

## 10 Benefits of a Passive House

by Beth Brindle

### Green Living Image Gallery



**Green Living Image Gallery Darmstadt Kranichstein, built in 1991, is the first passive house building and has been subject of extensive measurements. See more green living pictures.**  
<http://www.passivhaustagung.de>

## 10 Benefits of a Passive House

Imagine living in a comfortable, modern house with no cold drafts, no temperature variations from room to room, and, best of all, virtually no heating or cooling bills. It might sound too good to be true, but these cozy conditions are the norm for people who live in passive houses.

A passive house is an extremely energy-efficient home in which a comfortable interior climate can be maintained without active heating and cooling systems [source: [Passivhaus Institut](#)].

Passive homes are heated primarily by the sun, but unlike solar-powered houses, which use solar panels to convert sunlight to electricity, passive houses capture the sun's energy in the form of heat, using the design and construction of the home itself to eliminate the need for a [furnace](#), [fireplace](#) or other conventional heat source.

The first passive house was built in Darmstadt, Germany, in 1991 [source: [Feist](#)]. While houses built as early as the 1970s and 1980s employed something called a passive solar design to collect heat from the sun, the passive house

standard takes the idea a few steps further, adding superior insulation, airtight construction, energy-efficient windows and carefully controlled ventilation as essential components of the home's construction.

As of 2010, more than 15,000 buildings in Europe had been built or remodeled to the passive house standard [source: [Passive House Institute US](#)]. Only a handful of passive houses have been built in the United States, but homebuyers here are beginning to inquire about this eco-friendly option, and the Passive House Institute US has begun to test and develop efficient models for hot and humid climates such as Florida, where cooling is a bigger challenge than heating [source: [Passive House Institute US](#)].

Will your next home be a passive house? Read on to discover the benefits of passive-house living.

### 10: Doing Your Part

Can building just one passive house stop [pollution](#) or [global warming](#)? Sadly, no. But if even a small percentage of the new homes and buildings constructed in the United States and elsewhere were built to passive house standards, the energy savings would be significant.

A study conducted in Germany in 2003 compared the energy consumption of passive houses with the energy consumption of both conventional and energy-efficient homes and found that passive houses had an average energy savings of 90 percent over conventional homes and up to 80 percent compared with homes built to Germany's stringent low-energy construction standards [source: [Passivhaus Institut](#)].

Passive houses still use electricity for things like lighting, electronics and appliances, and heating water, but most require no heating source at all aside from the sun and the incidental heat generated by the appliances and people inside the house. By using energy-efficient appliances and alternative energy sources like solar panels or [wind turbines](#), many passive house owners can power their homes with little or no reliance on the electric company or other polluting sources of energy.



**The residence hall at the University of Wuppertal in Germany was built in the '70s but has been successfully retrofitted into a passive house.**  
<http://www.passivhaustagung.de>

### 9: Lower Utility Costs

Passive house design eliminates the need for traditional heating systems in even the most challenging climates, so bills for heating oil, [natural gas](#) or propane could become a thing of the past. Super-insulated construction and the use of energy-efficient appliances further reduce the [energy footprint](#) in a passive home. To be certified by the Passivhaus Institut, a passive house must consume less than 15 kilowatt-hours of electricity per square meter per year for heating and cooling, with total energy consumption for all heat, hot water and household electricity not to exceed 120 kilowatt-hours per square meter per year [source: [Passivhaus Institut](#)].

Dr. Gary Konkol, owner of the "Passive House in the Woods," a 1,940-square-foot (180.2 square-meter) passive house built in 2010 in Hudson, Wis., reported energy consumption of 679 kilowatt-hours for a 38-day period that included the cold and cloudy month of November 2010 [source: [Hanson](#)]. Even with the cloudy weather, a small solar array in the yard provided 366 kilowatt-hours of electricity, leaving just 313 kilowatt-hours to be purchased from the electric company. Total energy cost for 38 days: \$35, which covered all heating, ventilation, hot water and household electricity

[source: [Eian](#)].

### 8: Rebates and Tax Credits

While specific tax incentives vary from year to year and place to place, you may be eligible for a number of federal, state and local energy tax credits when you retrofit your existing home to passive house standards, or build a new energy-efficient home such as a passive house.

Some states, municipalities and utility companies also offer grants, rebates or low-interest loans to help you cover the cost of purchasing and installing new [energy-efficient materials](#), appliances and structures. Web sites such as [EnergySavvy.com](#) and the [Database of State Incentives for Renewables & Efficiency](#) make it easy to search for the credits and rebates available in your area.

### 7: Better Indoor Air Quality

One of the most important elements of the passive house concept is controlled mechanical ventilation, which continuously replaces stale, humid or otherwise "polluted" indoor air with fresh, outdoor air [source: [Passivhaus Institut](#)].

In a passive house, high efficiency ventilation systems pull air from kitchens, bathrooms, and any other high-moisture or odor-producing spaces and pipes fresh air into bedrooms, great rooms and other living spaces. This balanced ventilation system keeps the humidity inside the home at a comfortable 30 to 60 percent [source: [Passive House Institute US](#)]. While the windows in a passive home can be opened just like the windows in any other house, homeowners may also choose to keep them closed, bringing all fresh air in through the filtered ventilation system and reducing exposure to dust and allergens.



