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## RESEARCH ARTICLE

## USE OF MODERN IR FILTER DESIGN TO REDUCE TEMPERATURE EFFECTS ON SOLAR PANEL AND INCREASE ITS EFFICIENCY.

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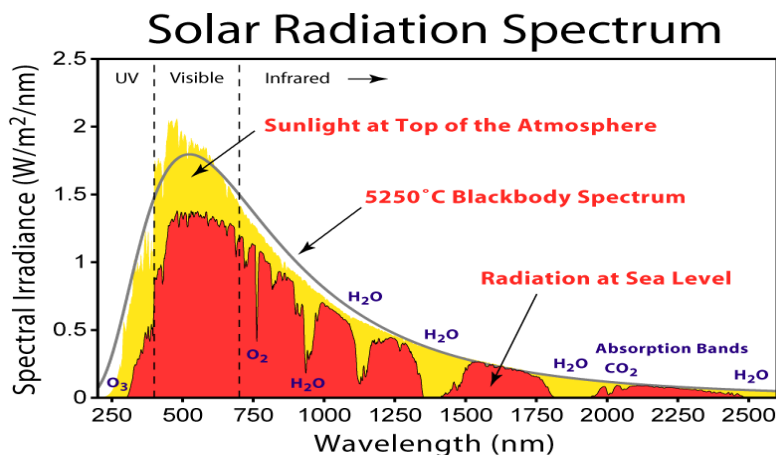
### Abstract

This paper discusses the solution of the problem of decreased efficiency in solar panels due to increase in temperature. This high temperature of panels is due to infrared radiation falling over the panel along with the sunlight. The idea here is to discuss a modern design of IR filter which not only filters the infrared but also utilizes this waste infrared heat for some productive uses like solar heater. For this reason, the filter utilizes a glass box along with flow of water in it which acts as a cooling medium to absorb infrared heat from the sun and only let the sunlight pass.

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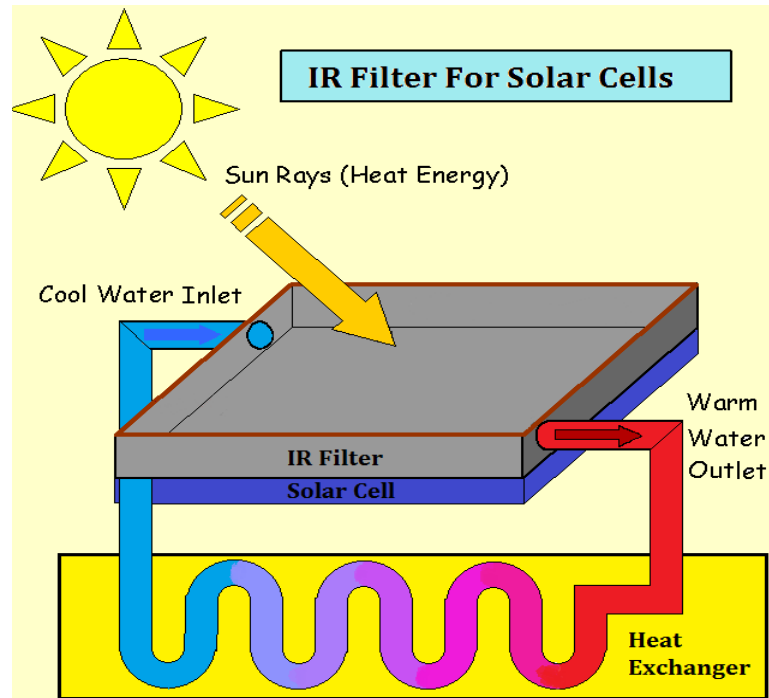
### Introduction: -

Solar energy: radiant light and heat from the sun, has been harnessed by humans since ancient times using a range of ever-evolving technologies. The Earth receives 174 petawatts (PW) of incoming solar radiation at the upper atmosphere. The total solar energy absorbed by Earth's atmosphere, oceans and land masses is approximately 3,850,000 exajoules (EJ) per year. This is more energy in one hour than the world uses in one year. Solar power is the conversion of sunlight into electricity directly using photovoltaic (PV). PV is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect. Photovoltaic power generation employs solar panels composed of a number of solar cells containing a silicon material.

