

HOW TO-SOLAR HOT WATER



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Heat your water or home for less than \$500.

Heating water for a shower or water to circulate in a floor radiator or underfloor heating system is accomplished with the same method.



This is the concept. Anything black or very dark colored absorbs solar radiation or heat energy. Anything light colored or mirrored/shiny reflects the heat back up into the atmosphere. This process involves placing several feet of black hose in the sun and circulating a liquid inside the tubes to leach the heat out. This heat is then released inside a water tank for heating water or radiator system to warm your home.

How much energy?

HOW MUCH ENERGY?

It is estimated that the sun produces 1000 joules of heat energy per square meter (about 3.3 feet by 3.3 feet). 1 Joule equals 1 Watt. So 1.5 square meters (the size of a small kitchen table) equals 1500 watts or one hair dryer. It is not possible to retain 100% of the solar energy. This is where the word efficiency comes into play. While black objects absorb much of the sunlight's heat, some is lost due to reflection, atmospheric leaching and wind. Realistically we will be capturing about 60% of the solar heat.

YOUR ROOF OR YARD.

If you will be installing this system on your roof, measure the sq. footage and divide by 9. Example (20 feet x 40 feet equals 800). 800 divided x 9 = almost 89 sq. yards. This equals 81 sq. meters. 81,000 watts of power (10 times your maximum usage) in a perfect world. Subtract for efficiency and you are at 46,000 watts of heat energy. Consider that it is unrealistic to completely cover your entire roof 100% and you drop to about 10,000 watts. THAT IS STILL A LOT!

The Basic POLY System

For our system we use BLACK POLY HOSE. This hose is cheap per linear foot and absorbs heat very well. In a later section we cover using steel tubing. While it works much better, it is expensive and requires advanced building skills. If



you have it or found several 10' pieces of scrap material, by all means USE IT! Also black 5/8" water hose is fantastic, easy to connect and a great alternative but does not last as long (3 years).



Ploy hose is designed for sub-terrain sprinkler systems and is not intended for this use but it holds up well in the sun (10 years+) is easy to replace if damaged and easy to find. LOWES or HOME DEPOT. At first the hose will seem like a pain in the A%# to work with but if you follow it's natural desire to curve, you can make ever expanding coils that will not be a total eyesore on your roof.

PARTS REQUIRED 500 FEET 3000 usable watts.

I will go into details as much as possible with each system and you can add more or less for your project based on budget and space.

1. 500 ft poly hose 1/2" dia. (5 rolls)
-----or (10) 50' sections Black Garden Hose
2. 10' length 1/4" CPVC (Poly pipe use only)



3. All Purpose PVC GLUE and Hose Clamps.

4. A Mixing Tank ----- Useable HOT WATER ONLY See Mixing Tank (BELOW)

Note: This is not needed for floor heaters or radiators or if you are using metal pipe. The Mixing tank prevents leached chemicals from Poly and rubber hose from entering your hose environment. If you don't drink it, you are safe.

5. 6-12 VOLT Water Pump.



6. Deep Cycle Battery

7. 36 watt Solar Panel

20 watt no battery needed



8. 12 Volt A/C Battery Charger. Optional

9. Solar Panel Charge Control Regulator.



GETTING STARTED



1. Attach all of the poly hose together by inserting a 8" long piece of 1/4" CPVC into the open end. It should be very tight and hard to insert.



5. Tighten with hose clamps and repeat as necessary so you have a long 500" length.



2. Coating with cooking oil will help.



3. Slide the CPVC into place and use a wooden block to hammer it half

way in. (You may taper the CPVC with sandpaper to allow for easier initial insertion. Once it is fully in place, attach hose clamps. We use this method verses standard couplings with glue as they will leak or pop off when heat builds up.



4. Insert the second side as much as possible. This requires a bit of strength. Use a heat gun or hair

dryer to softer the material if needed.

If using Black Garden hose, simply screw them together (much easier but more expensive).

6. Coil the hose into one big loop or several small pods so that no hose overlaps itself. This is where creativity comes into play.

