

# SOLAR WATER HEATER BY WASTE PLASTIC BOTTLES

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**Abstract-** Solar water heating (SWH) is the conversion of sunlight into heat for water heating using a solar thermal collector. A variety of configurations are available at varying cost to provide solutions in different climates and latitudes. SWHs are widely used for residential and some industrial applications. A sun-facing collector heats a working fluid that passes into a storage system for later use. SWH are active (pumped) and passive (convection-driven). They use water only, or both water and a working fluid. They are heated directly or via light-concentrating mirrors. They operate independently or as hybrids with electric or gas heaters. In large-scale installations, mirrors may concentrate sunlight onto a smaller collector.

## I. INTRODUCTION

### Make A Solar Water Heater with Stuff You Have lying Around the House;

A standard solar water heater these days can cost above \$1000. Not many people can afford that. Fortunately, with a little bit of ingenuity and creativity, you can build your own solar water heater using empty plastic bottles as the main components. It can take you some time to build the thing but the assembly process itself is a walk in the park. It's just a matter of running lengths of drip tubing inside and around large plastic bottles. The empty bottles work as greenhouses by trapping heat then transferring these to the water running through the tubes. The water is pumped through the tubes by a 9-volt direct current motor pump which is in turn attached to more than one solar cells.



Fig.1 Assembling the homemade solar thermal hot water system

### The materials required for building the water heater:

We have used 6 water bottles that can accommodate 2 liters of water. These will serve as heat-accumulators. These 6 bottles are

enough to heat a mug of water. With that said, if you want to heat a larger amount of water, then you need to scale the number of water bottles that you are going to use. You'll also need coils of 4 millimeter pvc tubing. Each bottle will use at least 3.5 meters of this tube. Doing the math, you must have at least 21 meters of the coil to be used in all 6 bottles.

To connect the bottles to each other, you need small T-connectors. These elbows and connectors should fit well with the 4 millimeter pvc tubing to avoid leaks and water run-off. And last but not the least, you must have a 9 direct current water pump. You are going to utilize this pump to move the water inside the tubing and around the solar-heated water bottles. It's best that you power the motor pump using solar cells. But if solar cells are not available, you can always power the pump using standard electricity. If you want the bottles to capture more heat from the sun's rays, you can paste aluminum sheets at the bottoms of the water bottles.



Fig.2 Proposed working model

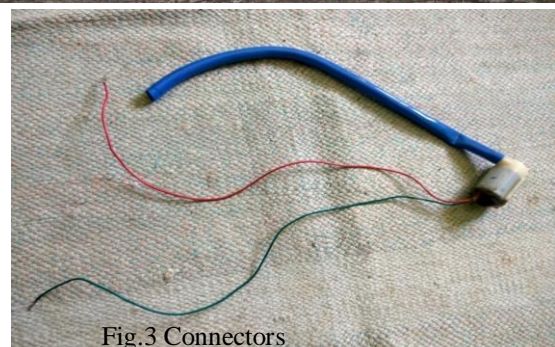


Fig.3 Connectors

### The Basic Steps In Assembling The Solar Water Heater

Step 1: Create two holes in the caps of all the 6 bottles. Cut

190cm pvc tube of 1cm diameter then place it inside a water bottle. Both ends of the pvc tube should be sticking out of the holes you've made in the bottle caps. Do this with all of the 6 bottles. Connect the bottles to each other using T-connectors. Make sure that water can pass unencumbered through all the bottles.

Step 2: After connecting all the bottles with pvc tubes, you should end up with two main tubes which you are then going to put in a bucket or drum of water. To make the water run through the solar-heated bottles, you need to pump the water using the 9-volt DC motor pump. As the pump cycles the water through the tubes and bottles, it gets increasingly heated. You can turn off the pump when you've achieved the level of heat that you wanted.

Always remember that you can scale the assembly process by increasing the water bottles to 10, 14, 16 or even above.

## II. COMPONENTS

The only material required to build a recycled water heater are:

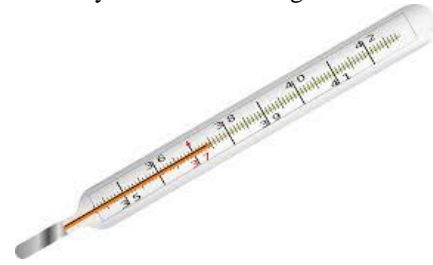
- 2L plastic bottles (6),
- PVC pipe (190 cm per bottle, dia-1cm)
- PVC T-connectors (20)
- 20 mm PVC end caps (2)
- PVC glue
- Black matt paint
- Paint Roller
- Dc motor pump

1. A **plastic bottle** is a bottle constructed from plastic. Plastic bottles are typically used to store liquids such as water, soft drinks, motor oil, cooking oil, medicine, shampoo, milk, and ink. The size ranges from very small sample bottles to large carboys.