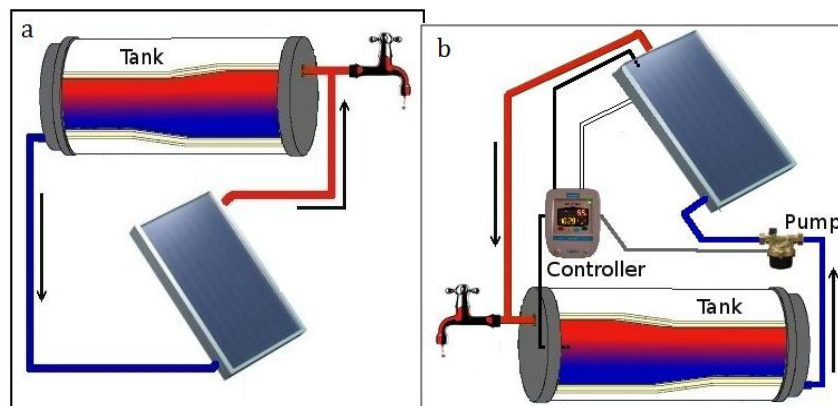


### Material and Methods: -

The design is shown in the figure below. The main idea of this filter is based on almost complete absorption of IR radiation by water. At the same time; the water is almost completely transparent to visible and near-UV light. This filter allows one to take the normally useless heating energy and use it for more productive purposes. The thin water layer can circulate from filter to the heat exchanger, where the water gives heat and comes back into the filter cooled.



Solar water heaters can be either active (see Figure below passive (a) or active (b)). An active system uses an electric pump to circulate the heat-transfer fluid; a passive system has no pump and they have extremely low or no maintenance. However, the efficiency of a passive system is significantly lower than that of an active system.



The reason for very low efficiency of type (a) kind of system is its passive nature itself. During the day time when sun light is falling on panel, it is obvious for the water in the filter box to get hot and as a result it is displaced towards the upper part of the tank due to density difference between the hot water and the cold water. As this system works on natural method of circulation between hot water and cold water, the efficiency is very slow as there is no efficient heat transfer through the liquid medium. On the other hand, the active system uses an electrical pump to circulate the water through the filter box efficiently and lead to an efficient mode of heat transfer through the liquid

medium. Hence, in this medium due to constant circulation of water through the filter box the heat transfer is efficient and capable enough to keep the panel cool and hence maintain its efficiency.

The main disadvantage of this method is the pump required to circulate the water needs electric power but it is to be taken into consideration that the power consumption should not be so much that it practically hampers the increased efficiency.

Here it is important to note that not all the time the pump would remain on and keep circulating the water. Obviously, the water takes some time to absorb the heat energy and also the panels are not so extraordinarily hot enough to heat the water in seconds. Hence it can be said that circulation pump can be used after some instants of time on periodic basis or to have a sensor-controller set which can measure the temperature of module and water and circulate the water through pump whenever needed.

This would reduce the electricity consumption by pump and in turn make system more efficient as well as cost effective.

### **Result and Discussion: -**

The design presented in the above discussion leads to a more profound and effective as well as robust solution for the infrared filter of solar panels. The main idea is to utilize the water which is a cheap and free resource and is easily available in most of the places. Also a tank of water conservator can be installed at the places where no constant water flow is available to ensure the proper cooling of the system. This can be done as by having a cold water conservator tank which cools at night and during day time keeps circulation of water through the panel and does the cooling process. As the hot water is passed through heat exchanger and can be utilized as solar heater application. This could be closed loop application where the water in conservator tank is stored and used for circulation. Another could be the idea when thinking of open loop system where the solar PV panel is covered by such filter and the water getting hot is used for other purposes like the ones obtained by solar heater directly. This system can be used for house rooftops as well as in industries and standalone plants that are installed for domestic purposes. In such cases this methodology would serve as heater as well as cooling filter to increase the efficiency of PV panel. This means both objectives of solar are achieved with higher efficiency and total energy of sun (thermal as well as light) is utilized for the productive use.

In this way this method is quite advantageous to achieve higher efficiency in Solar PV panels.

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