



CAPTURING ENERGY WITH THERMAL MASS

With a global concern over climate change, many people are exploring ways to make a difference and reduce our impact on the planet. “Passive Solar” energy is an option that has come up time and time again. Is passive solar a viable option for housing and if so, how does it actually work?

Passive solar is the gathering and use of solar energy (heat from the sun) without any mechanical tools to move it around (like fans or pumps). That is the beauty of this technology. With nothing to break down, passive solar is maintenance-free. If designed correctly, passive solar works the same way on Day 10,000 as it did on Day 1. Can any other building technology make this claim? In fact, every other system has maintenance and parts that wear out and need replacing. Perhaps the biggest advantage of passive solar especially with rising energy prices is that the heat from the sun is free and untaxed. Essentially, if a new house incorporates passive solar in the design, the occupants will have much of their heat free, forever, with no maintenance.

How does it work? The sun’s heat passes through the windows and gets absorbed by dense materials like brick, stone, concrete, or rammed earth that will store the heat and release it later. Also called “Thermal Mass”, these heavy materials serve to keep the house from overheating when the sun shines and later release heat when the sun is not shining.

A good way to explain how passive solar works is to compare it to a hot water bottle. Imagine first that you heated up an airplane pillow to 100°C and brought it to bed with you. It would probably lose its heat in the first 10 minutes because it has no thermal mass. Second, imagine a hot water bottle that is about the same size as an airplane pillow.

If you filled it with boiling water (100°C) and brought it to bed with you it would likely stay warm through the night because it has thermal mass.

Standard stick frame homes have a couple of tons of thermal mass, which is not enough to avoid overheating when the sun shines through the windows. As a result, to prevent overheating, all windows are coated with a product that reflects the sun’s heat from entering the house. This approach has some benefit but may not be viable in the future as energy costs continue to rise. To get that free heat and still be comfortable takes 50 to 100 tons of thermal mass for an average house. Concrete floors, heavy fireplaces, and stone counters can increase the thermal mass of a house. However, these additions may get you only 50 tons of mass -- the bottom end of passive solar comfort.

A typical SIREWALL home creates over 100 tons of thermal mass in an average house. Stabilized, Insulated, Rammed Earth (SIRE) walls are made using rebar and insulation enveloped with the mass of 14 – 20 inches of rammed earth. With this system, a house can have over 100 tons of thermal mass plus an insulation value of R33.

In the last energy crisis, homeowners would add thermal mass to their houses by pouring concrete walls (known as Trombe walls) or big barrels of water in front of or near south-facing windows. While effective, these are clumsy ways to increase the amount of mass in our homes.

