

**DOE CHALLENGE HOME
CASE STUDY****Manatee County
Habitat for
Humanity**

Ellenton, FL

**BUILDER PROFILE****Manatee County Habitat for Humanity**

Bradenton, FL

Bruce Winter

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www.manateehabitat.org**FEATURED HOME/DEVELOPMENT:****Project Data:**

- Name: Hope Landing Lot 2
- Location: Ellenton, FL
- Layout: Duplex, 3 bedrooms, 2 baths, 1 floor
- Conditioned Space: 1,143 ft²
- Completion: Nov. 2012
- Climate Zone: 2A

Performance Data:

- HERS Index without solar PV: 53
- HERS Index with solar PV: 23
- Projected annual energy cost savings (compared to a similar home built to Florida code minimum): without PV \$520, with PV \$947
- Projected annual utility costs: without PV \$783, with PV \$356
- PV production revenue: \$427
- Cost over builders standard: with PV \$17,000; without PV \$11,926; without PV or solar water heating \$7,774
- Annual energy savings: without PV 14.8 MMBtu, with PV 26.9 MMBtu

Volunteers with the Manatee County Habitat for Humanity are giving hope to 18 families at the Habitat affiliate's aptly named Hope Landing in Ellenton, Florida, just across the bay from Tampa. They are giving them the hope of homeownership, and hope for homes that are healthy to live in and affordable for the long term.

The Habitat affiliate broke ground on the 18-home community in 2010; all of the homes meet the requirements of ENERGY STAR for Homes Version 3 and three of the homes are certified LEED Platinum through the US Green Building Council's LEED for Homes program (more likely would have certified but were not registered due to costs). Half way through the project, the affiliate heard about the U.S. Department of Energy's Challenge Home program and signed on, committing to build the next home, a three-bedroom, two-bath, 1,143 ft² duplex, to Challenge Home criteria. The home is the first DOE Challenge Home in Manatee County.

Since its founding in 1994, the Manatee County Habitat for Humanity affiliate has always upheld the vision of Habitat for Humanity International—to build simple, low-cost homes by forming working partnerships with low-income families in need of decent housing. For over 15 years Manatee County Habitat for Humanity built wood-framed homes using the most economical products available. This allowed families to buy their homes at low prices but they were not always the most affordable homes to live in on a monthly basis. With the homes at Hope Landing, the affiliate has made a radical departure from the way it had been building homes.

“The start of this new development, Hope Landing, gave us an opportunity to re-think how we wanted to build homes for our low-income families,” said Bruce Winter, construction manager of the affiliate. Working with an architect and a home energy rater, the affiliate set out to design a low-cost home that met three objectives: they wanted to build homes that were more energy efficient, more



DOE Challenge 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 Challenge 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.

The homes were constructed by volunteers with insulated concrete form (ICF) foam block walls that have a steel rebar-reinforced concrete core. The foam blocks stack like bricks to create a hollow wall that is then filled with poured concrete. The foam blocks have 2.5 inches of EPS rigid foam on the inside and the outside, providing exceptional air sealing and insulation value.



CHALLENGE HOME CERTIFIED:

1 BASELINE
certified ENERGY STAR for Homes Version 3.0

2 ENVELOPE
meets or exceeds 2012 IECC levels

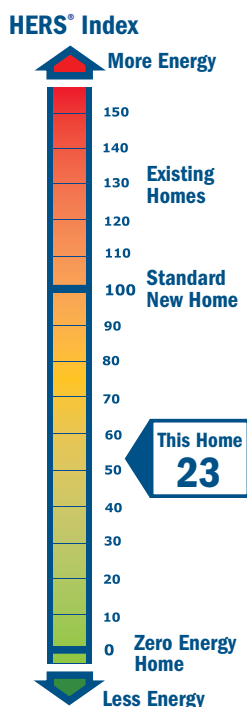
3 DUCT SYSTEM
located with the home's thermal boundary

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.



sustainable, and safer without increasing costs for the families they serve. To make the homes truly affordable they realized they had to be affordable to own and operate, not just to construct.

