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

DOE ZERO ENERGY READY HOME™

U.S. DOE ZERO ENERGY READY HOME 2016 WINNER *Housing Innovation Awards*

DP Construction

Choctaw Ridge
Prattville, AL

BUILDER PROFILE

DP Construction, Prattville, AL
Dow Perry, perryd86@gmail.com
334-730-2662, https://www.facebook.com/DPConstruction
Rater: Newport Builders, LLC
Marshall Newport
marshall.newport@gmail.com

FEATURED HOME/DEVELOPMENT:

Project Data:

- Name: Choctaw Ridge
- Location: Prattville, AL
- Layout: 3 bdrm, 2 bath, 1.5 fl, 1,664 ft²
- Climate Zone: IECC 3A, hot-humid
- Completion: December 2015
- Category: custom for buyer

Modeled Performance Data:

- HERS Index: without PV 57
- Projected Annual Energy Costs: without PV $995
- Projected Annual Energy Cost Savings (vs home built to 2009 IECC): without PV $578
- Projected Annual Energy Savings: without PV 8,096 kWh
- Added Construction Cost: $2.60/ft²

Builder Dow Perry builds three to five custom homes a year in and around Prattville, Alabama, in styles ranging from colonial to craftsman to French country to cottage. While the design styles change, Perry wants them all to be energy efficient. When a buyer approached Perry asking for a modern minimalist structure with high ceilings and a wall of windows to take in views of the wooded lot, Perry gave them what they wanted, knowing that he could turn the simple rectangular shape, cathedral ceilings, and wall of south-facing windows into a very efficient house. In this case, the 1.5-story, 1,664-ft² home, located in Prattville, Alabama, was efficient enough to earn the builder a second Housing Innovation Award from the U.S. Department of Energy.

The house was constructed to the high performance requirements of the DOE Zero Energy Ready Home program. Perry won his first Housing Innovation Award, also in 2016, for a custom spec home constructed at the Pebble Creek development in Prattville. That home also had the distinction of being the first home in Alabama to be certified as a DOE Zero Energy Ready home. Every home certified to the program criteria must meet ENERGY STAR Certified Homes Version 3.0 and the U.S. Environmental Protection Agency's Indoor airPLUS program. Each 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.

While the award-winning home at Chocktaw Ridge does not have solar panels installed, they could easily be added and the home's large shed roof, although slightly angled toward the north, should receive plenty of solar radiation to make photovoltaics worthwhile should the home owner decide to install them in the future.

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.

DP Construction built this 1,664-ft² home in Prattville, Alabama, to the performance criteria of the DOE's Zero Energy Ready Home (ZERH) program. Advanced framing techniques used less wood and provided more space to fill the walls with spray foam insulation.

What makes a home a DOE ZERO ENERGY READY HOME?

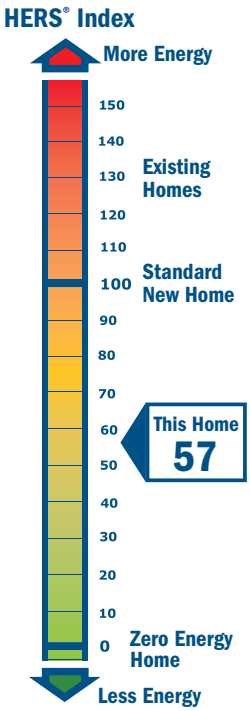
1 **BASELINE**
ENERGY STAR Certified Homes Version 3.0

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.

Even without PV, the home achieved a Home Energy Rating System (HERS) score of 57. A typical new home built to code would score a HERS 80 to 100. The efficient home should cut energy bills by nearly $600 compared to a home built to the state's energy code, which is equivalent to the 2009 International Energy Conservation Code. Perry calculated that the home should have average yearly energy bills of $955, or about $80 per month. Perry estimated added costs of about $2.60/ft² to construct this home to DOE Zero Energy Ready Home standards versus constructing to the state's energy code.

The home is a large rectangle in shape, with a 17-ft-tall south-facing wall covered with 14 windows plus French doors for 342 ft² of south-facing glazing. The home has only two north-facing windows, one west-facing window, and no east-facing windows. Sunlight pours through the south-facing windows filling the open space along the south wall where the kitchen, dining, and living areas are located. This open area has vaulted ceilings allowing the bedrooms and bathrooms along the back of the home to receive southern daylight through interior windows. Overhangs around the outside of the home provide protection for the home's exterior walls and shading from high overhead summer sun.

All of the windows are double pane with low-emissivity coatings on the glass to reduce heat transmission and an argon gas fill between the panes to increase the insulation value. The windows allow in sunlight that provides passive heating by warming the concrete floor slab, which is sealed and stained to provide the home's finished flooring surface. The slab was poured over a 6-mil vapor barrier laid over compacted soil and was not insulated as slab insulation is not required by code.

The walls, however, are heavily insulated. The home's walls consist of 2x6 wood framing on the south side and 2x4 framing on the other sides; advanced framing features were used including California corners and single-member headers over doors and windows to allow more space for insulation. The walls were sheathed with 7/16-inch OSB and the wall cavities were filled with 3.5 inches of open-cell spray foam. Over the sheathing, the builder installed standard house wrap and 2x2 pressure-treated furring strips. He then applied 1 inch of soy-based closed-cell spray foam over the house wrap and battens, which left a drainage gap of about a half inch behind the siding. Most of the home was sided with standing-seam metal while a small portion was covered with rough-cut stained cypress. All of these components together provided a wall insulation value of a little over R-22.

