By Troy J. McMullen

Airtight Logic

Using sealed construction and energy-efficient systems, passive homes are at the forefront of residential sustainability

THE 3,000-SQUARE-FOOT home tucked away on a leafy road in Fairfield County, Connecticut, has all the trappings of a modernist luxury estate. Polished concrete flooring covers the main level of a residence that has a soaring three-story entrance foyer adorned with a towering 12-foot chandelier. It's all surrounded by an ipe wood facade that helps the property find harmony in organic textures. Rounding it out are a pool with a lounge and an art studio above the garage.

Yet the home's most important design features are less visible to the naked eye. The residence is built to "passive house" standards, which means it employs the kind of energy-efficient principles that make it one of the most environmentally sustainable in the state. The term "passive" refers to passively keeping the temperature consistent, rather than actively using energy to heat and cool the structure.

The Connecticut house is constructed airtight, with triple-pane windows for increased energy efficiency and 8.5 inches of wall insulation calibrated for the local climate. The heating and cooling system is run by an air-source heat pump, which further reduces the carbon footprint as compared to a gas or electric heating system and is three to four times more efficient than fossil-fuel-dependent furnaces. A Zehnder energy-recovery ventilation system was installed to remove stale air from baths, laundry and kitchens while providing a continuous supply of fresh outdoor air into the living spaces.

"The house requires virtually no energy use for heating or cooling," says Salvatore Zarrella, founder of Construction Management Group, the Connecticut firm that designed and built the home. The company specializes in energy-efficient construction, building homes for sustainable-minded clients in some of the state's priciest zip codes. "Passive houses are more efficient than the average home, but that doesn't mean they can't also be luxurious," Zarrella says.

TOP: SARAH SZWAJKOS; BOTTOM: TRENT BELL

"Green is good" has long been the mantra for a growing number of eco-minded homeowners in the U.S., but the trend is increasingly going upscale. People in expensive pockets of the country are hiring architects and builders skilled in energy-efficient techniques such as passive design to help erect dream homes that incorporate a greener way of living.

Rather than succumb to the usual soulless, boxy designs that define many energy-efficient homes, a new crop of passive house designers is employing a level of inventive elegance rarely seen in energy-saving designs. "You don't necessarily have to forgo attractive design aesthetics to build a home that's energy-efficient," says Tom Bassett-Dilley, a Chicago-area architect who focuses on sustainable building. His firm has designed more than 20 passive homes in the region, including Chicago's first certified passive home in 2012 in River Forest, a leafy suburb of the city. Beyond fulfilling the basic tenets of a passive home—airtight construction, high-performance window glazing, heat recovery ventilation—all of the property's construction materials were selected to be nontoxic.

"Most people still have this idea of a clunky, unattractive green home," says Bassett-Dilley. "But nothing could be further from the truth these days." The passive house concept was first developed in Germany about 35 years ago to focus less on environmentally friendly ways to produce energy and more on ways to cut the need for energy consumption in the first place—in some cases by as much as 90 percent compared with the average American home.

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CLOCKWISE FROM TOP LEFT: Exterior and interior of a house in River Forest, Illinois, built by Tom Bassett-Dilley Architects; house in Stamford, Connecticut, built by Construction Management Group
OPPOSITE, FROM TOP: House in Hope, Maine, built by GO Logic; GO Logic house in Rockport, Maine

TOP: HAUSMAN & ASSOCIATES PHOTOGRAPHY (2); BOTTOM: JAY COHEN

A passive house achieves this with its thick, well-insulated walls and roof and air sealing to an exacting standard. Buildings are designed to capture maximum sunlight through their orientation and the installation of high-efficiency windows: Heat is kept in during the winter and out in summer.

The first passive house in the U.S. was built in Urbana, Illinois, in 2003. Since then, hundreds of passive-certified single-family homes have been constructed throughout the country, according to Phius (Passive House Institute U.S.).

Passive homes generally cost about 10 percent more to build than conventional structures, says Alan Gibson, principal at GO Logic, a certified passive house builder and designer in Belfast, Maine. The higher costs are due to the added insulation to keep the home airtight, the ventilation system, and more energy-efficient windows and doors. But homeowners will see an economic payback fairly quickly in the form of lower utility bills, Gibson says.

GO Logic recently completed a 1,500-square-foot passive house in Hope, Maine. The two-story New England farmhouse is built airtight with a wall of windows on its south side and a rooftop solar power system that can generate up to four times as much energy as the house needs on bright, sunny days.

"The focus of a passive house is on conservation and reducing the need for utilities," says Gibson, whose work utilizes modernism for high-end and budget-minded clients alike. "That directly translates to lower monthly costs for energy."