

A Study Paper on Experimental Analysis of Aircooler for Optimum Performance Using Solar Tracking

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Abstract:

This paper deals with a brief article about a solar tracking mechanism & its working explained along with Air Cooler. A solar tracker is a device that orients a payload toward the sun. Payloads can be photovoltaic panels, reflectors, lenses or other optical devices. In this system we will use photo voltaic method to absorb the solar energy usually with photovoltaic panels. The solar panel was tilted according to the sun movement. So this mechanism is called "Solar Tracking Mechanism".

The above figs will give the brief idea about photo voltaic effect & conversion of light to electricity.

Key Words:

solar tracking, solar panel, Solar Tracking Mechanism.

1. Introduction:

The solar panel is converting sun rays to the Electricity by "Photo-Voltaic Effect". This electrical power is stored in a 12-Volt battery. Battery D.C power is used to run the D.C motor and D.C water pump. The D.C motor is coupled with impeller blades. The D.C motor runs during the air cooler button ON, the impeller blades starts rotating. The water pump is used to circulate the water to the blower unit. The forced air is flow through the water which is sprayed by water pump, so that the cold air produced. The switch control is used to ON/OFF solar air cooler circuit. To understand this Paper, we will take an example of air cooler with auto tracking mechanism.

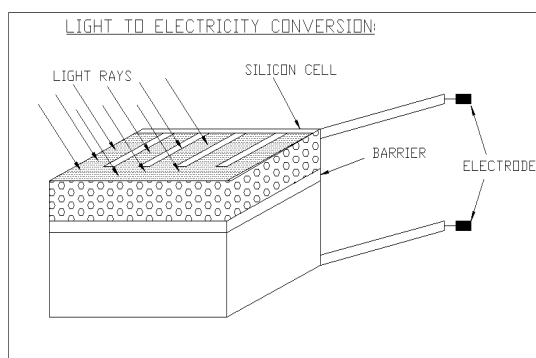
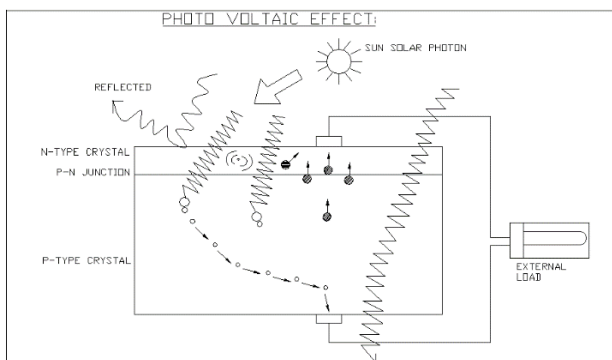


Fig – Physical Setup of Solar Air Cooler With Auto Tracker

2. Components:

Components – Solar Panel, Battery, Blower, Water pump, and auto tracker.

1. Solar Panel:

A solar Panel works on the principle of photo-voltaic principle, the photo-voltaic solar energy conversion is one of the most attractive non-conventional energy sources of proven reliability from the micro to the Megawatt level.



2. Battery :

In isolated systems away from the grid, batteries are used for storage of excess solar energy converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water supplies for storage. In fact for small units with output less than one kilowatt.

Batteries seem to be the only technically and economically available storage means. Since both the photovoltaic system and batteries are high in capital costs. It is necessary that the overall system be optimized with respect to available energy and local demand pattern.

To be economically attractive the storage of solar electricity requires a battery with a particular combination of properties



Battery

3. Auto Tracker :

A solar tracker is a device that orients a payload toward the sun. Payloads can be photovoltaic panels, reflectors, lenses or other optical devices. In flat-panel photovoltaic (PV) applications, trackers are used to minimize the angle of incidence between the incoming sunlight and a photovoltaic panel. This increases the amount of energy produced from a fixed amount of installed power generating capacity. In concentrated photovoltaic (CPV) and concentrated solar thermal (CSP) applications, trackers are used to enable the optical components in the CPV and CSP systems. The optics in concentrated solar applications accept the direct component of sunlight light and therefore must be oriented appropriately to collect energy. Tracking systems are found in all concentrator applications because such systems do not produce energy unless pointed at the sun.



3. Observation:

The Solar Tracker which we are showing in this paper is single axis solar tracker. This is as shown in fig. We may consider this though X-axis or Y-axis. But the rotation of the PV panel should be from the East to West.

Advantage:

i. Compare to solar panel in fixed form, single axis solar tracker has better efficiency. The efficiency of single axis solar tracker over fixed mount panel is 32.17%.

Disadvantage:

- i. Single axis solar tracker tracks sun only from east to west direction.
- ii. Its efficiency is less compare to dual axis solar tracker

Direct power lost (%) due to misalignment (angle I):

Because of not imposing the solar panel to sun rays we may lost the power production capacity. The below chart is representing the % of lost due to misalignment.

