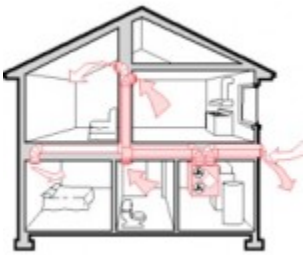
HEAT EXCHANGERS

Whole House Fan

In the attempt to make the house as energy efficient as possible, there are quite a few heat exchangers set up around the house to take help keep all the warmth and coolth in it's proper places. Some are active, some are passive, and they run the gamut of passing heat from air to air, air to ground, water to water and air to water. Here is a run down of our systems:



Heat Recovery Ventilation in action

Heat Recovery Ventilation

HEAT RECOVERY VENTILATION (or HRV): In the picture at right where you see the ducts hanging down, is the space in the garage where our HRV unit will go (the square insulated duct is the air intake). In the

winter when it is cold outside, the windows and doors are shut tight, and our super insulated house will do a great job of keeping all the warmth inside where we want it. Unfortunately, it will also be keeping lots of stale air and indoor pollutants in. To keep indoor air fresh, many building codes call for an air exchange rate of .35 air exchanges per hour. It used to be that, in leaky drafty old houses, this happened naturally through the poorly insulated walls and around windows and doors, but with our tight construction, we would fall way below this if we didn't actively ventilate the house. Simply turning on a vent fan, and blowing 1/3 of our nice warm air outside every hour would mean a lot of energy going out with that warm, stale air. Enter the HRV – an exhaust system that draws warm air from the potentially stinkiest areas of the house (like the bathrooms and kitchen). It then passes that air on its way out the house through an air to air heat exchanger where it passes it's heat to the fresh (but cold) incoming air. You can even get units with HEPA filters! The warmed clean air is then vented into bedrooms and living space, setting up a stable airflow through the house, and scavenging about 75% of that heat that would otherwise have been lost. In the Spring when we open the windows again, we'll turn off the HRV until next winter.

Earth Tubes

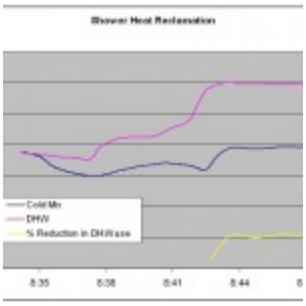
EARTH TUBES: In the summer evenings, when the air inside the house has spent the day heating up, most of the time we will be able to simply open the windows and turn on a whole house fan (the monster fan you see as the main picture on this blog entry). Because this fan blows into the attic space, it also pushes the super heated attic air out, further cooling the upstairs bedrooms. On those awful hot days when the outside air isn't much better than the inside air, however, we'll keep our windows closed when we turn on the whole house fan, and the earth tubes will come to our rescue. These tubes are embedded deep in the concrete foundation, and run all the way around the house. As we draw our ventilation air in through this air/ground heat exchanger, we will be cooling the air we bring in. The picture at right shows the point in our great room where the (currently capped) tubes will bring air in behind a vent screen. (see the "Earth Tubes" blog entry from 6/20/09 for more pics and details)

1" Copper Pipe in the Wine "Cellar"

Heat Exchanger

THE WINE CELLAR: The ideal wine cellar is a cave that stays between 55F-58F year round. Around here in Mountain View, our deep ground temperature is 62F on average. It is OK to store wine as high as 65F if you can keep it constant (high temperatures and fluctuations will rapidly oxidize the wine, and even a constant 62 is still going to age wine faster than ideal), but digging a deep cellar in this seismically active area would have been very expensive, and putting our wine in a wine refrigerator seemed to fly in the face of green design. So we decided that if we can't put our wine cellar in the ground, we'd bring the ground temperature into our wine cellar in the form of the domestic water supply. This is another way to use the "coolth" stored in the ground. Every time someone turns on a tap in the house, 62 degree water comes in and passes through an air to water heat exchanger inside our heavily insulated wine cellar, cooling the air. It will be interesting to see how well this works. At right you can see where our 1" copper water pipe passes through the wall, and it will be stubbed out and connected to a bank of hydronic baseboard heater heat exchangers. We have run wiring to the room so we can monitor the temperature and see how this passive cooling system works. We'll monitor it for about a year before we put any really expensive wine in there (not that we're going to be able to afford any expensive wine after building the cellar for it!)

Shower Heat Recovery



Ross Koningstein's Shower Heat Recovery Data

SHOWER HEAT RECOVERY: When you take a shower, think about all that nice warm water going down the drain. That is a lot of heat! It turns out that if you use a water to water heat exchanger, you can use the draining shower water to preheat the incoming cold water. This system is made by GFX, and you can see the cold water coils at right wrapped around the shower drain. Ross Koningstein who instrumented his house in Atherton and is measuring the effects of all of his green tech actually put thermocouples on his input water and measured the flow. The graph I stole from his website www.greenerhouse.info is at right, and since he took the data, I figured I didn't need to repeat the experiment. From his measurements, you can reduce your hot water use by 20% after the first minute of the shower.

Source : http://www.301monroe.com/?p=206