Hot water storage systems

Using solar collectors , heliostats or tracking concentrators to heat water for domestic and home heating is well on it's way to becoming the energy of choice for the future. What has lagged behind is the storage methods of the energy. Hot water storage systems are nothing new, so why are the choices so limited? ON this page, I hope to offer some help on this topic. One that I have been participating in since I designed and built my home. Since then I have built two other large hot water storage systems, mainly for small indoor wood fired boilers, with solar supplement. This all can be easily done by the average handyman and for a fraction of the cost of available readymade ones.

First, using firewood, at least in the northern areas, will be the fuel of choice if there is a decline in the availability of oil, natural gas or propane. Unfortunately, using firewood, just like cheap oil, has only recently prompted manufactures to build high efficiency wood burning products. Gasification is the best, but still is unaffordable for most. I have to mention that there are alternatives out there, but most people, as our "concerned" leaders of our government know, are poor and are teetering on possible poverty, so they cannot afford $6 to $8000 for the commercially built gasification systems. This has to change. There needs to be mass production in the USA, not China. Some of these boiler systems cost as much as a brand new Hyundai and there's nothing to them. The way that firewood is being burned and used to heat today is primitive and so outdated and inefficient. An off the shelf "air tight" wood stove has an efficiency rating of less than 40%. That is, the amount of BTU's that a pound produces, converted to the amount of heat that is made available to the purpose. One pound of oak firewood produces 6400 Btu's. A cord contains 24,000,000 Btu's. A gallon of #2 oil contains 138,000 btu's. If a 2000 sq ft home is using 7 or 8 cords of wood to heat the house, then they are using all most 200 million btu's which would be equal to 1400 gallons in oil. It is well known that most older oil furnaces have a very low efficiency rating. Firewood has been like oil, cheap and available. But that has changed. Seasoned firewood in the RI area, is going for $200 to $300 a cord. So getting the most from the firewood is becoming as important as good gas mileage for your car.

Storing the energy of firewood using a hot water boiler and using it on demand is the most efficient way to get the most from any biomass. In this case, I am illustrating here a simple to build hot water storage system that most any one could build. I made my tank out of 3/4" BC plywood, secured at the corners with a heavy angle iron frame top and bottom. In hindsight, I would add the angle iron at the corners and centers as well.

After 5" of insulation was placed next to the outer layer of plywood, a/2"



was put up against that. Then I epoxied the whole thing including multiple layers in the corners. I thought that I could use the tank like that, but the heated water softened the epoxy and eventually parted and leaked at the seams. So I added a high temp liner made by a liner company out west. This works well and can handle temps of 200 F or more! It has worked very well for over four years. Basically I keep the tank heated to 160 to 180, and will let it run down to 110 before relighting the boiler. The usual recharge time, or burn time is 6 hours, or 15 sticks of oak, or about 110 lbs of wood. When outside temps is 30 to 40 F, the tank will need to be recharged every three or four days. Heating for the house pulls the tanks temperature down drastically, while the domestic usage draws very little from the storage. In the dead of the winter when temps are below 20, I will have to light a fire and burn each day, but not as long. If I had made the tank 1000 or more gallons, I would have been able to go every other day in the coldest of weather. In the summer time, once the tank is charged to 160 to 180, it will supply domestic hot water for 10 to

12 days from one firing of the boiler! That is very efficient, from 15 sticks of wood to have all your hot water for such a long time.

Two of the systems that I have been involved with the construction was by my friend Jim. He opted to set up forms in his basement and pour a 10" wall of concrete for the tank. He made it large enough to hold 1400 gallons. He had an older Tarm wood boiler in place that was tied into a conventional hot water baseboard system, but it never worked well. Now he has this huge heated reservoir so that when the house calls for a lot of hot water at once, it has it, and then when its not using it, the wood boiler is charging the tank. This has worked very well for him. His domestic hot water is coming out of there as well.

There are also plans for a very similar hot water storage system at www.builditsolar.com. They are using EMBM rubber membrane which is fine for temperatures of 140 F or less, and that is what solar heated water would be maximum. Also at www.woodboiler.com or www.tarmusa.com in New Hampshire, they are selling premade tanks. There is a pressurized steel tank, which is more common in Europe, and makes a lot of sense, doing away with the copper coils. Opess has been making the round easy to assemble version for years, but quite pricey. Once this tank is in place, an additional coil is put in place so that the water is heated by solar as well. I don't understand why it is done more. It works excellent.

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