



## Passive House Concepts

*What if you could heat your home with a hair dryer?*

Passive House buildings, residential or commercial, meet a rigorous energy standard developed in Europe. They are extremely energy-efficient and comfortable, with excellent indoor air quality. They are also better built and more durable, with lower utility costs than most buildings. The Passive House concept slashes heating and cooling consumption of buildings by up to 90%!

Passive House buildings have the following principles:

### **Superinsulated walls**

In a Passive House, the entire envelope of the building- walls, roof and floor or basement- is super-insulated, depending on the climate. In Berkley CA, 6" of insulation is needed; In Duluth MN, 16" is required.

### **No thermal bridges**

Heat flows out of a building on the path of least resistance, through a building element that conducts heat efficiently- a 'thermal' bridge. PH construction minimizes or eliminates thermal bridges.

### **Airtight construction**

Airtight construction reduces or eliminates drafts and heat loss, reducing the need for space conditioning. The airtightness of a house is measured with a 'blower door' test. PH construction is very 'tight', and is confirmed by multiple blower-door tests during and after construction.

### **Energy recovery ventilation**

A house and its occupants need to breathe. The ventilator provides a constant supply of fresh air while conserving most of the energy already used to condition the house by using an air-to-air energy recovery system. PH buildings have excellent indoor air quality, whether you open the windows or not.

### **High-performance windows and doors**

Passive House windows and doors are chosen based on their insulating values. Typical windows have a thermal resistance value equivalent to R2; PH windows are 5+ times more efficient. No more drafty windows or leaky doors!

### **Passive solar design and internal heat gains**

Passive House designs utilize well-known and proven passive solar design principles- building orientation, window size, type and location, sunshading- to manage energy gains and losses. Because the exceptionally low levels of heat loss, heat from appliances, electronic equipment, lighting and people can significantly affect the heat gain in a Passive House.

### **Passive House Standard**

PHPP is an energy-modeling tool that helps the designer integrate each of the elements so the final design will meet the Passive House standard. PH standards are met when:

- *Space heating and cooling requirements are less than or equal to 4.75kBtu/ft<sup>2</sup>/yr (15kWh/m<sup>2</sup>a). [US commercial building average is 33.00kBtu/ft<sup>2</sup>/yr, from US EIA 2003 Commercial Buildings Survey];*
- *Total primary energy use of the design is less than or equal to 38.1kBtu/ft<sup>2</sup>/hr (120kBtu/m<sup>2</sup>a); and*
- *Airtightness of the building is verified to be at or below 0.6ACH @50Pa (ACH = air changes per hour, Pa = Pascals, unit of pressure).*

For an introduction to Passive House design and construction, see 'Homes for a Changing Climate- Passive Houses in the U.S.', by Katrin Klingenberg, Mike Kernagis, and Mary James, 2008. Or, see [www.passivehouse.us](http://www.passivehouse.us).

**GREENSTEPS** is a Certified Passive House Consultant. Let's talk!