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

DOE ZERO ENERGY READY HOME™

U.S. DOE ZERO ENERGY READY HOME 2015 WINNER Housing Innovation Awards

Sunroc Builders

Bates Avenue
Lakeland, FL

BUILDER PROFILE

Sunroc Builders, LLC, Lakeland, FL
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Rater: Calcs-Plus
Jeremy Gary, j.gary@calcs-plus.com

FEATURED HOME/DEVELOPMENT:

Project Data:

- Name: Bates Avenue
- Location: Haven, FL
- Layout: 3 bedrooms, 2 baths, 1 floor
- Conditioned Space: 1,104 ft^2
- Climate Zone: IECC 2A, hot-humid
- Completion: May 2015
- Category: Affordable

Modeled Performance Data:

- HERS Index: without PV 57
- Projected Annual Utility Costs: without PV $870
- Projected Annual Energy Cost Savings (compared to a home built to the 2009 IECC): without PV $502
- Builder's Added Cost Over 2009 IECC: without PV $11,000
- Annual Energy Savings: without PV 4,364 kWh

A desire to give his tenants lower utility costs prompted Scott Willemsen to found Sunroc Builders, a Lakeland, Florida, based construction company dedicated to building affordable homes that meet the energy efficiency requirements of the U.S. Department of Energy's Zero Energy Ready Home program.

Over time, Willemsen had purchased several small 1970s and 80s-era homes as rental properties. Although the rents were low, high utility bills were making the homes unaffordable for his tenants. "I was hearing a lot of complaints about their electric bills," said Willemsen. Tenants were paying $200 to $300 a month for electricity, while they had friends who lived in homes twice as large and were paying less. Willemsen decided it was to start replacing the homes he had with new, efficient homes.

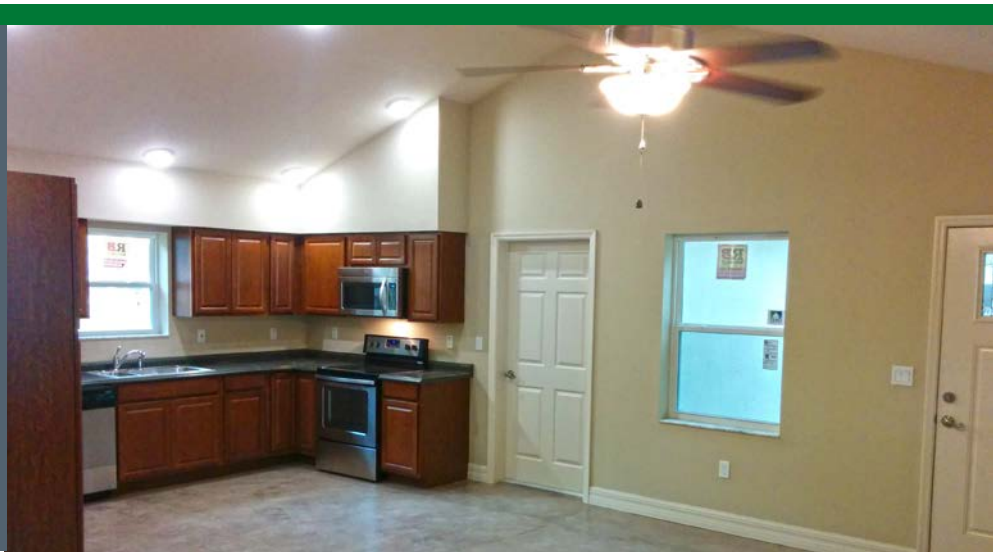
When Willemsen began researching construction methods to replace his inefficient homes, he discovered structural insulated panels (SIPs). Further research in SIPs construction led to Ted Clifton of Zero-Energy Home Plans. Clifton told Willemsen about the DOE Zero Energy Ready Home program and designed Sunroc Builders' first DOE Zero Energy Ready qualifying home, a 2015 Housing Innovation Award winner.

Willemsen built the 1,104-ft^2 home on Bates Avenue using SIPs because he was convinced that SIPs were the best way to build an energy-efficient home. The home achieved a Home Energy Rating System (HERS) score of 57 without roof-mounted solar panels. A standard new home would score a HERS 100. The home's utility bills come to an average of $73 per month, for a savings of $500 annually. The home also meets all of the requirements of the DOE Zero Energy Ready Home program.