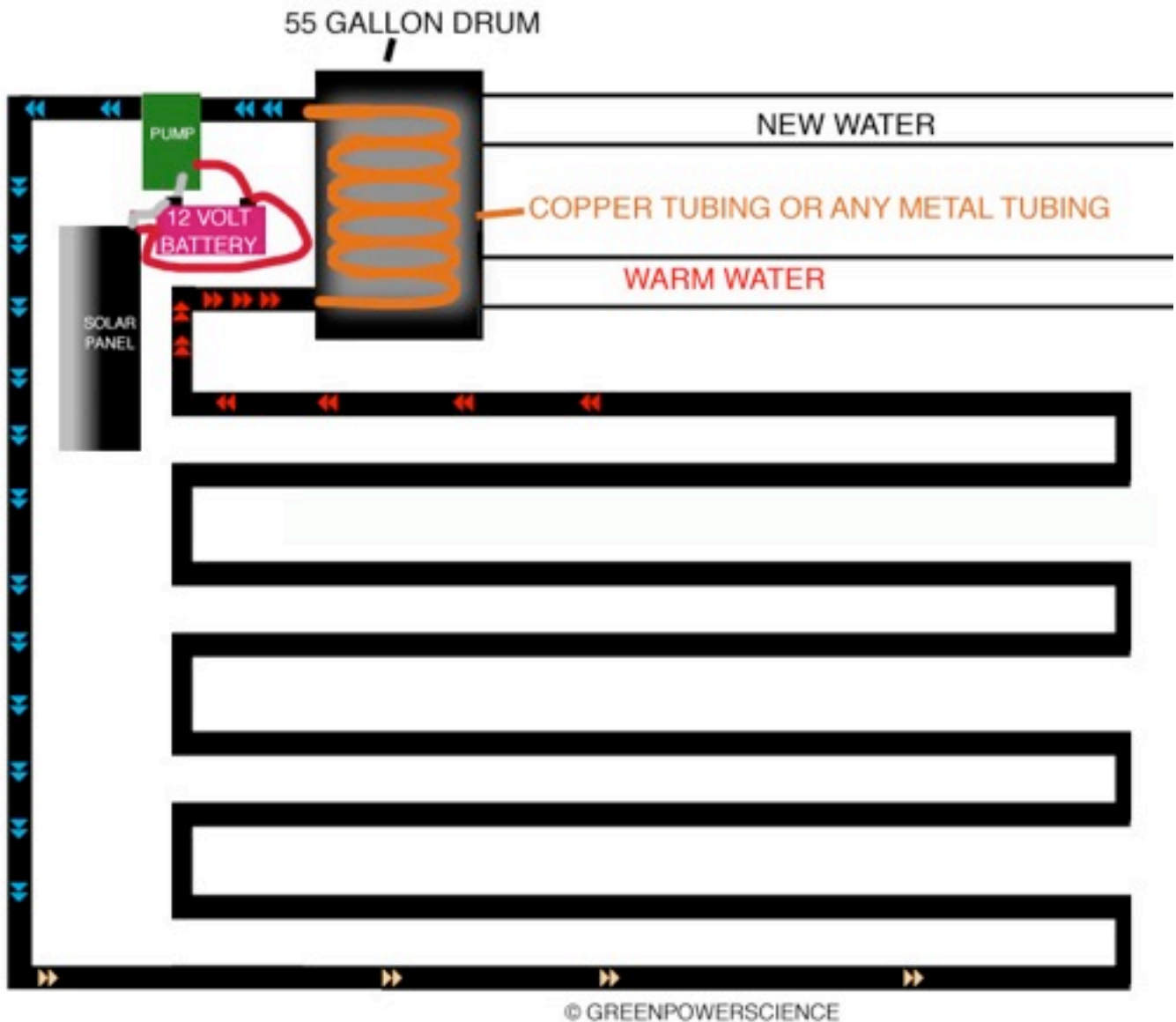


If you have extreme housing restrictions you will need yo build a flat area in your back yard. This system works well in on the ground also but any grass or snow is a bad thing as it blocks the sun. Regular garden hose may be placed in long strands back and forth. The poly tube is better coiled.

7. Attach standard hose fittings and place a 12 volt pump on the cool side of the system. (See illustration below.



BASIC PLAN A



BASIC PLAN A HEAT EXCHANGER

The solar panel charges your battery (Optional if your panel is strong enough) and the system circulates hot water or Glycol into your tank. This heat is leached by the usable water in the storage tank. The 55 gallon drum can be replaced with a standard electric water heater. This takes some work but it can be done. The 12 volt batter charger is needed for days when the weather is cloudy for a while and your battery needs an additional boost or in replace of the solar panel. Strong panels alone are the best choice as they do not run the pump when cloudy or dark. This acts as a natural regulator for night.

BASIC PLAN B

DIRECT SYSTEM

I personally use the direct system as the concern for chemical leaching is more for drinking purposes and breathing excessive steam. If you will be adding the system as a pre-heater to an existing gas or electric hot water heater, I would advise Plan A especially if you are a steamy shower type. I like warm showers and have my direct system attached to an outdoor shower. Black garden hose (not polytube) contains several warnings in regards to chemicals. This is a lead warning regarding the brass connectors. If you are concerned, cut off the connectors and attach with CPV as listed above. It is worth noting that ALL electric water heaters have plastic contact the warm or hot water so the chemical leaching is actually less in a direct system than a standard electric heater. Also since you ARE NOT DRINKING (never drink tap water) you actually get much less exposure than bottled water.

