

E2 Homes

Lake Knowles
Winter Park, FL



BUILDER PROFILE

E2 Homes, Maitland, FL
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Rater: Two Trails, Inc.
Drew Smith
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FEATURED HOME/DEVELOPMENT:

Project Data:

- Name: Lake Knowles
- Location: Winter Park, FL
- Layout: 5 bdrm, 4 bath, 2 fl, 3,912 ft²
- Climate Zone: IECC 2A, hot-humid
- Completion: Fall 2015
- Category: custom for buyer

Modeled Performance Data:

- HERS Index: without PV 60, with PV 5
- Projected Annual Energy Costs: without PV \$2,258, with PV \$610
- Projected Annual Energy Cost Savings (vs home built to 2012 IECC): without PV \$1,191, with PV \$2,851
- Projected Annual Energy Savings: without PV 9,925 kWh, with PV 23,764 kWh
- Added Construction Cost: without PV \$0

Zero energy homes come in all shapes and sizes. The U.S. Department of Energy Zero Energy Ready certified home on Lake Knowles in Winter Park, Florida, is a great example of how ultra-modern can also be ultra-efficient. The two-story, 3,912-ft² home should cost its homeowners less than \$50 a month to heat and cool thanks to energy-efficient construction, high-efficiency HVAC, and a 10-kW solar photovoltaic (PV) system. These features helped the home achieve a Home Energy Rating System (HERS) score of 5, making it essentially a zero energy home, or one that produces as much energy as it uses in a year. Typical new homes built to code in the U.S. would score a HERS 80 to 100. Even without the PV included, the efficient home would score a HERS 60 and cut energy bills for its homeowners by one-third (to under \$200 per month) compared to a home built to the Florida state energy code, which is equivalent to the 2012 International Energy Conservation Code.

These savings are especially impressive considering that the modern design dictated that 34% of the structure would be glass, not solid walls. Even the garage doors are glass. The performance is a credit to the builder, Rob Smith, whose company, E2 Homes, has specialized in high-performance custom, luxury homes and remodels in Central Florida since 2005. Smith, a certified licensed general contractor and LEED-accredited professional with a master's degree in environmental studies, also has the distinction of having constructed the first home in the country certified to the U.S. Department of Energy Zero Energy Ready Home program criteria. That home, constructed in Winter Park in 2013, and the Lake Knowles home have both been selected as DOE Housing Innovation Award winners.

To achieve the DOE Zero Energy Ready Home certification, a home must be certified to ENERGY STAR Certified Homes Version 3.0 (3.1 in Florida) and the U.S. Environmental Protection Agency's Indoor airPLUS program.



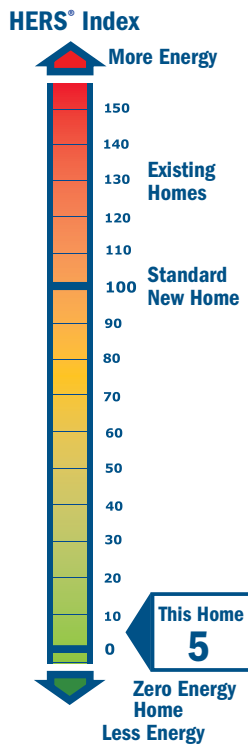
The U.S. Department of Energy invites home builders across the country to meet the extraordinary levels of excellence and quality specified in DOE's Zero Energy Ready Home program (formerly known as Challenge Home). Every DOE Zero Energy Ready Home starts with ENERGY STAR Certified Homes Version 3.0 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.

E2 Homes, LLC, built this 3,912-ft² home in Winter Park, Florida, to the performance criteria of the DOE Zero Energy Ready Home (ZERH) program. For extra energy savings, this home has ENERGY STAR-rated appliances and LED lighting.



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 must meet 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 installation of solar panels.

The Lake Knowles home was recently certified as LEED for Homes Platinum by the U.S. Green Building Council and certified at the gold level by the Florida Green Building Coalition.

While the home buyers were passionate about energy-efficient construction (and that is one of the reasons they sought out E2 Homes), aesthetics were also very important. "The homeowners had a very clear vision of how they would live in the house and how they wanted the house to open up to the neighborhood," said Smith. They wanted the main living area of the home to let in as much light as possible while taking full advantage of views of the lake across the street from the front yard and the pool in the back. Michael Wenrich Architects designed the home to include the entry, living room, dining area, and kitchen in one large, open primary space measuring 44 x 34 x 17.5 feet while a second, more private space behind and above the garage contains the five bedrooms and four bathrooms. The home itself is composed mainly of glass and concrete with exterior wall surfaces of white stucco and grey concrete created with a board-formed surface to provide texture. Patio floors are tile while the inside floors are highly polished concrete. Many of the inside wall surfaces are also board-formed concrete, while cypress tongue-and-groove ceilings warm up both interior and exterior spaces. An open, cantilevered steel-and-wood staircase "floats" up along the main interior wall to the second-story interior balcony and bedrooms beyond. The home fills most of the small infill lot in this established neighborhood, leaving just enough space for outdoor seating areas with custom-built fire pits, a pool in the private walled backyard, and a front yard with patio and lake views. The low-maintenance, low-water use, turf-free yard consists of stones, concrete pavers, and native plants that complement the simplicity of the home.

It was up to Smith to turn this modern marvel into an energy power house. The concrete block walls were reinforced with rebar and connected with steel support beams and steel ceiling joists to provide strength for the structure. The exterior walls were clad with rigid foam and also utilized an air space and foil-paper insulating sheeting to achieve efficient wall insulation levels.



