

# Design and Fabrication of Solar Powered Water Purifier and Cooler

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**Abstract**—“Design and fabrication of solar powered water purifier and cooler”, deals with the fabrication of a system that will achieve water cooling by utilizing the solar energy which will be beneficial for households both rural and urban. Cooling process employs different methods to cool water. But considering the lower application and cost effectiveness, the water cooling by using thermoelectric module (Peltier effect) and filtration system is considered for our project.

The present water cooling technique/system is producing cooling effect by using refrigerants like Freon, Ammonia, etc. Using these refrigerants one can achieve maximum output but one of the major drawback is its poisonous gas emission and global warming we can cope up this problem with use of thermoelectric module and thereby protecting the environment.

This project deals with the thermoelectric water cooling using Peltier effect is discussed.

Thermoelectric cooling system have advantages over conventional cooling devices such as small in size, lightweight, highly reliable, no moving parts and working fluid.

**Keywords**— Solar energy, solar panel, peltier module, water purifier and cooler.

## I. INTRODUCTION

Solar energy is the light and radiant heat from the Sun that influences Earth's climate and weather and sustains life. Solar power is sometimes used as a synonym for solar energy referred to electricity generated from solar radiation. From decades humans have been using solar energy in various forms such as wind, tidal, biomass etc. Solar energy technologies can provide electrical generation by means of heat engine or photovoltaic means. Sunlight can be converted into electricity by using photovoltaics (PV), concentrating solar power (CSP), and various experimental technologies. PV has mainly been used to power small and medium sized applications and medium sized applications, from a calculator powered by a single solar cell to off grid homes powered by off-grid photovoltaic array. In this project, the voltage developed by the solar panels will drive the entire system setup which includes the thermoelectric module. Thermoelectric cooling also referred to as TECs (thermoelectric coolers) has advantages of high reliability, no moving parts, compact in size and light in weight. In addition it possesses the advantage that it can be powered direct current electric sources, When a voltage is applied to two dissimilar conductors, a circuit can be created that allows continuous heat transport between the conductor's junctions this is the principle of thermoelectric cooling. Direct conversion between electrical and thermal energy is possible because of the important effects: Seebeck effect and Peltier effect. The method into consideration is the Peltier effect which refers to the absorption of heat into one end of a thermoelectric material and release of heat from the other end due to flowing current through the material. The cooling technique which is utilized in this project is Thermo-electric cooling also known as “Peltier Cooling System” which is a thermoelectric device and consists of semiconductors. The main advantage of using this effect is that it lacks moving parts compared to other refrigeration cycles; Thermoelectric can be used for cooling electronic devices and as refrigerator and air conditioners.

### 1.1 Components used

#### 1.1.1 Solar panel

Thermoelectric cooling, commonly referred to as cooling technology which makes use of thermoelectric coolers (TECs), has advantages of high reliability, no mechanical moving parts, compact in size and light in weight and no working fluid. Air conditioning removes heat from a room and other applications. The harmful gasses are chloro fluoro and some other gasses are present.

#### 1.1.2 Fans:

A standalone fan is typically powered with an electric motor in this project, two small dc fans will be used in the heat sink in order to cool the hot side of the peltier module by increasing the heat transfer rate by supplying the air at the ambient temperature to the heat sink which will increase the durability of the peltier module eventually.

### 1.1.3 DC pump:

A pump is used for recirculation purpose which will be attempted multiple times since achieving the desired water temperature is not possible in the single pass through the heat exchanger by using the pump and through the recirculation the temperature of the water will be gradually decreased to the desired temperature, pump will be controlled by the thermostat attached to the wall of the tank.

### 1.1.4 Peltier module:

It is the main component in the cooling system. It is a flat structure with the thickness of (7.10)mm, it generates the temperature difference across the two surfaces on the application of dc power supply to its terminals, the modules like (TEC 12715) are capable to create the temperature difference of 68 degree Celsius in other words the cooler side can reach the temperature upto - 20 degree Celsius.

### 1.1.5 Thermostat:

A thermostat will be attached to the wall of the cooling tank. which serve two functions, first one is it will sense the water temperature and second one is it will control the functioning of the dc pump for the recirculation it will be programmed to supply electricity to the pump until the desired water temperature is reached.

### 1.1.6 Heat exchanger:

A heat exchanger is the aluminium frame attached to the cooler side of the peltier module It will extract the heat from the water which will be passed through it.