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.

At 1,104-ft², this home constructed by Sunroc Builders in Lakeland, Florida, has a small physical footprint. It has a small carbon footprint as well because it meets all of the requirements of the U.S. Department of Energy Zero Energy Ready Home program.



What makes a home a DOE ZERO ENERGY READY HOME?

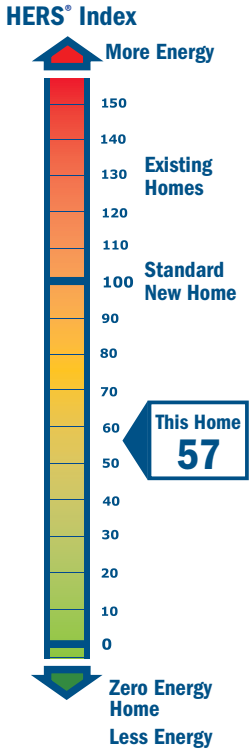
1 **BASELINE**
ENERGY STAR Certified Homes Version 3.0

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 DOE Zero Energy Ready Home program requires homes to meet all of the requirements of ENERGY STAR Certified Homes Version 3.0 and the U.S. Environmental Protection Agency's Indoor airPLUS, as well as 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 it.

The Sunroc Builders home was built on a monolithic concrete slab that was raised above the natural grade surrounding the house to allow for water to drain away from the home. The slab was poured over a 6-mil polyethylene sheet that was taped and sealed at all joints and penetrations to provide a continuous vapor barrier. A termite treatment was applied under the slab prior to pouring the concrete and a perimeter termite treatment was applied after construction. Willemsen's energy rater recommended not insulating the slab to allow heat to transfer to the ground in this central Florida location, based on heat load calculations. Along the perimeters of the slab, the builder installed foam sill gasket, then an 8-inch strip of treated plywood was laid down. Two beads of SIP sealing adhesive were applied to the plywood then the 2x6 sill plates were laid down. Then, more SIP seal adhesive was applied before installing the SIP walls.

For the walls of the home, Sunroc Builders used 6 ½ inch SIPs having an insulation value of R-26. The SIP walls consist of two layers of 7/16-inch OSB sandwiching a 5 ⅝ inch-thick layer of expanded polystyrene (EPS) foam board. The EPS foam layer is the same width as the 2x6 bottom plate and stops about 1½ inches in from the OSB, allowing the SIP panel to fit snugly over the 2x6 bottom plate to form a tight seal. Where the SIPs fit together, a two-part expanding foam was applied to reduce air leaks. When tested with a blower door, the home showed exceptional air tightness of 0.84 air changes per hour at 50 Pascals pressure (ACH 50). "SIP walls really make it easy to do a tight envelope," said Willemsen.

On the interior of the home, drywall was applied directly to the SIPs. On the exterior, the SIPs were covered with house wrap, then a 1/8-inch channeled rain screen product, then stucco lath with a weather barrier, then three-coat stucco.

The home was constructed with 6.5-inch-thick (R-26) SIP wall panels and 8.25-inch (R-34) roof panels. The panel's inner core of foam provides a nearly continuous thermal layer around the home. The solid panels with their interlocking glued joints also form a solid air barrier around the home.

The home's roof was constructed of 8¼ inch SIPs, providing an insulation value of R-34. All of the SIP splines (connectors) were drilled and filled with two-part expanding foam and the ridge gap was filled with two-part expanding foam as well. The roof was topped with 30# felt and ENERGY STAR-rated asphalt shingles. The home was designed to withstand 140-mph winds and additional hurricane straps were embedded in the concrete at the corners and gables.

Willemsen considered a ductless mini-split heat pump but an engineering firm recommended a standard split system heat pump because of concerns about high humidity levels and the resulting risk of building failure if indoor moisture levels became too high. Sunroc installed a 1.5-ton heat pump with a seasonal energy efficiency ratio (SEER) of 15.

To help ensure healthy indoor air quality, Willemsen installed a fresh air ventilation system consisting of a fresh air intake that brings outside air in to the return side of the central air handler fan, which has a high-filtration MERV 11 filter. ENERGY STAR-rated exhaust fans were installed in the bathrooms. To further ensure air quality, Sunroc used only low-VOC paints and cabinets and countertops were certified by the KCMA Environmental Stewardship Council.

