

# The Precast Green

The European trend of low-cost, zero-energy home-building takes off for America's largest philanthropic home builder.

BY CAROL BRZOZOWSKI  
PHOTOS BY INTERNATIONAL PRECAST

Homes built with precast concrete foundation systems are popping up across the United States – an increase from 3 percent to more than 16 percent of all homes built over the past decade, according to the National Association of Home Builders. After years of mass production and popularity in Europe, Americans are catching on to the structural and energy-efficient design of insulated precast concrete sandwich walls, otherwise known as thermal mass walls. Benefits include resistance to termites, fire and wind – and as a bonus, the homes go up in the blink of an eye. And from what current energy costs have taught American homeowners, keeping home-sweet-home comfortable these days can cost a bundle.

## Habitat for Humanity

A newly released study by the Oak Ridge National Laboratory near Oak Ridge, Tenn., indicates that even more widespread construction of these low-cost zero-energy homes may be reality by 2010. The study was based on data drawn from four single-family dwellings constructed by the Tennessee Habitat for Humanity between 2002 and 2004.

Only one of the four homes – “House Four” – used thermal mass wall construction, and it has since proven its effectiveness as an energy saver. A single mother and her children lived in this fourth home, which included sensors embedded in the walls to measure energy gained and lost during the family's occupancy. The family reveled over added savings from low energy costs derived through the home's unique construction.

House Four was the only two-story house built for the study because of the lot's steepness. The 1,139-square-foot residence includes a walkout basement, three bedrooms, vinyl siding and a rooftop solar photovoltaic (PV) system, to churn out a portion of the electricity consumed by the tenants.

International Precast of Siler City, N.C., provided the insulated precast concrete panels. Among the benefits of the precast wall system:

**Resistance to disasters.** A four-hour fire rating enables homeowners to get



IN THIS SEQUENCE OF CONSTRUCTION PHOTOS, THE PANELS WERE INSTALLED IN A SIX-HOUR WINDOW, WHICH REQUIRED AN EMERGENCY CALL TO THE POWER COMPANY TO SHUT OFF THE POWER AT THE FRONT OF THE HOUSE SO THE PANELS COULD BE LIFTED AND PUT IN PLACE.

## Project Profile



**Project:** Precast concrete insulated panels, Loudon City, Tenn.

**Owner:** Tennessee Habitat for Humanity

**Contractor:** Tennessee Habitat for Humanity

**Precast Manufacturer:** International Precast, Siler City, N.C.

# Zone

breaks on insurance costs.

**Durability.** Justin Schreiber, who is in design engineering and sales for International Precast, says the product could last 100 years.

**Cost savings.** Drywall is unnecessary because the walls have a smooth finish on both sides. House wrap is unnecessary. One can use a spray-on stucco, which reduces stucco costs. Wood and brick can also be used for siding.

**Sound dampening.** Higher ratings indicate more effectiveness in muffling or blocking noises and other sounds. The panels' 47 STC (Sound Transmission Class) rating falls within the "very good" sector.

**Mold and mildew resistant.** "The concrete foam [insulation] cannot act

as a food source for mold," Schreiber says.

**Pest-resistant.**

**Installation speed.** "You can set footers and have your bases mounted in a couple of days instead of a couple of weeks compared to poured-in-place or something else," says Schreiber.

The data from the sensors has shown the Habitat houses so far have realized an overall energy savings of 40 percent to 60 percent annually compared with a computer-simulated house identical in size and layout. House Four had the highest Home Energy Rating System score – 92.5 percent compared with 80 percent for a base house. Each 5 percent reduction in energy use compared with the base house increases the score by one point. Energy Star status is achieved when a house scores at least 80 percent.

Todd Helton, construction director for Habitat for Humanity Loudon County, likes those numbers and is heartened by

how the insulated precast concrete panels have heightened the occupants' comfort level. "That system eliminates some of those cold spots and works really well with the heat and air system," he says. The net bill for the homes, occupied for the most part by minimum wage-earning families, has been less than \$1 a day after solar credits. The Tennessee Valley Authority pays a premium for the solar power that comes from the houses and sells it for a premium to anyone desiring the "green" power.

## R-value

The ORNL studies point to House Four's R-value in achieving overall energy savings through the effective R-value of the house, which in this study was R-16. Climate factors give the panels different R-values in various regions of the country. These numbers tend to be higher in warmer regions and lower in cooler regions. For example, the same panel may have an R-value of 16 in New



York and 30 in North Carolina.

R-value refers to how energy slowly dissipates through the panels. During the day, the sun warms the exposed panels as the heat slowly migrates through them and then is released into the home throughout the night. This energy transfer operates in reverse during the day. This leads to a reduction in dependency on heating and air conditioning systems, a decrease in energy bills and lower overall power usage.

Jeff Christian, director of the Buildings Technology Center for Oak Ridge National Laboratory, says that while House Four is larger than the three houses constructed before it and is the only two-story home, it actually realized the most energy savings. He credits the insulated precast concrete panels.

“One of the particular features we are very interested in is that when the sun would shine on a very warm December day, the house would increase in temperature substantially, which would result in the homeowner cracking open the windows,” Christian says. “Improved energy costs could be seen if other homes were built with the insulated precast concrete panels.”

Christian says the houses have been designed to continually bring in fresh air. “We do that by bringing in the air in the return duct of the central distribution system for the heat pump,” he says. The goal was to bring the heat from the upstairs to the basement, where the insulated precast concrete panels are installed and allow it to radiate back out at night without any expenditure of additional circulating air.