The home was insulated above the roof deck. After installing ice-and-water shield over the entire decking, the builder installed 1x4 purlins, which were set off from the decking using 6-inch sections of PVC pipe that were set upright. The purlins were screwed to the decking using very long screws that extended through the PVC sleeves. This provided space to install 5.5 inches (R-38.5) of closed-cell soy spray foam over the roof decking under the standing seam metal roof.

The home owner requested a stained wood ceiling with exposed rafters on the inside of the home. Perry set the rafters in place then installed the half-inch pine plywood over the rafters with the sanded and stained side facing down to serve as the decking. He laid ice-and-water shield over the entire decking then installed 1x4 purlins. The purlins were installed over 6-inch sections of PVC pipe that were set upright. Using very long screws, Perry screwed through the purlins, through the PVC sleeves, through the decking, and into the rafters to secure the purlins so that they would be a sturdy base for the roofing. Offsetting the purlins with the PVC provided space to install 5.5 inches (R-38.5) of closed-cell soy spray foam over the roof decking under the standing seam metal roofing. The spray foam for the roof decking and the exterior coating over the wall sheathing were installed together to provide a seamless thermal layer over the entire exterior of the home.

Perry noted that, with the metal siding and roofing that were pre-cut at the factory and the use of concrete flooring, there was so little construction debris on the site that they didn't even have a dumpster delivered. Anything not reused was hauled off in a small trailer.

Like all DOE Zero Energy Ready certified homes, the home was tested by an energy rater for whole-house air leakage. Spray foaming the structure helped the builder achieve a whole-house air leakage rate of only 2.2 air changes per hour at 50 Pascals, meeting even the 3 ACH 50 limit specified in the 2015 International Energy Conservation Code for climate zone 3.

To provide good ventilation for the home, an energy recovery ventilator (ERV) was installed and set for continuous operation at 56 cfm of airflow. The ERV brings in fresh air from an outside air intake and exhausts stale air. The fresh air and stale air ducts pass through a heat exchanger in the ERV where heat is transferred from the warmer stream to the colder stream so the incoming air is warmed in the winter and cooled in the summer.

The ERV also helps to circulate conditioned air from the high-performance ductless mini-split heat pumps, which heat and cool the efficient home. The home's open interior is also ideal for the use of these ductless wall-mounted units. Perry installed one 9,000-Btu unit in the master bedroom, which is located in the back of the house, and one 18,000-Btu unit in the living room. Both are connected to a 24,000-Btu outdoor compressor. The system provides cooling with a seasonal energy efficiency rating (SEER) of 21.7, well above the SEER

HOME CERTIFICATIONS

DOE Zero Energy Ready Home Program

ENERGY STAR Certified Homes Version 3.0

EPA Indoor airPLUS

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.

The stained concrete flooring is durable and moisture resistant. The floor's thermal mass serves as a heat sink to help moderate indoor temperatures.

14 required by the 2015 federal standards. The indoor air handler units are individually controlled to provide zoned heating and cooling.

Most standard central furnaces and cooling systems have one-speed motors that are on or off, resulting in high temperature swings between cycles. Because mini-split heat pumps have variable-speed compressors and fans, they can better match low cooling or heating load conditions, thus increasing their efficiency. "These mini-split systems are ideal for the low heating and cooling loads of very energy-efficient homes," said Perry.

The home's hot water is provided by a 50-gallon heat pump water heater. The ENERGY STAR qualified unit has an efficiency rating of 2.40. The water heater is centrally located in a laundry room in the home. All of the faucets meet EPA WaterSense standards for water efficiency.

To further reduce energy demand, all of the home's lighting is provided by LEDs and the home is equipped with ENERGY STAR-qualified appliances. The bathrooms are also equipped with ENERGY STAR-rated exhaust fans that are activated by humidity sensors.

To promote better indoor air quality, the home complies with the EPA's Indoor airPLUS program. All of the stains, paints, and cabinets in the home are low- or no-VOC products.

Perry has participated in ENERGY STAR and Alabama Power Company's Earth Cents program. He said he likes the DOE Zero Energy Ready Home program because "it is pushing the envelope and the market towards more efficient construction."

Photos courtesy of DP Construction

KEY FEATURES

- **DOE Zero Energy Ready Home Path:** Performance.
- **Walls:** R-22: 2x4 and 2x6, advanced framed; 3.5″ open-cell spray foam in cavities, 7/16 OSB, house wrap, 2x2 batten rainscreen, 1″ closed-cell soy spray foam over battens, metal and cypress siding.
- **Roof:** Cathedral ceilings with exposed pine decking. Full ice-and-water shield over decking, 1x4 purlins screwed over 6″ PVC sleeves, 5.5″ R-38.5, closed-cell soy spray foam over roof and walls.
- **Attic:** None.
- **Foundation:** Uninsulated monolithic slab-on-grade.
- **Windows:** Double-pane, low-e, argon-fill, SHGC=0.29, U=0.32.
- **Air Sealing:** 2.2 ACH 50.
- **Ventilation:** ERV.
- **HVAC:** Ductless mini-split heat pump - two indoor air handlers, one outdoor compressor, 21.7 SEER.
- **Hot Water:** Heat pump water heater.
- **Lighting:** 100% LED.
- **Appliances:** ENERGY STAR refrigerator, dishwasher, clothes washer, dryer.
- **Solar:** Pre-wired for solar.
- **Water Conservation:** All WaterSense faucets.
- **Energy Management System:** None.
- **Other:** Low-VOC paints and stains.

PNNL-SA-123521, December 2016