HOME PERFORMANCE

Making Sustainable Attainable

Whirlpool and Purdue University team up to give sustainable technologies wider appeal

BY CHELSEA BLAHUT

According to Whirlpool and Purdue University, any average American home can become energy efficient, and the team plans to create the prototype that shows how it's done. In West Lafayette, Ind., a 1928 bungalow is becoming a residential laboratory for appliance- and resource-efficiency research for Purdue graduate students enrolled in the Whirlpool Engineering Rotational Leadership Development (WERLD) Program. Dubbed the "ReNEWW House"—Retrofitted Net-zero Energy, Water, and Waste—Whirlpool engineers worked with local builder Green Goose Homes to complete a deep energy retrofit of the bungalow over the summer, with the aim of eventually achieving net-zero status. To show how everyday homes can be more resource-efficient, the engineers chose this particular house because it's about the same size as the typical American home today—two-stories, with three bedrooms and two full baths, which is about 3,000 square feet of conditioned space.

"That was important to us because we feel like net-zero energy business [is] focused on new construction, when that's only a small fraction of homes [in the nation]," says Dr. Eckhard Groll, Purdue University's Reilly Professor of Mechanical Engineering and director of the Office of Professional Practice, who is leading the project at Purdue. "The research has to focus on the existing homes"—of which there are about 13 million.

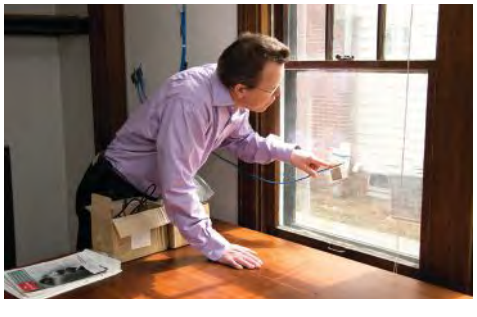
According to Ron Voglewede, Whirlpool's global sustainability director, the team's approach stresses attainability. The methods and products used must be available to the average consumer. "This is a huge challenge because we're [getting] consumers to understand how to change their footprint, not through a *total* change in the home, but in smart choices. We want to help both builders and consumers with sustainable living," he says.

RESEARCH IN STAGES

The ReNEWW House project will consist of three phases, each focused on conducting comprehensive research into a specific challenge: energy, water, and waste. It's anticipated that each phase will take about a year to complete.

The graduate students living in the house will observe their living habits and analyze how much energy the retrofits and high-efficiency appliances actually save. The bungalow's basement—referred to by Dr. Groll as the "brain" of the house—has been renovated to be an in-house lab, focused on data collection and analysis.

The deep energy retrofit completed this past summer focused on the energy part of the project, upgrading the tightness of the envelope by replacing the insulation, siding, windows, and roof. Foam-Lok, a closed-cell spray polyurethane foam system from Lapolla Industries, was applied in the wall cavities on each floor. The spray foam uses Honeywell's new Solstice Liquid Blowing Agent, a non-toxic, non-ozone-depleting agent that won't affect indoor air quality. The house is clad with Ply Gem's Structure Home Insulation siding, which is made of 50% recycled materials and incorporates polystyrene foam insulation backing up to 1¼ inches thick. The new Ply Gem EcoSmart windows are also made from recycled materials and have triple-pane, krypton-filled lites with sashes and frames welded together to be weather-tight. Custom-made fiberglass exterior doors are also from Ply Gem, and the existing shingle roof was replaced with standing seam.



Working Better, Together
Top: The finished exterior of the ReNEWW House. Bottom: Dr. Eckhard Groll, who is leading the project at Purdue.

Photos: courtesy Whirlpool

Photo: courtesy Stephen Caskey and Mark Simons

Living Laboratory The basement, which functions as the "brain" of the house, monitors the home's energy consumption.

TESTING, TESTING

To determine the efficacy of these new technologies, Eric Bowler, project engineer at Whirlpool, performed baseline testing before any upgrades were made. The existing bungalow's air change rate: 11 air changes per hour (ACH)—about 4 ACH is typical for the average home; its HERS (Home Energy Rating System) Index score: 177—which equates to the house being 77% less efficient than a standard new home. The Whirlpool/Purdue team is comparing this baseline data with data collected over the course of a year. So far, a post-renovation HERS analysis completed in September gave the home a HERS Index score of 2, and the estimated annual energy cost went from $3,728 before renovations were completed to $148 afterward.

The home now has a geothermal system from Enertech Global, and photovoltaic-thermal (PVT) modules from SolarZentrum are installed on the roof to provide up to 900 watts of electrical and thermal energy to the house. PVT panels are up to 30% more efficient than other solar systems because, unlike conventional photovoltaics where as the surface temperature of the glass laminate rises, the module's efficiency at producing power begins to decline, this system's solar cells have heat exchangers—a fluid circulates behind the panels, cooling the panels while absorbing the panels' heat. Also, because PVT systems use direct and indirect sunlight, they can be installed in any climate zone. "I get daily reports about how much energy the solar panels have produced," Groll says of the graduate students living in the ReNEWW house since August. "They see the house like it's a playground for them."

Within the next two years, the team will focus on the net-zero water and zero-waste-to-landfill aspects of the house. Implementing the water-saving systems is already under way in the kitchen, bath, and laundry, with low-flow appliances and a gray-water system that uses leftover water from previous cycles. Also still to come is the installation of a biowall air-filtration system that will work in tandem with the HVAC system. *—Chelsea Blahut is a content producer for* REMODELING*'s parent company, Hanley Wood.*