



Building America Case Study

Southern Energy Homes, First DOE Zero Energy Ready Manufactured Home

Russellville, Alabama

PROJECT INFORMATION

Project Name: First DOE Zero Energy Ready Manufactured Home

Location: Russellville, AL

Partners:

Southern Energy Homes, sehomes.com

ARIES, levypartnership.com

Building Component: Whole building

Application: New construction;
single-family

Applicable Climate Zone: Mixed-humid,
3A

PERFORMANCE DATA

Home Energy Rating System (HERS)
Index: 57

Projected annual utility costs: \$799

Projected annual energy cost savings
compared to 2009 IECC: \$372

Builder's added cost over HUD Code:
\$2,502

Annual energy savings: 4,658 kWh

The country's first Zero Energy Ready manufactured home that is certified by the U.S. Department of Energy (DOE) is up and running in Russellville, Alabama. The manufactured home was built by a partnership between Southern Energy Homes and the Advanced Residential Integrated Energy Solutions Collaborative (ARIES), which is a DOE Building America team. The effort was part of a three-home study including a standard-code manufactured home and an ENERGY STAR® manufactured home. Cooling-season results showed that the building used half the space-conditioning energy of a manufactured home built to the U.S. Department of Housing and Urban Development's (HUD's) Manufactured Home Construction and Safety Standards. These standards are known collectively as the HUD Code, which is the building standard for all U.S. manufactured housing.

This home meets all of the requirements to qualify as a DOE Zero Energy Ready Home (ZERH)—the high-performance home labeling program that includes all of the requirements of ENERGY STAR Certified Homes Version 3.0. The home also meets the requirements of the U.S. Environmental Protection Agency's (EPA's) Indoor airPLUS program and the hot water distribution requirements of the EPA WaterSense program. The DOE ZERH program also requires homes to meet the insulation requirements of the 2012 International Energy Conservation Code (IECC).

The home and the study have gained the attention of the manufactured housing industry; factory building organizations across the nation have run articles in their publications describing the home and its advances. Articles have also run in industry press such as *Builder* magazine (July 28, 2014). David Brewer is the general manager for Southern Energy Homes; he was impressed by the results of the study. "We're excited about the project," he said. "It will be highly marketable."

Key Features

Walls: 2×4 16-in. on center, R-13 unfaced fiberglass batt, 1-in. (R-5) extruded polystyrene (XPS) rigid foam with taped seams, no house wrap

Roof: R-45 blown fiberglass that is dense packed at eaves

Foundation: Open crawlspace with ventilated skirting, R-28 blanket fiberglass under-floor joists

Windows: Double-pane, low-E, argon-filled, U = 0.30, SHGC = 0.23

Air Sealing: 3.85 air changes per hour at 50 pascals

Ventilation: Exhaust, continuous

HVAC: A single, mini-split, wall-mounted, ductless heat pump (SEER: 22; HSPF: 12); thermostat-controlled in-wall fans transfer heat to bedrooms

Hot Water: Electric storage tank: 30 gal; energy factor: 0.93

Lighting: 100% compact fluorescent lamps

Appliances: All ENERGY STAR-rated appliances

Certifications

- ENERGY STAR Certified Homes Version 3.0
- DOE ZERH
- EPA Indoor airPLUS .



Blown fiberglass is dense packed into the roof eaves using a removable baffle

For more information see the Building America report *Field Evaluation of Advances in Energy-Efficiency Practices for Manufactured Homes* at buildingamerica.gov.

Image credit: All images were created by the ARIES team.



The continuous layer of rigid foam provides insulating, air sealing, and drainage plane in one step, which eliminates the need for house wrap and takes the place of a separate, weather-resistant barrier.

Continuous Insulation

One of the biggest differences in the construction of the home was the addition of rigid foam exterior sheathing. In addition to installing R-13 unfaced fiberglass batt insulation in the wall cavities, the exterior of the walls was covered with a 1-in. layer of XPS rigid foam insulation sheathing, which was attached to the studs with fasteners and adhesive.

When carefully taped, the rigid foam takes the place of house wrap as a drainage plane for any rainwater that might get behind the siding or around the windows. Thus, the insulated taped sheathing provides a continuous air barrier, thermal barrier, and drainage plane. Combining all three functions in one application saves the manufacturer considerable production time and costs while greatly improving the performance of the walls.

High-Efficiency HVAC

This certified DOE ZERH uses a new heating, ventilating, and air-conditioning (HVAC) design that keeps the HVAC equipment completely within the home's conditioned space. The home is equipped with a super-high efficiency, mini-split heat pump that has a seasonal energy efficiency ratio (SEER) of 22 and a heating seasonal performance factor (HSPF) of 12. To move the conditioned air to the bedrooms, each bedroom has a small fan mounted in the wall to pull the air through the wall. Door undercuts and transfer grilles in the bottoms of some doors provide a path for air to return from the bedrooms to the return side of the wall-mounted heat pump.