path:** performance
- **Walls:** 2x4, 16-inch-on-center, R-13 batt insulation, R-3 exterior rigid insulation (Dow Styrofoam), cement lap siding
- **Roof:** 4/12 pitch, hip roof, 30-year architectural shingle
- **Attic:** vented, radiant barrier, R-38 blown-in insulation
- **Foundation:** slab on grade
- **Windows:** double-pane, argon-filled, vinyl-framed, with low-e coating; U=0.33, SHGC=0.18
- **Ventilation:** energy recovery ventilator (Panasonic FV-04VE1), MERV 8 filter
- **HVAC:** SEER 15, HSPF 8 heat pump
- **Water Heater:** 80-gallon solar with 40 ft² collector
- **Lighting:** 100% CFL fixtures, ENERGY STAR ceiling fans
- **Appliances:** ENERGY STAR dishwasher, clothes washer, refrigerator
- **Solar:** solar ready
- **Water Conservation:** low-flow plumbing fixtures
- **Other:** handicap accessible
- **Electric Car Charging Station:** none

At the request of Executive Director Rosemary Walker, Volusia Habitat builds all of their homes with "aging in place" features. The homes' entrances and driveways have no steps. "You can roll a wheelchair right into the house," said Allnutt. All of the doors are 3 feet wide to accommodate a wheelchair and the house plan with the modified truss is a "split plan," which eliminates the hallway.