### 1.1.7 Float valve:

Float valve will be used to maintain the water level in the tank.

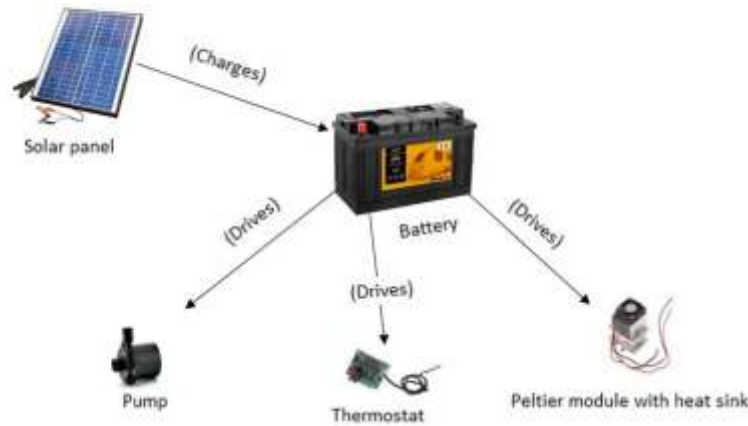
### 1.1.8 Battery:

Thermoelectric cooling, commonly referred to as cooling technology using thermoelectric coolers (TECs), has advantages of high reliability, no mechanical moving parts, compact in size and light in weight, and no working fluid. In addition, a circuit can be created that allows for continuous heat transport between the conductors's junctions this is the principle of thermoelectric air-condition.

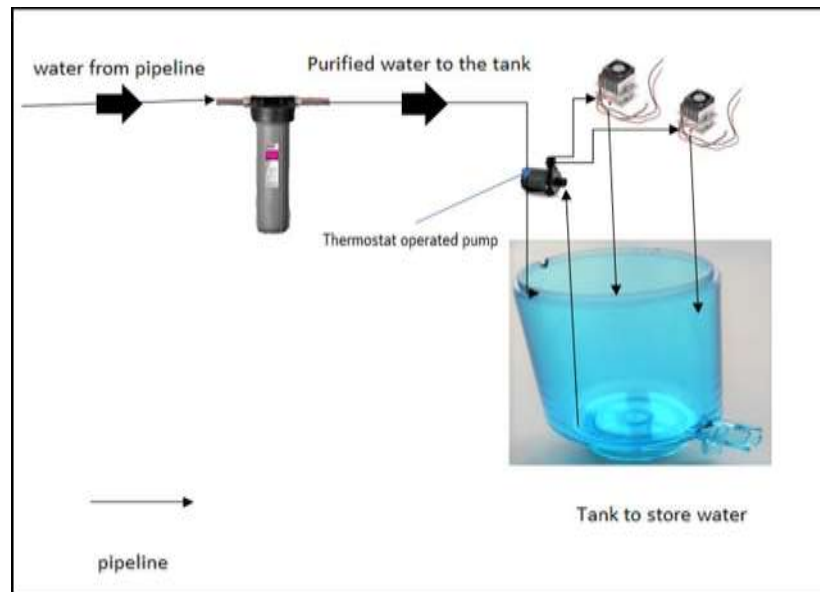
### 1.1.9 Product description:

The proposed model will work through the following five mentioned steps in order to deliver cold water.

- The battery will be charged by the 200W solar panel (100 W each) and this stored electricity will be used to drive peltier module pump and thermostat to control the pump.
- Water from the outsource supply is passed through the filter to remove the impurities and clean it.
- The filtered water is passed through the heat exchanger connected to the cooler side of peltier module while the peltier module is power by the battery to create the temperature difference at the both side of it.
- Because of the vicinity of the colder side the water passed though it is cooled to the temperature lower than room temperature.
- The sensor of the thermostat will attach to the inner wall of the container so that it will sense the temperature of the water if the temperature water is not as per the desired range (8-12) degree celsius the water will be recirculated through the two parallely placed peltier modules which will further reduce the water temperature to the desired range.
- The cold water is drawn out though the tap whenever it is required.



**Fig a. Load contribution**



**Fig b. Water circulation for cooling**

## II. CONCLUSION:

The literature represented in this study describes the importance of cooling water with the help of peltier module. Peltier modules are compact in structure and need very less maintenance. Hence these can be used in household both rural and urban. The entire project can be compact, cost efficient and environment friendly. As stated above this setup will require less maintenance and therefore it will be useful for the people living in the rural areas.

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