A heat pump water heater was installed in the home's laundry room. It is centrally located within 15 feet of the farthest water fixture. Although it is close to water uses, Willemsen's HERS rater recommended installing the heat pump water heater in the garage in future homes because 1) there is more hot air in the garage, 2) it cools the garage, and 3) it is noisy. The heat pump water heater has an energy factor of 2.75. For water efficiency, the home's toilets and fixtures are EPA WaterSense rated. To reduce water use outdoors, Willemsen did not install an irrigation system. Instead he selected Florida-friendly landscaping including drought-tolerant grasses and used pine straw to mulch beds.

The home's two ceiling fans, refrigerator and dishwasher are ENERGY STAR-rated for further energy savings. All of the home's lighting is energy efficient; 40% is LED based and 60% is CFL based.

HOME CERTIFICATIONS

DOE Zero Energy Ready Home Program, 100% commitment

ENERGY STAR Certified Homes Version 3.0

EPA Indoor airPLUS

ENERGY STAR

Building AMERICA U.S. Department of Energy

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.

A heat pump water heater provides the home's domestic hot water.

The builder installed energy-efficient, double-pane, vinyl-framed windows. The window glass has a special low-emissivity clear metal coating that minimizes heat transfer and an argon gas fill between the panes that adds insulation value to the windows. The windows have an insulation value of U-0.30 and a solar heat gain coefficient of 0.22. Due to the home's orientation on the narrow, north-south lot, only one window was installed on the south side of the house. It is under a 10-ftx10-ft porch roof, which provides ample shade to reduce solar heat gain.

The builder incorporated universal design features into the home including large doorways, no-step entries, a roll-in shower, rocker switches, and Americans with Disabilities Act (ADA)-approved faucets. The home's concrete slab was stained and sealed to provide the finished flooring within the home. This hard, low-maintenance surface is easy to clean and impervious to water damage. The SIP roof panels provided insulated vaulted ceilings, which give the home a spacious feel despite the small footprint.

This was Sunroc Builders' first DOE Zero Energy Ready home, and it was a learning experience for Willemsen. Although Willemsen still thinks SIPs are a good idea, he has chosen to use foam-filled concrete block for his next home, because he encountered pushback from home buyers, contractors, and even building inspectors who were unfamiliar with SIPs. Even so, with the expertise of an experienced zero energy home designer, SIP engineer, HVAC designer, and energy rater, Willemsen was able to turn out an award-winning home and felt that building to the DOE Zero Energy Ready Home program specifications was a positive experience.

"I would definitely recommend this program to other builders. As a consumer, I know I would want the third-party verification. I researched other labeling programs but the DOE program gave the most bang for the buck. It has everything the other programs have and more, at a lower cost" said Willemsen. These are savings the builder can pass on to his low-income home buyers along with the energy savings, which they will enjoy for years to come.

Photos courtesy of Sunroc Builders

KEY FEATURES

- **DOE Zero Energy Ready Home Path:** Performance.
- **Walls:** 6.5″ SIPs (R-26); 2-part foam-filled splines; 1/8″ channeled rain screen; stucco lath; 3-coat stucco.
- **Roof:** ENERGY STAR-rated asphalt shingles; 30# felt.
- **Attic:** 8.25″ SIPs; 2-part foam filled splines.
- **Foundation:** Slab on grade over 6-mil poly; SIP adhesive caulk; sealed 2x6 sill plate; 8″ treated plywood on sill; no slab insulation.
- **Windows:** Double-pane; argon-filled; vinyl-framed; low-e; U=0.30; SHGC= 0.22.
- **Air Sealing:** 0.84 ACH 50.
- **Ventilation:** Dampered fresh air intake; timed bath fans.
- **HVAC:** Ducted air-source heat pump; 16 SEER.
- **Hot Water:** Heat pump water heater.
- **Lighting:** 40% LED, 60% CFL.
- **Appliances:** ENERGY STAR-rated refrigerator, dishwasher, and ceiling fans.
- **Solar:** None.
- **Water Conservation:** All EPA WaterSense-rated fixtures; hot water heater within 15' of fixtures; drought-tolerant plants; no irrigation.
- **Other:** Certified cabinets; low-VOC.

PNNL-SA-113535, September 2015