The team started by reviewing “green home” certification programs to see what new building practices were being recommended. Then they sent letters to their suppliers and subcontractors, explaining that they were taking a new “green” approach to their building methods. “We asked them to bring us their most innovative ideas on how we could improve our homes and then we worked with them to balance cost and benefits to meet an acceptable total construction cost,” said Winter.

The biggest change was to switch from 2x4 stud framed walls to insulated concrete form construction. ICF walls provide an R-23 insulation value, a complete thermal break around the home’s exterior (i.e., there are no studs extending through the wall to provide thermal bridging from the interior to the exterior), and the ICF provides the thermal mass benefits of a concrete wall (it heats up slowly during the day and releases that heat slowly at night). The solid ICF walls provide an exceptionally air-tight wall and they are rated for 200 mph winds, far exceeding the 150 mph rating required by the Florida Building Code. “The ease of construction for the volunteers made this an easy switch in building methods,” said Winter. Choosing ICF construction also gave the project several LEED points.

The decision to use ICF blocks was the catalyst for a change in the affiliate’s design process as well. They determined the wall dimensions of the new homes based on the size of the ICF blocks so that the exterior walls could be built without cutting any ICF blocks in the first or last course of blocks. An open floor plan provided more living space but also cut down on the materials and time involved in interior wall construction. Interior walls were designed using 4-foot or 8-foot dimensions wherever possible to reduce the amount of materials waste and time spent cutting. Two-foot dimensions were used wherever possible when specifying rebar, lumber, wood trim, and siding materials. “These practices have cut our waste by at least 25% over our construction in the past,” said Winter.

To simplify things for the volunteers the house plans show all dimensions working from the home’s outside rear corner. The dimensions are not cumulative but dimensioned from the corner to each opening or wall feature and all dimensions are in full inches. “This keeps our volunteers from having to work with fractions or



The use of ICFs greatly reduced HVAC size. ACCA Manual J calculations showed the 1,143 ft² home needed only a 0.9 ton air conditioner; a wood-framed home would need a 2- or 2.5-ton AC. The affiliate chose a mini-split heat pump with an inverter-driven compressor that can deliver 0.3 to 1.2 ton of cooling at an efficiency of 16 SEER; it can provide heating at an efficiency of 10 HSPF. Although these systems can be wall mounted rather than ducted, Manatee chose to install the heat pump in the insulated attic with supply ducts to the bedrooms and living areas.

add multiple dimensions to get layout locations,” said Winter. Measured layout tapes and story poles are used during construction. All exterior and interior walls are marked out on the concrete slab before construction begins.

For exterior siding, the affiliate chose fiber cement siding rather than the wood or vinyl siding they had used in the past. Fiber cement siding does not expand and contract like wood and vinyl siding and it holds onto paint three to four times longer than wood siding, reducing the overall maintenance costs, according to Winter. It also resists flame spread.

The design team settled on an American Craftsman style with many features of an American Foursquare but constructed as a single-story with a shared wall. (All of the homes are duplexes.) “This gave us many advantages in terms of energy efficiency,” said Karl White, a home energy rater with Energy & Sustainability Consultants, LLC, who donates his time on Habitat projects.

The roof is an all-hipped design with no gables. This design is preferred in hurricane areas because it resists wind uplift, earning homeowners maximum discounts on their insurance (up to 15% savings). The galvanized metal roof offers the same reflective value as white shingles but also provides a 120-mph wind speed rating—much greater than the 60-mph rating for the asphalt shingles they used to use. “Although, the metal roof costs more, it can last the life of the house if taken care of properly, offering considerable savings in replacement costs, not to mention the environmental benefits of reducing materials sent to the landfill,” said Winter, who noted that asphalt shingles last about 15 years in their climate.

Under the metal roofing, the affiliate uses a coated OSB product. They install this on the rafters, tape the seams with a proprietary tape, and install the metal roofing directly over it. Winter noted that the built-in moisture-resistive barrier eliminates felt paper, H-clips, and expensive peel-n-stick underlayment, greatly reducing roofing time and cost.

