

ENERGY EFFICIENCY: Tenn. project to test range of residential upgrades

(Tuesday, December 1, 2009)

Jenny Mandel, E&E reporter

If small energy improvements are good, are bigger ones better? That's a question researchers at Oak Ridge National Laboratory hope to answer with their studies of "deep retrofits" of existing homes.

Jeff Christian, a researcher with the lab's building technologies program, plans to work with about 10 homes near the Tennessee lab to examine how extensive retrofits -- changes costing about \$10 per square foot of living space, or \$25,000 for an average home -- affect energy use and utility bills.

The initiative will be funded in part by \$1.4 million from the stimulus law, but study participants will be responsible for the vast majority of the upgrades, Christian said in an interview.

Most of the federal funding for the project will go to yearlong energy monitoring on retrofitted houses, information that will be measured against data from the previous three years.

"The argument here is that we're going to offer some very good guidance," Christian said, adding, "I hope to demonstrate that this is going to be a very good investment."

The program will focus in on houses that are 15 to 35 years old and ready for upgrades to heating, ventilation and air conditioning systems, which make up a big share of a home's power use, Christian said.

Those replacements create a window of opportunity to shift toward more thrifty models, efficiency experts agree.

Christian said equipment purchases will not dominate the retrofit, though.

"On a first-cost basis, the biggest thing we're doing is the insulation and the air sealing of the attic," he said. "Once you do that, you spend less on your heating and air conditioning system, because you need a smaller one."

The retrofit program draws partly on studies Christian has done on common residential construction near the Oak Ridge lab. In one such project, Christian manages three vacant "robohomes" that are controlled by timers to simulate use by families.

The first home is a builder's model, and statistically average for a new home built around 2007 in the Tennessee Valley Authority's service territory, Christian said. The second model includes the kind of deep retrofits he hopes to use in the new program, targeting roughly 30 to 40 percent in energy savings through measures that pay for themselves. The third home is even more aggressively revamped to target zero net energy use.

The first home was insulated with material packed under the attic floor, above which a cooling unit was located. In the second home, the researchers reworked the building's envelope, replacing the insulation under the attic floor with

spray foam and other material inserted under the roof and effectively adding the attic into the home's conditioned space. They made sure the air conditioning ductwork was inside that zone.

During cooling season, the first house on one day had an attic temperature of 130 degrees, while the second house's attic was 77 degrees, just a degree higher than the thermostat setting downstairs.

Christian said he hopes the new project will show that major improvements like a building envelope redesign can create dramatic energy savings and can pay off financially.

"This whole project is going right at one piece of information that we hope will convince a few more -- we hope thousands more -- homeowners ... that this is worth looking at and then worth investing in," he said.

Putting buildings on energy diets

Project participants have not been selected yet, though Christian has had initial indications of interest from families that heard about it via news reports and word of mouth.

Criteria for participation will include a willingness and ability to pay for, or get a loan for, the hefty upfront costs of making upgrades, and to give researchers access to energy performance data for a year after the work is complete.

While the homes will also have to resemble the statistical averages built in the region, Christian acknowledged that from a behavior standpoint, the participants are likely to be far from average.

"My hypothesis is that these 10 people that get chosen will be energy-aware families," he said.

The energy use profiles in those homes could later be fed back into the robohomes, Christian said, to run simulations there modeling how variations in behavior affect energy use.

Earlier research he conducted on a group of 30 virtually identical homes found a fivefold variation in energy use from behavior patterns alone. That study points to the limits of an approach that does not take into account occupants' habits, he said, and illustrates the difficulty in designing a study to conclusively prove the value of retrofits.

Nonetheless, Christian hopes the new project will yield valuable data and that it will prove to be a cost-effective undertaking for the participants.

"It is my feeling that every single house, every single building in America needs to be on the path towards zero energy," he said. If the goal is to reverse the climate changes caused by energy use, he added, "the only way we can get there is with our homes, and doing a lot different story than what we've been doing."



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