This Montessori school in Aufkirchen, German, designed by architect Gernot Valentin is built to passive house standards.  
<http://www.passivhaustagung.de>

## 6: Comfort

The notion of comfort is so integral to the passive house concept that the Passivhaus Institut has gone so far as to apply a "comfort equation" to its building process [source: [Feist](#)]. Passive house design strives to maintain a comfortable, even temperature throughout the home, with low temperature variations from room to room. The difference between radiant temperature (i.e., the temperature of windows, doors and other surfaces) and air temperature remains small, helping to eliminate drafts.

High-performance windows and superior insulation also help to keep the inside of the passive house extremely quiet, and the steady ventilation eliminates odors and keeps the [humidity](#) within a comfortable range.



Architect Andreas Thomsen's passive house building complex in Hamburg.  
<http://www.passivhaustagung.de>

## 5: Construction Quality and Durability

To meet the passive house certification standard established by the Passivhaus Institut, homes must be built to the best possible modern standards, making for a durable, well-built home. Because every aspect of the passive house is carefully planned and specified in advance, there is theoretically little room for error in the building process, and nothing is left to chance with regard to materials or construction. Many of the interior and exterior finish materials used in passive house design, such as the high-end windows and doors, are virtually maintenance-free, and the elimination of a furnace, boiler or other conventional [HVAC system](#) means that there are fewer "moving parts" to repair or maintain.

## 4: Peace and Quiet

The high-performance [windows](#) and heavily [insulated](#) doors and walls in a passive home greatly reduce exposure to street noise and other outdoor sounds. Inside the house, Passivhaus Institut requirements specify that the efficiency of the central heat exchanger should be high, energy consumption of the fans should be low, the operational conditions should be clean and the unit should be very quiet [source: [Feist](#)].

In the Wisconsin "Passive House in the Woods," even the duct work itself helps reduce noise in the home. Flexible plastic air ducts are run directly to the ventilation system, without the need for duct tape or other joint adhesives, "making for a clean and quiet system, where noise cannot transfer from one room to the next through the ventilation ducts" [source: [Eian](#)].

## 3: Reduced Reliance on Outside Power

While building a passive house doesn't necessarily mean going entirely "off the grid," many devotees of the passive house standard are quick to point out the benefits of decreasing our reliance on oil, coal or [natural gas](#) -- and the infrastructure that supplies them -- as we confront an uncertain energy future.

The low-energy consumption required by a passive house makes it easy to supply some or all of the household's electricity through clean, on-site power sources such as solar panels or [wind turbines](#). Added bonus: You get to enjoy many of the benefits of an underground bunker without giving up fresh air, sunlight or a social life.

## 2: Value

There's no question that the upfront cost to build a passive home is higher than the cost to build a conventional home, but over time, the higher initial price of [materials](#), design and construction will be offset by savings on utility bills and home maintenance.

The Passive House Institute US estimates that an additional upfront investment of around 10 percent of the construction budget is required to achieve passive house standards, as compared to regular energy code-compliant 2x4 construction [source: [Passive House Institute US](#)]. In practice, the cost difference is often greater, but the price per square foot to build a passive house may be partially offset by the relatively small [footprint](#) of the home.

For example, The Shift House, a 1,741-square-foot (161.7 square-meter) passive home outside Portland, Ore., had a construction and design budget of \$330,000, or

approximately \$190 per square foot. That's compared to an average cost of about between \$200,000 and \$282,000 (\$85 and \$120 per square foot) to build a conventional new home with an average size of 2,349 square feet (218.2 square meters) [source: [Minervini](#)]. But by spending an extra 10 percent during construction, Root Design Build (the project designers) expect to reduce the energy costs for [heating](#) by 90 percent indefinitely, and don't anticipate the annual heating bills to cost more than \$200 [source: [Minervini](#)].



This passive house in Oed-Öhling, Austria is built of untreated larch.  
<http://www.passivhaustagung.de>

## 1: The Coolness Factor

As of September 2010, there were just 13 certified passive structures in the United States, and the few passive homes in existence here have taken on near celebrity status among environmental enthusiasts [source: [Zeller](#)].

Roughly 2,000 visitors toured the Passive House in the Woods in the six weeks before it was first occupied by its owner in October 2010, and several of the passive homes built to date have been featured on [green building](#) Web sites, in newspaper articles, and in building and remodeling magazines [source: [Eian](#)].

Of course, even if you'd prefer not to have a few thousand of your closest friends traipsing through your house before you do, you'll be able to rest easy knowing that you're minimizing your impact on the environment even as you improve your own quality of life.

## Lots More Information

### Related Articles

- [How Living off the Grid Works](#)
- [How Solar Thermal Power Works](#)
- [10 Tips for a Cutting-edge Green Home](#)
- [How EarthCraft Homes Work](#)
- [What is the code for sustainable homes?](#)
- [How ENERGY STAR Works](#)

### More Great Links

- [DSIRE: Database of State Incentives for Renewables and Efficiency](#)
- [EnergySavvy.com](#)
- [Home Energy Audits](#)
- [Passive House in the Woods](#)

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