I	Hrs.	Lost = 1 - Cos(I)
15°	1	3%
30°	2	13%
45°	3	30%
60°	4	>50 %
75°	5	>75%

Here
I = Incident Angle,
Hrs. = No of hours imposed to sun rays.

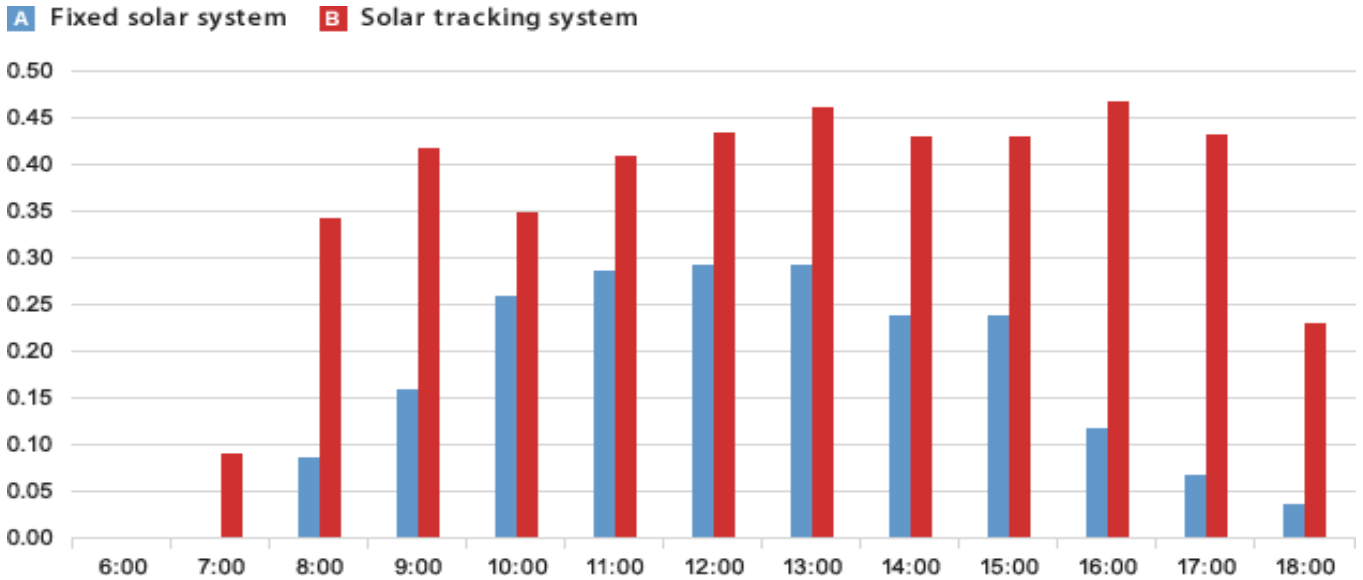
4. Efficiency of Single-Axis Tracking System over Fixed Mount :

The power output for the single-axis and fixed mount panel are tabulated for a single day. The average power values prove that the single-axis panel produces more power than that of the fixed mount. The power efficiency calculated for the single-axis solar tracker is said to be 13% more than that of the fixed mount. The tabulated values are simulated & obtained using MATLAB. Disadvantages This kind of tracker is most effective at equatorial latitudes where the sun is more or less overhead at noon. Due to the annual motion of the earth the sun also moves in the north and south direction depending on the season and due to this the efficiency of single-axis is reduced since the single-axis tracker only tracks the movement of sun from east to west. During cloudy days the efficiency of the single axis tracker is almost close to the fixed panel.

HOUR	POWER FOR FIXED MOUNT (mW)	POWER FOR SINGLE-AXIS (mW)
08.00	20.664	62.403
09.00	39.780	67.473
10.00	44.176	77.212
11.00	70.616	93.772
12.00	88.110	110.430
13.00	104.960	137.160
14.00	125.334	130.754
15.00	105.342	120.335
16.00	86.172	103.096
17.00	70.620	89.910
18.00	46.494	65.625

Table - Power output for the fixed mount and single-axis panel

The below graph will show the difference between fixed solar system & solar tracking system. This will show clear idea of the solar tracking system while in day times.



X-axis: Day time in Hrs. Y-axis: % efficiency.

5. Conclusion:

In this paper we have achieved a clear knowledge of comfort cooling system for human by using non-conventional energy and heating system by power supply. This study would be fruitful in both domestic & industrial backgrounds. We also know about non-conventional energy sources and utilization. This paper although fulfilling our requirement has further scope for improvements. Some of the improvements that could be made in this solar air cooler unit are listed below.

1. By adding solar panel auto tracking system
2. By adding some components to make solar heater cum cooler

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