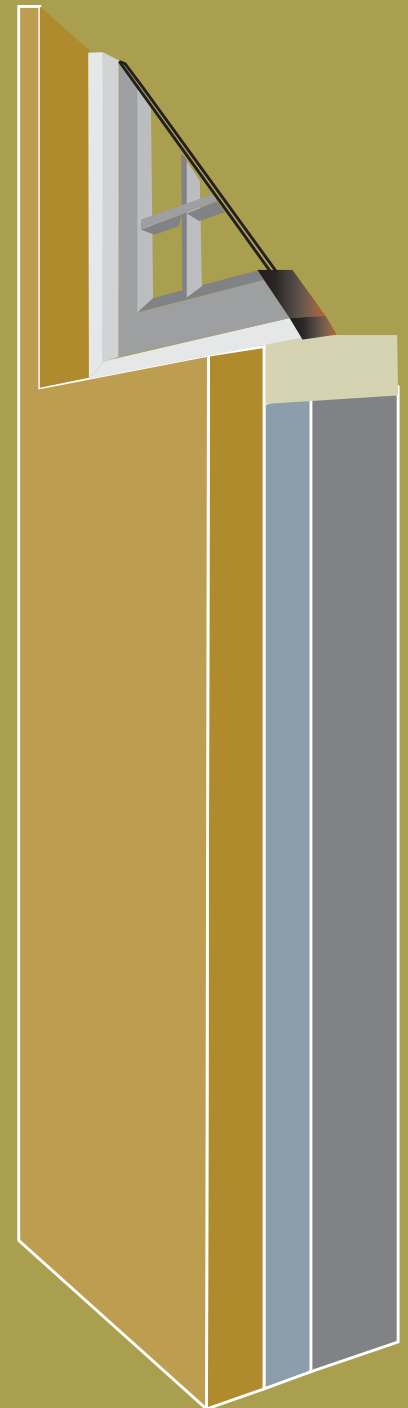
By doing so, “We have seen some improvement in the stability of the inside air temperature, and as a result, the homeowner has been less inclined to push the thermostat up and down. That’s proven to work extremely well,” Christian says.

### Quick installation

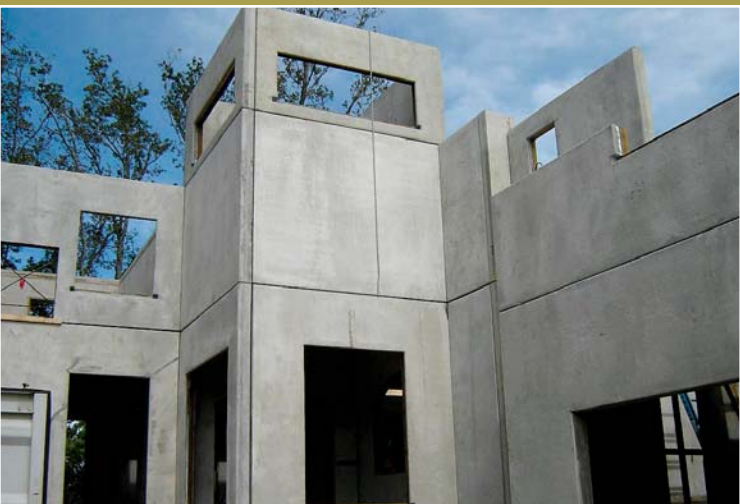
Christian was also impressed with the quickness of the panel installation and reaction to emergency scenarios.

“The footers had to be poured ahead of time, and one always has to have a square and level foundation system,” he says. The panels were installed in a six-hour window, including an emergency call to the power company to shut off the power in front of the house so the panels could be lifted over them.

Christian says that it is very possible



PRECAST CONCRETE PANELS COUPLED WITH INSULATION, DISPLAYED ABOVE IN BLUE, CREATE AN ADOBE HOME-LIKE ENVIRONMENT FOR TENANTS. THE OAK RIDGE NATIONAL LABORATORY RATED THIS HOME, ONE OUT OF FOUR FOR THE STUDY, THE HIGHEST HOME ENERGY RATING SYSTEM SCORE — 92.5 PERCENT COMPARED WITH 80 PERCENT FOR A BASE HOUSE. *Illustration by Christopher Whited*



for a professional crew to set the insulated panels within two days. "Certainly when one thinks of Hurricane Katrina reconstruction, this is an extremely attractive method."

One of the first U.S. residential applications for the technology was in Las Vegas, Schreiber says. The Habitat house is the first residential application for International Precast, and it has led to projects in Alabama, North Carolina and Virginia.

"These projects are primarily single-family homes that vary in size and complexity," says Schreiber. "The North Carolina homes are designed to look like a traditional house. If you were to walk into one, you wouldn't realize that they were concrete unless you went up and knocked on the wall." The same holds for the house in Virginia constructed with insulated precast concrete panels, except the home is larger, he says.

A home in Alabama is going to be a complete departure from traditional home construction. "The owner of this house wanted a factory-type look, so we'll provide him with panels that are a rougher finish," he says. "He is going to use a European-style plumbing system that leaves the pipes exposed."

Adopting foreign design is one thing, but if American homeowners can further embrace this building system over the next decade, the energy efficiency obsession by the Europeans may become our own.