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.
DOE ZERO ENERGY READY HOME  DP Construction

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

While packed with high-performance features, the home does look like most homes in the neighborhood with the same tan brick siding and traditional accents. Perry said the only difference people might notice is that the walls are thicker. Perry’s DP Construction company built the wood-framed walls with 2x6 studs rather than the 2x4 framing typical of local construction. They employed several advanced framing techniques to reduce the amount of lumber used and to make more room in the walls for insulation. In standard construction, the space at the corners, where interior walls meet exterior walls and over doors and windows is often constructed in such a way that the framing lumber boxes off uninsulated empty space or the space is filled with solid framing that is costly and leaves no room for insulation. DP Construction installed California corners, which are three-stud corners with one stud turned to allow space for insulation all the way into the corner and ladder blocking where interior walls intercept exterior walls, which allows space for insulation. Over windows and doors, rather than installing three solid 2x8s or 2x10s, they installed one set flush with the outside edge of the wall, which provides adequate structural strength while still leaving 3.5 inches of room for insulation.

The 5.5-inch wall cavities were filled with open-cell spray foam for an R-20 cavity insulation value. The walls were sheathed with ¾-inch OSB. Then another 1.5 inches of closed-cell soy-based spray foam was sprayed over this to provide an additional R-11 of insulation. A ¾-inch air gap separated the foam from the brick veneer. This closed-cell foam layer “creates a shell that truly protects the home from water, vapor, air, and thermal loss and gains while also adding some structural strength,” noted Perry.

The home’s unvented attic is also insulated with spray foam, with 11 inches (R-42) of open-cell spray foam filling the 2x6 rafter bays and completely covering the rafters to prevent any thermal bridging. The vaulted ceiling in the bonus room is filled with 5.5 inches (R-41) of soy-based closed-cell spray foam. The roof is sheathed with ¾-inch OSB, topped with roofing felt and fiberglass shingles.

The home is built on a raised slab-on-grade foundation. The slab was poured over a 6-mil vapor barrier laid over compacted soil and is uninsulated as slab insulation is not required by code.

Double-pane, vinyl-framed high-efficiency windows with heat-blocking low-emissivity coatings complete the thermal envelope of the home.
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 1.4 air changes per hour at 50 Pascals, well below the 3 ACH 50 permitted by the 2015 International Energy Conservation Code in climate zone 3. The home has code-compliant ventilation provided by ENERGY STAR-rated exhaust fans that are activated by humidity sensors in the bathrooms.

The builder specified high-performance ductless mini-split heat pumps for heating and cooling because of the efficient home’s low heating and cooling loads. His DOE Zero Energy Ready home has a heating load of 36,000 Btu/h and a cooling load of 32,000 Btu/h. 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 system has one exterior unit and four interior units which are mounted on walls in the master bedroom, above the front door, at the top of the stairs, and above the window in the bonus room. The system provides cooling with a seasonal energy efficiency rating (SEER) of 18.4 and a heating season performance factor (HSPF) of 8.7, above the SEER 14 and HSPF 8.2 required by the 2015 federal standards. The ductless units are individually controlled to provide zoned heating and cooling.

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. To reduce hot water demand in the home, the plumbing system is equipped with a recirculating pump that is push-button activated at the kitchen and master bathroom sinks to speed hot water to the faucets.

To further reduce energy demand, the home is equipped with energy-efficient CFL and LED lighting. ENERGY STAR-qualified appliances include the dishwasher and refrigerator.

In keeping with the requirements of the DOE Zero Energy Ready Home program, the home is pre-wired for solar photovoltaic panel installation. Perry selected a lot in the established neighborhood that allowed the long side of the house to face south. The home has more than enough south-facing roof area to house a solar PV system that can reduce the annual power bill to $0.
This was the first home built on spec for Perry who has been in business in Alabama since 2010 constructing 3 to 5 custom presold homes per year. The home took a little longer to sell than he anticipated, and Perry determined the main reason was the wall-mounted mini-splits. “People just aren’t used to them yet. Most people don’t like change and are scared to invest in what they don’t know much about,” said Perry.

Perry has put quite a bit of effort into educating real estate agents, as well as potential home buyers, on the energy-efficient features of the home. “I met with real estate agents, and only a couple of them were only slightly familiar with different things we did in the home. I provided them with all the information about what makes this home different and how it performs. I printed materials from ENERGY STAR and the DOE Zero Energy Ready Home program websites for them and I participated in the realtor open house,” said Perry. Perry did some of his own marketing, creating a Facebook page for the home to provide accurate, detailed information about the home’s high-performance features.

He noted that the power company was very enthusiastic about the home and offered to do an open house, but the house sold before they had an opportunity to hold the event. The house participated in the Alabama Power Company’s Superior Solutions program, earning a platinum-level certification. In addition, the home was certified to the DOE Zero Energy Ready Home program, ENERGY STAR Certified Homes, and the EPA’s Indoor airPLUS program.

Perry said he appreciates the marketing support and consumer information provided by the DOE program. He also appreciates how the DOE program is trying to help change standard practice.

The greatest reward for this builder is the long-term results. “The goal we set out for ourselves was to build a house that looks the same and costs the same as other homes in the neighborhood, but far outperforms them. This home has been constructed with exceptional attention to details that will continually pay off. With no additional upfront cost for the home owner, they are able to move in and instantly reap the benefits of owning such an efficient and sustainable home; and they will continue to do so for years to come,” said Perry.

Photos courtesy of DP Construction

KEY FEATURES
- Walls: 2x6, 24” o.c., advanced-framed, 5.5” open-cell foam in cavity, ¾” R-21 OSB sheathing, 15” soy open-cell spray foam over sheathing, brick veneer.
- Roof: ¾” OSB decking, roofing felt, fiberglass shingles.
- Attic: Unvented attic with 11” R-42 soy open-cell spray foam on underside of roof deck, 5.5” in vaulted ceilings, ¾” OSB, roofing felt, fiberglass shingles.
- Foundation: Uninsulated slab on grade.
- Windows: Double-pane, vinyl-framed, low-e, U=0.33, SHGC=0.26.
- Air Sealing: 1.4 ACH 50.
- Ventilation: Moisture-activated bath exhaust fans.
- HVAC: 4 wall-mounted mini-split ductless heat pumps, 18.4 SEER, 8.7 HSPF.
- Hot Water: 50-gallon heat pump water heater, 2.40 EF.
- Lighting: 90% CFL, 10% LED.
- Appliances: ENERGY STAR dishwasher, refrigerator.
- Solar: Pre-wired for solar.
- Water Conservation: Button-operated on-demand hot water pump.
- Energy Management System: None.
- Other: Low-VOC paint and carpet.