passive houses

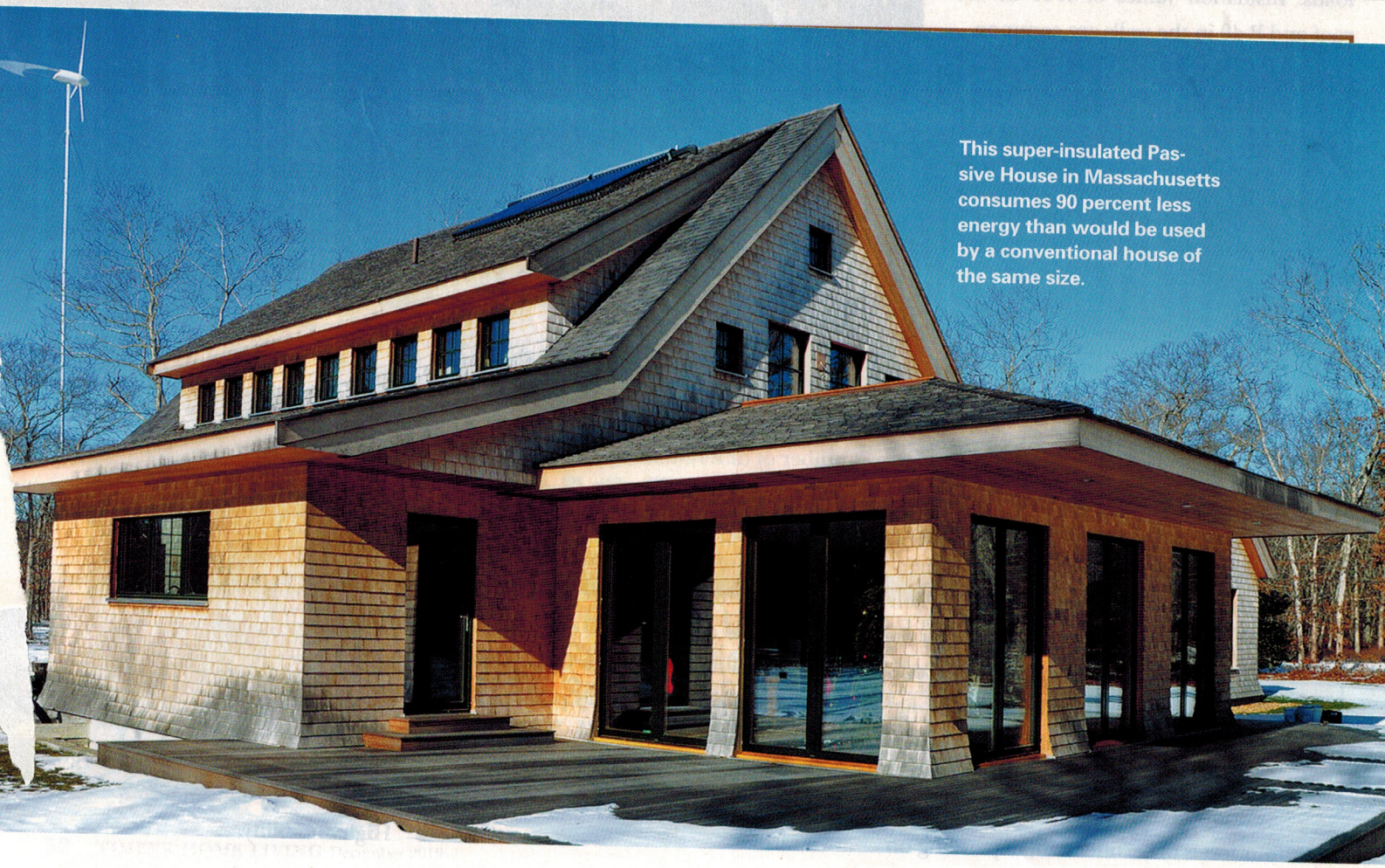
Dr. Wolfgang Feist, a German physicist, developed the Passivhaus standard in the 1990s. It has been slow to catch on the in U.S., where it is known as Passive House, but it has been gaining ground and a number of the houses have been constructed here. The Passive House Institute US, in Urbana, Illinois, is the hub of the program on this side of the Atlantic.

The homes are super-insulated to the point that very little energy is needed to heat and cool them. In a winter power outage, the homes are expected to be warm and livable for days. Passive House standards for energy efficiency and building envelope tightness are very strict. Air leaks must be reduced to 0.6 air changes per hour at 50 pascals of pressure (a blower-door testing standard referred to as "ACH50"). This is extremely low, far tighter than a conventionally built house.

Energy consumption also must meet strict maximums. Maximum heating and cooling energy can't exceed 15 kWh per square meter (or 4,755 Btu per square foot), and maximum source energy for all uses can't be more than 120 kWh per square meter. The standards also recommend the U-value of windows be no more than 0.14 (U-value is the inverse of R-value, so the lower the number the less potential heat transfer). Windows are typically triple-glazed with two low-e coatings and foam-filled frames to reduce energy losses.

Houses built to this standard in Europe often have double-stud walls 16 in. thick. Masonry buildings may have as much as 10 in. of exterior rigid foam insulation. The R-values of walls and roofs range from R-38 to R-60. The first Passive House certified house in the U.S. had a roof insulated to R-100.

Because houses are so tight, they must have a mechanical ventilation system to bring in fresh air. This is usually supplied by a heat-recovery ventilator (HRV), which uses a heat exchanger to moderate the temperature of incoming air, thereby reducing the energy penalty of keeping the house comfortable.



This super-insulated Passive House in Massachusetts consumes 90 percent less energy than would be used by a conventional house of the same size.