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DOE, TVA partners in groundbreaking energy efficiency project

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OAK RIDGE, Tenn. — Three houses under construction in East Tennessee carry the story of "The Three Little Pigs" to an entirely new level and will become a model for the nation when it comes to determining energy efficiency.

While the first house isn't made of straw, it is a typical Energy Star "builder house" with an energy efficiency score of 85 Home Energy Rating System, or HERS. The second unit, called a retrofit house, includes energy-efficient upgrades to the building envelope and mechanical equipment. This house has a HERS rating of 64 (the lower, the better).

"The retrofit unit will provide a 20 percent energy savings from the builder house yet offers a package of technologies that are considered a reasonable upgrade for many homes in most of the United States," said Jeff Christian, a senior researcher in the Department of Energy's Oak Ridge National Laboratory.

The third unit is a high-performance house with a package of technologies, including windows with efficiency approaching common residential walls, that help push the predicted HERS rating to 30. This house, which includes solar panels mounted on the roof, will provide about 55 percent energy savings compared to the builder unit.

"With these three houses in a typical residential setting, we will have research capabilities that are world-unique," Christian said. "And the really exciting thing is that these houses will be available for research for seven years, so we will be able to replace, test and accelerate the development of even more efficient component technologies."

Construction of the three houses is scheduled for completion by mid-December for the first two and mid-January for the high-performance residence.

The project at Campbell Creek in Knoxville involves many partners, but key players include builder John Kerr, developer Michael Rhodes, General Electric, Dow Chemical, Louisiana Pacific, BioBased Foam, Johns Manville, Serious Materials, Sustainable Future and Big Frog Mountain. ORNL's research and consumer education activities are sponsored by Tennessee Valley Authority and DOE's Building Technologies Program.

The houses are all typical two-story models built on insulated slabs. The builder and house plans were selected after an extensive study of the residential market in the Tennessee Valley Authority generation territory to be very close to the average house sold in 2007. The houses have similar solar orientation, lot slope, wall areas and wind exposure and range in size from 2,400 to 2,512 square feet.

Occupancy for all three will be simulated to accurately represent conditions of a typical family of four. The same occupancy behavior -- right down to opening and closing the refrigerator door, running the clothes dryer and taking a shower -- will be used for all three homes.

"Eventually, these houses will have simulated occupancy of three levels of users, typical of an energy-saving family and a high-energy-using family," Christian said. "We envision at least once a month these three simulated families will be living in each of these houses for at least a week."

For monitoring purposes, each house will have between 100 and 200 channels of continuous energy performance and thermal comfort data collection.

The overall initiative is sponsored by TVA and DOE and goes by the moniker of the Zero Energy Building Research Alliance, ZEBRAlliance. When the project is complete, measured energy performance of the three houses in Knoxville and four more being built nearby in Oak Ridge will result in a rating system that will allow homeowners to compare their home to these high-performance houses. That information will guide homeowners toward cost-effective energy reduction.