This home meets the EPA Indoor airPLUS requirements by using low-VOC paints and finishes. A timer controlled fresh air intake provides ventilation for improved air quality in the home. The double-pane windows have nearly invisible low-emissivity coatings to minimize heat transfer.

The uninsulated slab-on-grade foundation consists of a 4-inch-thick concrete slab that was stained and polished to provide a durable interior flooring surface. The floor slab, together with the concrete walls, provides considerable thermal mass to the home, which helps balance the day-night temperature fluctuations contributed by solar heat gain.

Solar heat gain is also minimized by the white stucco exterior walls and the white thermoplastic polyolefin (TPO) roof membrane, which covers the flat roof. The vaulted ceiling is insulated with R-21 of open-cell spray foam insulation.

The home's expansive windows and sliding doors contain two layers of insulated coated glass with an overall U-factor of 0.26 and a solar heat gain coefficient (SHGC) of 0.27. The low-emissivity (Low-E) coating consists of an extremely thin, practically invisible, layer of silver metal that minimizes heat transmission through the glass to reduce solar heat gain.

Like all DOE Zero Energy Ready homes, the house was inspected by an energy rater, who conducted energy analyses and testing, including a whole-house blower door test, which showed that the home had total air leakage of 2.11 air changes per hour at 50 Pascals pressure difference (within the 3 ACH 50 maximum required by the 2015 IECC). For ventilation, the home was equipped with a thermostat-controlled fresh air damper to regulate the air intake and provide the fresh filtered air that was distributed by the home's HVAC system.

The home's heating and cooling system consists of a geothermal heat pump, with an energy-efficiency ratio (EER) of 26.71. The Lake Knowles home used an open-loop system that pulled well water into the geothermal heat exchanger, before returning water back into the ground. The geothermal heat pump also preheats the domestic hot water.

The home's water heating is provided by a hybrid heat pump. The system looks like a tall electric water heating tank but pulls heat from the room it is located in for very energy-efficient operation. This heating method has the beneficial side effect of cooling and dehumidifying the room in which the water heater is located, in this case, the garage. Although these units are more expensive than a traditional water heater (from \$600-\$1,200 more depending on unit size), they are two to three times more energy efficient, saving families an average of \$300 per year.

HOME CERTIFICATIONS

DOE Zero Energy Ready Home Program

ENERGY STAR Certified Homes
Version 3.1

EPA Indoor airPLUS

LEED for Homes

Florida Green Building Coalition (FGBC)
Green Home Standard



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.



An ultra-efficient geothermal heat pump provides for the home's heating and cooling needs and also preheats water for the heat pump water heater.

finishes, and cabinetry; good moisture management practices to reduce the opportunities for mold; and pest control practices.

Although Smith didn't have to market the custom home because it already had an owner, he did use the construction as an opportunity to educate the public about zero energy construction. E2 Homes shared their progress on social media sites such as Facebook, Instagram, and Houzz, and hosted a USGBC tour during construction. "We are listeners, thinkers, and creators, and our homes represent a distinct vision with our commitment to smart construction," Smith said. As with every high-performance home they construct, E2 Homes provided the homeowner with a manual of all of the specifications and product warranties for the job. "E2 Homes is committed to high-performance construction to deliver whole-house energy savings and help protect the environment," said Smith. "Better insulation; high-efficiency water heating, appliances, and lighting; improved mechanical systems; airtight building envelope construction techniques—all of these features together give our clients lower electric bills and improved comfort."

E2 Homes is not only building smart custom homes in Central Florida but it is helping to give back to the local community as well. E2 has built several Habitat for Humanity homes during professional Builder Blitz events that have also received LEED designations. In addition to helping Habitat for Humanity, they are currently building the Emeril Lagasse Foundation Culinary Garden and Teaching Kitchen for the Edible Education Experience and helping out some locally founded 501(c)(3)'s such as the Africa Windmill Project (AWP) and Rebuild Globally. These organizations each share Smith's desire to build sustainably. "Whether it is building a work force, a windmill, a family, or a custom home, in today's age it needs to be built smartly and sustainably," said Smith.

Photos courtesy of E2 Homes

For added energy savings, all of the lighting in the home is provided by advanced LED lights. All of the home's appliances are high-end energy-efficient models, including the ENERGY STAR refrigerator and dishwasher. Highly efficient plumbing fixtures were used for water savings. The home was also equipped with an internet-connected energy monitoring system. Smith also installed "self-learning" ceiling fans that turn on when someone enters the room.

The home meets all of the requirements of the EPA's Indoor airPLUS program, including use of low- and no-VOC paints,

KEY FEATURES

- **DOE Zero Energy Ready Home Path:** Performance.
- **Walls:** R-19 concrete block walls.
- **Roof:** Thermoplastic polyolefin roof membrane.
- **Attic:** Spray foam R-21.
- **Foundation:** Slab-on-grade.
- **Windows:** Low-e windows and sliders, U=0.26, SHGC=0.27.
- **Air Sealing:** 2.11 ACH 50.
- **Ventilation:** Timer-controlled exhaust fans and controlled fresh air intake.
- **HVAC:** Geothermal heat pump, 26.71 EER.
- **Hot Water:** Hybrid heat pump hot water, with geothermal heat recovery/preheat.
- **Lighting:** LEDs.
- **Appliances:** ENERGY STAR refrigerator, dishwasher.
- **Solar:** 10-kW PV, wired for more.
- **Water Conservation:** WaterSense low-flow fixtures, high-efficiency irrigation.
- **Energy Management System:** Web-based energy monitoring.
- **Other:** Low-VOC paint.