Slip Form Stone House

by Doug Kalmer

In 1982 my wife and I bought 34 acres in Tennessee and started to build our dream home, with passive solar space and water heating, earth sheltered, post and beam framed, slipformed stone, and cedar cordwood infilled south wall. We had some money from selling a house I remodeled, but funds were tight, so we did all the work we could ourselves. We hired a track loader to excavate a 25' by 65' recess into a south facing hillside, and then hand dug footer trenches, poured 15 yards of concrete in them, and started slipforming stone walls. We placed locally gathered stone into the forms and mixed concrete with a gas mixer to fill around the stone. Once set up, the form could be moved, using the same forms over and over again to move down the walls.

I then felled and ripped posts and beams from oak trees on our property. I also cut Eastern Red Cedar (Juniper) into 16" lengths to stack for drying. After framing and decking the original shed roof, we poured another 15 yards of concrete with the help of friends and neighbors for a slab. We floated the slab surface for texture, and stained it a dark brown to improve solar absorption. After 15 months of drying time, we could wait no longer for the cedar to dry further, so we started building with it. First I built a shaving horse and using a drawknife, I had to peel all of the bark from the cedar. I later learned that if I had cut the cedar in the spring when the sap is up, it would have peeled more easily.

Laying two strips of sawdust-rich mortar along the inside and outside of the wall, I laid the 16" cedar lengths onto them, filling the inner space with insulation. This way there is no continuous mortar bond through the wall to transfer heat. The cedar cordwood wall was labor intensive, but cost little cash to build. Everyone likes the way it looks and smells. However, soon after moving in we noticed drafts where the wood meets mortar— air infiltration. When the wind blew rain through the wall, I knew I had to cover the outside of the cedar. I first used 6 mil plastic, covered with hand split oak shakes. It helped with the infiltration, but insects found the shakes a good home, and several types of wasps, even a bat moved in. I finally removed the shakes and plastic, tacked 5/8" closed cell Styrofoam board over the cedar, and stuccoed over the entire outside wall. This stopped the insects and infiltration. I now do not recommend cordwood walls for dwellings, as the rate of expansion/contraction with humidity changes is very different for mortar and wood, and infiltration is inevitable unless you tightly cover the outside wall.

For the past 18 years, we have been living in a solar collector—otherwise known as a direct gain passive solar home. It is naturally well lit, thanks to many large, evenly spaced windows on the south wall.

These appropriately shaded windows allow direct sunlight to reach the back of

the building in winter, but allow no direct sunlight inside in summer. The light which does enter strikes the textured, brown concrete floor, slip-formed stone walls, and large stone fireplace, gently warming these surfaces which absorb and store heat, moderating temperature fluctuations. Having insulation on the exterior of the building allows these thermal masses to remain at or near room temperature, absorbing heat during sunny days and radiating warmth at night. This makes interior temperatures very stable, naturally staying warm in the winter and cool in the summer. Because the floor and walls are doing double duty as thermal flywheels, temperatures also remain very even throughout the house.

This simple system is effective enough to require backup heat only after cloudy days in December, January, and February. My only backup heat is a large stone fireplace, modeled after the high thermal mass Russian and European designs. Mine also provides domestic hot water. My space and water heating bills are near zero. The cost to build our original design was about $8 a square foot, with lots of our own labor.

Sometimes there are minor problems with having sunlight entering your home. At times I find a certain chair too brightly lit for comfort, but I just move to another. This is the advantage of spreading the windows out along the southern wall; you have some solid wall in between windows to minimize glare and provide some shaded areas. I suppose the sunlight also helps fabrics fade, although I haven't noticed this occurring. People in more populated areas may have some privacy concerns with a lot of large windows facing their neighbors, but this can be designed around, possibly
going to a Trome wall, or indirect gain system.

An attached solar greenhouse, or sunspace, can provide heat, food, beauty, and additional room. Plants thrive in them. My 8' x 18' attached solar greenhouse cost $250 to build, and my wife enjoyed it and what it can do for plants so much that we now have a 22' x 48' freestanding greenhouse for her plant business. Properly placed vegetation is also important, even for houses with no solar aspect. Deciduous trees, shrubs or vines on the east, west, or south sides will lose their leaves in winter to allow sunlight in, while providing cooling shade in the summer. Evergreen foliage on the north side will buffer winter winds.

Solar hot water
Solar hot water can be added to existing structures, as I did to my house ten years ago. I am now past the point where the money I invested in the solar water heater equals the money I would have spent on electricity to heat water. Consider the fact that in the next five to eight years you are going to pay the cost of a solar water heater, whether you buy one or not.

It's your choice. You can invest in solar now, demonstrating your support for sustainable energy, and getting free hot water after your payback period, or continue to pay ever-increasing energy bills, which indicates your support for

maintaining the status quo. Cooling Passive solar design is not just about heating. Many solar design considerations also help with summer cooling. Thermal mass resists overheating, direct earth contact through slab-on-grade, and earth sheltering all contribute to cooling in hot weather. The most efficient shape of building for maximum winter solar gain is elongated along the east-west axis, giving a large south facing wall and smaller east and west facing walls. This design also minimizes unwanted summer heat gain on the hot east and west sides.

Radiant barrier placed in the attic or roof system can reflect 97% of radiant heat, keeping the excess solar gain in summer from the living spaces. Light colored roofing also helps. Vegetation is usually the best shade, because it is later arriving in the spring, when we need more solar gain, and usually gives shade into fall, as well as providing its own evaporative cooling effect.

As sure as the sun will rise tomorrow, our energy costs will also continue to rise. Getting heat from sunlight is economical, ecological, dependable, readily available, time tested, powerful and empowering. This free and equally distributed energy source arrives at our homes almost daily. Let's all try to make better use of it, for our own well-being as well as the planet's.

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