The affiliate opted for an unvented attic that is insulated along the underside of the roof deck with R-21 of open-cell spray foam, rather than the vented attics with R-30 of blown insulation on the ceiling deck they had used in the past. Unvented attics provide more protection against wind uplift, wind-driven rain, and the entry of humid air in a coastal climate. “Our attic space is normally no more than 10 degrees above the temperature of the home’s living space,”

HOME CERTIFICATIONS:

DOE Challenge Home

ENERGY STAR Version 3

LEED - Platinum

Florida Green Building Council Green Home - Platinum



Every DOE Challenge Home combines building science specified by ENERGY STAR for Homes and advanced technologies and practices from DOE’s Building America research program.

said Winter. The attic is used to house the home's HVAC equipment and ducts, shielding the equipment from the heat and humidity found in vented south Florida attics. The semi-conditioned space also provides valuable storage space for the home owners.

Manatee Habitat upped its window choice from aluminum-framed to a less heat-conductive vinyl-framed window. The ENERGY STAR windows are single-hung, double-pane glass windows with an insulating layer of argon gas between the panes and invisible low-emissivity coatings on the glass that reduce heat loss in the winter and heat gain in the summer. The windows have a high insulating rating with a U-factor of 0.29 and a solar heat gain coefficient of 0.28, indicating that they reduce glare and ultraviolet light transmission. On some homes in the development, Manatee is using windows with an SHGC of 0.22. The windows are rated for 150-mph winds and have metal storm covers with see-through panels; this option costs four times less than impact-rated glass while providing safety in the event of hurricanes, said Winter.

With the shared wall design, the homes only have five windows total — four have 24-inch roof overhangs and one is next to the front door under a large front porch roof. Manatee Habitat selected fiberglass, insulated exterior doors with fiberglass jambs, to minimize rot, warping, denting, scratching, and rust. According to Winter, they hold the paint better than other types of doors. The doors were hung to swing out, which is more secure in high-wind events.

Every bedroom and the main living areas of the home have ENERGY STAR ceiling fans. The homes' refrigerators are ENERGY STAR. All lighting is CFLs. All outdoor lighting is either motion sensor activated or photo-cell operated to reduce operating time.

Water heating is provided by a solar water heating system — a direct circulation drain-back system obtained with assistance from Florida Power and Light. The affiliate switched from contractor-grade plumbing fixtures to energy-efficient fixtures with low water flow rates that meet EPA WaterSense guidelines. Plumbing pipes, which used to be routed through the attic, are now insulated and run beneath the slab for shorter, more direct runs. No plumbing is routed inside exterior walls. Drought-tolerant landscaping and rain barrels for garden irrigation also reduce water use.

The Challenge Home has a 2.5-kW PV system obtained with assistance from Florida Power and Light. All of the homes in the development are solar-energy ready with conduit in place and amply sized electrical panels.

Manatee Habitat has taken several steps to improve indoor air quality: for example, using only low and no-VOC adhesives and caulks, covering HVAC openings during construction, and shearing rather than sawing siding and flooring to minimize sawdust.

KEY FEATURES

- **Path:** performance
- **Walls:** ICF walls, R-23, fiber cement siding
- **Attic:** unvented with open-cell spray foam to R-21 on underside of roof deck
- **Roof:** metal roofing
- **Foundation:** slab on grade, no insulation
- **Windows:** double-pane, argon-filled, vinyl-framed, low-e windows, U=0.29, SHGC=0.28
- **Air Sealing:** 1.02 ACH 50
- **Ventilation:** ducted, dampered fresh air intake to air handler with MERV 8 filter; ENERGY STAR exhaust fans
- **HVAC:** variable-speed mini-split ducted heat pump, 16 SEER, 10 HSPF; air handler and ducts in insulated attic; duct leakage to outdoors 1.2 cfm 25 per 100 ft²
- **Hot Water:** solar thermal direct circulation drain-back solar water heating system with 80-gallon electric tank
- **Lighting:** all CFL bulbs, motion sensor or photo-cell activated
- **Appliances:** ENERGY STAR refrigerator and ceiling fans
- **Solar:** solar water heating plus 2.42 kW PV
- **Water Conservation:** EPA WaterSense-certified plumbing fixtures; drought-tolerant, non-invasive plants; rainwater collection
- **Other:** low- or no-VOC caulks and adhesives; hard-surface flooring; gravel bed around sides of home; no-VOC interior paint