SIMPLE

Attach several feet of black hose to the cold water, allow the sun to do the work (11am -5pm). 500 feet will heat 70 degree well water to 120 degrees Fahrenheit in one hour and 150 degrees in 3 hours. In summertime Central Florida, I have experienced unused water reach 170 degrees in my 15 gallon system. A 500' section 5/8" to 3/4" holds about 10 gallons of water. As it is used, it gets gradually cooler but even at 2 GPM, the water is noticeably warmer after the first 10 gallons are used. This past summer I filled three rain barrels for testing at 2 PM Results: barrel one 50 gallons = 110F(first 20 gallons 20 F) barrel two 50 gallons (100 gallons continuous) 97F barrel three 50 gallons (150 gallons continuous) 89F. Starting water temperature 72F. This was on our 9FT x 18F carport galvanized silver panels. This adds additional heat from reflection and the sheets, even though they are silver colored, they heat up to 140F. I have discovered that black roofing acts as a passive heater to the hose and works better than silver or mirrored backing. If you are deciding on a new roof in the future, go white, light or silver, dark roofs are pointless in the south and increase global warming, drive up AC costs \$30-\$100 a month depending on roof size.

STORAGE FOR CABINS

Night falls on your wilderness cabin and you only have 10 gallons of hot water in that hose? You want the simplicity of the direct system without tearing a hot water heater apart. This is where the 55 gallon rain barrel drums placed off the ground comes into the picture. By allowing the system to drip at 5 gallons an hour, you can store the hot water in this tank that must be painted black on the outside (pepper barrels are black no reactive food grade plastic. The sun will heat the tank and keep the water very warm. While the sun will not transfer enough energy to heat a full cold 55 gallon drum throughout the day, it will keep the water hot, what has already been heated. Adding a solar blanket at night will extend the heat retention for 10 hours. If you have a rain barrel, fill it up with cold water, let the sun heat it up. At the end of the day the water on the top 30% will be very warm, the lower 70% will be cold. An excellent example of the thermal abilities of large bodies of water. This is why the drip system works so well. If it is very cold outside, use a thermal blanket all day.

MAKE IT STRONGER



By simply searching for table tops with chipped corners, old unused glass doors or the best option, a double paneled window as large as possible, you build a custom box out of 2x4s. This is simple framing cut to size, place silicone

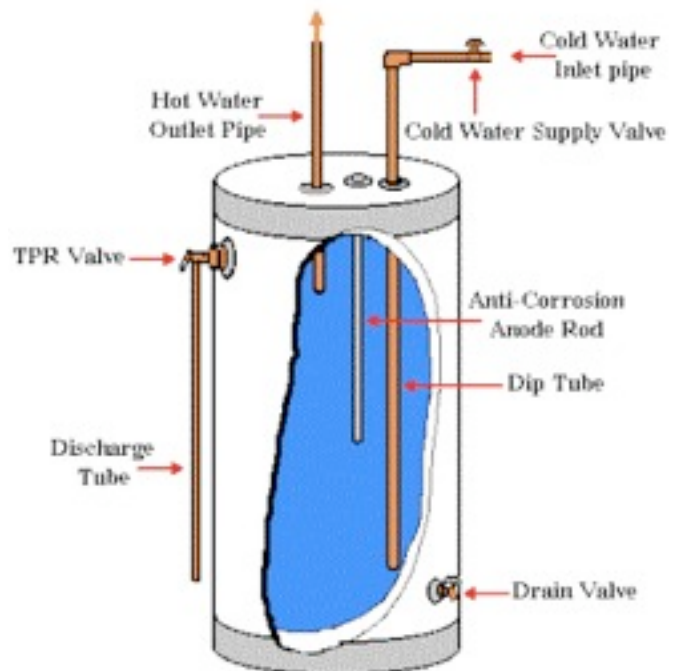


around the edges, seal with the glass. on the backside use a black piece of plywood or “Hardee Board” which is weather proof. Your hose coils inside the box. Some people think silver or mirrored surface are better thing that the light will double on the hose. In fact a passive heat transfer is much better. Because the inside of the box is painted BLACK, your box gets much hotter and your hose is in a baking environment vs a bright mirror box. I have tested both, the black box produces 15% more heat especially on cold days.

I have a shortened video of this process on our website GreenPowerScience.com. We also have a forum where you can add your ideas and experiences with this or any other solar project.

HEAT EXCHANGER

A heat exchanger is simply a copper tube with hot liquid inside submerged in a water bath, the heat is leached to the water bath. By water bath I refer to a tank. To convert from an existing electric hot water tank, simply remove the anode rod and place as much 1/4” copper tubing inside and seal. By removing the rod, do not use this tank of electric, you will have stink water fast. Never remove the pressure release valve. Some Electric heater have replaceable heating elements, this is another access point to the water core. A system like this is designed to hold household water pressure so you can add this tank prior to your electric or gas providing very hot water entering your electric tank preventing the thermostat from turning on saving you a bundle. Basic Plan A shows a metal 55 gallon drum, this will hold pressure but you need to know how to weld.



COLD NIGHTS

One problem with water system is cold nights. If you have a direct system feeding your hot water tank, an additional set of valves are needed to cut the roof system out of the loop, no sense in heating freezing cold water, this will run your bill way up at night. So make sure you have a diverter. You can install an automatic systems on a timer, I do it manually. If your have a heat exchanger system, simply add an additional 25 ft of tubing in and out on each side of your tank inside your house. This will prevent leaching.