2. A **thermometer** is a device that measures temperature or a temperature gradient. A thermometer has two important elements: (1) a temperature sensor (e.g. the bulb of a mercury-in-glass thermometer) in which some physical change occurs with temperature, and (2) some means of converting this physical change into a numerical value (e.g. the visible scale that is marked on a mercury-in-glass thermometer). Thermometers are widely used in industry to control and regulate processes, in the study of weather, in medicine, and in scientific research. There are various principles by which different thermometers operate. They include the thermal expansion of solids or liquids with temperature, and the change in pressure of a gas on heating or cooling. Radiation-type thermometers measure the infrared energy emitted by an object, allowing measurement of temperature without contact. Most metals are good conductors of heat and they are solids at room temperature. Mercury is the only one in liquid state at room temperature, and has high coefficient

of expansion. Hence, the slightest change in temperature is notable when it's used in a thermometer. This is the reason behind mercury and alcohol being used in thermometer.



3. Regular **PVC** (polyvinyl chloride) is a common, strong but lightweight plastic used in construction. It is made softer and more **flexible** by the addition of plasticizers. If no plasticizers are added, it is known as uPVC (unplasticized polyvinyl chloride), rigidPVC, or vinyl siding in the U.S.



## III. BLOCK DIAGRAM

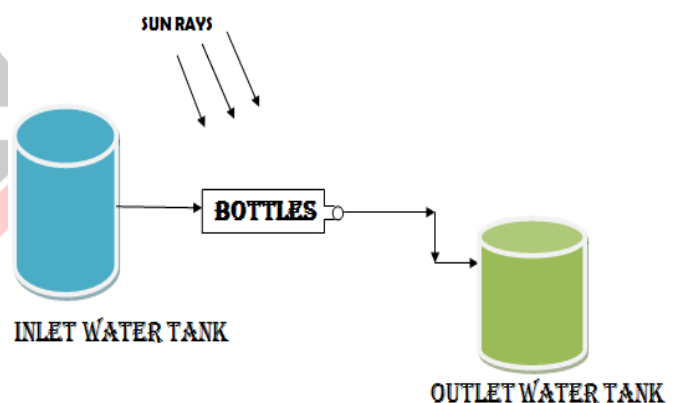
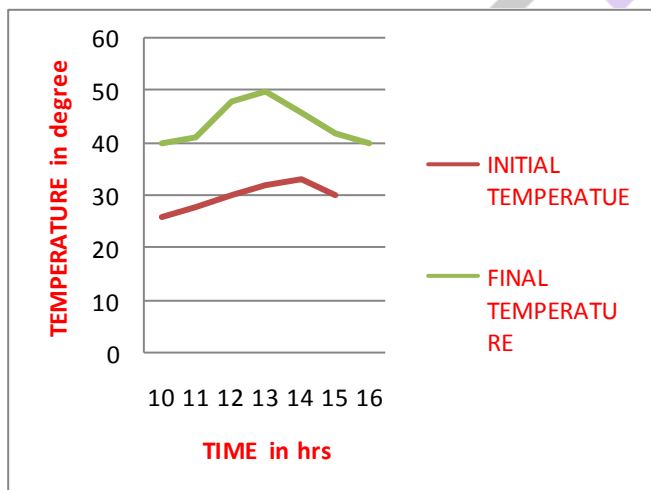


Fig:4 Block diagram representation proposed method

#### IV. TABULAR COLUMN

Time	Atmospheric Temperature	Initial temp(water)	Final temp(water)	Duration
10am	31°C	26°C	40°C	1hr
11am	32°C	28°C	41°C	1hr
12pm	36°C	30°C	48°C	1hr
1pm	34°C	32°C	50°C	1hr
2pm	30°C	33°C	46°C	1hr
3pm	28°C	30°C	42°C	1hr
4pm	25°C	24°C	40°C	1hr

#### V. GRAPH



#### VI. CONCLUSION

The above table shows that the solar water heater using plastic bottles we can save the electricity and also the environment. The cost can be less using the waste plastic bottles.

#### VII. FUTURE SCOPE.

- Instead of black coated bottles we can paste a sheet of aluminum foil in order to concentrate more heat inside the bottles.
- The solar water heater is scalable, so you can connect more bottles and groups of bottles in order to heat a swimming pool.
- Inserting one more coated water bottle into uncoated water bottle in order to accumulate more heat.

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