A REVIEW PAPER ON SOLAR TRACKING SYSTEM

Er. Srishti Goyal[1], Er. Vishvendra Prakash Goyal[2]

[1] *Assistant Professor, Electronics and Communication, Roorkee College of Engineering, Uttarakhand, India*

[2] *Assistant Professor, Electronics and Communication, Mayurakshi Institute of Engineering & Technology, Rajasthan, India*

ABSTRACT

The generation of power from the reduction of fossil fuels is the biggest challenge for the next half century. The idea of converting solar energy into electrical energy using photovoltaic panels holds its place in the front row compared to other renewable sources. But the continuous change in the relative angle of the sun with reference to the earth reduces the watts delivered by solar panel. In this context solar tracking system is the best alternative to increase the efficiency of the photovoltaic panel. Solar trackers move the payload towards the sun throughout the day. In this paper different types of tracking systems are reviewed and their pros and cons are discussed in detail. The results presented in this review confirm that the azimuth and altitude dual axis tracking system is more efficient compared to other tracking systems. However in cost and flexibility point of view single axis tracking system is more feasible than dual axis tracking system. The renewable energy is a source of energy that does not deplete with time, because of this most of the research focused on this source of energy. Solar energy is among the renewable energy that is free in nature and clean from pollution, but harnessing this energy has limitation due to some environmental conditions. To solve this problem, solar tracking is used. The result revealed the solar system with tracking is more efficient compared to that fixed solar system. Furthermore, dual axis tracking system is also more efficient than single axis tracking system due to the fact that dual axis tracking system have ability to track the solar irradiant on both axes. Finally, it is not recommended to use solar trackers with small PV arrays because of the energy consumption of the driving systems, which vary from 2% to 3% of the energy increase delivered by the solar trackers.

Keyword: - *solar energy, photo voltaic panel, Azimuth tracking, solar tracker, LDR.*

1. INTRODUCTION

Solar Panels are a form of active solar power, a term that describes how solar panels make use of the sun's energy; solar panels harvest sunlight and actively convert it to electricity. Solar Cells, or photovoltaic cells, are arranged in a grid-like pattern on the surface of the solar panel. Solar panels are typically constructed with crystalline silicon, which is used in other industries (such as the microprocessor industry), and the more expensive gallium arsenide, which is produced exclusively for use in photovoltaic (solar) cells. Solar panels collect solar radiation from the sun and actively convert that energy to electricity. Solar panels are comprised of several individual solar cells. These solar cells function similarly to large semiconductors and utilize a large area p-n junction diode. When the solar cells are exposed to sunlight, the p-n junction diodes convert the energy from sunlight into usable electrical energy. The energy generated from photons striking the surface of the solar panel allows electrons to be knocked out of their orbits and released, and electric fields in the solar cells pull these free electrons in a directional current, from which metal contacts in the solar cell can generate electricity. The more solar cells in a solar panel and the higher the quality of the solar cells, the more total electrical output the solar panel can produce. The conversion of sunlight to usable electrical energy has been dubbed the Photovoltaic Effect. A solar tracker is a device that orients a payload toward the sun. The use of solar trackers can increase electricity production by around a third, and some claim by as much as 40% in some regions, compared with modules at a fixed angle. In any solar application, the conversion efficiency is improved when the modules are continually adjusted to the optimum angle as the sun traverses the sky.

As improved efficiency means improved yield, use of trackers can make quite a difference to the income from a large plant. Commercial purpose of solar tracking system:

1. Increase Solar Panel Output.
2. Maximum efficiency of the panel.
3. Maximize Power per unit area.
4. Able to grab the energy throughout the day.

2. SOLAR TRACKING SYSTEM

The sun's position in the sky varies both with the seasons (elevation) and time of day as the sun moves across the sky. Hence there are also two types of solar tracker:

1. Single Axis Solar Tracker
2. Dual Axis Solar Tracker

2.1 Single Axis Solar Tracker- Single axis solar trackers can either have a horizontal or a vertical axle. The horizontal type is used in tropical regions where the sun gets very high at noon, but the days are short. The vertical type is used in high latitudes (such as in UK) where the sun does not get very high, but summer days can be very long.

Fig-1: Single axis solar tracker

2.1 Dual Axis Solar Tracker-

Double axis solar trackers have both a horizontal and a vertical axle and so can track the sun's apparent motion exactly anywhere in the world. This type of system is used to control astronomical telescopes, and so there is plenty of software available to automatically predict and track the motion of the sun across the sky. Dual axis trackers track the sun both east to west and north to south for added power output (approx 40% gain) and convenience.

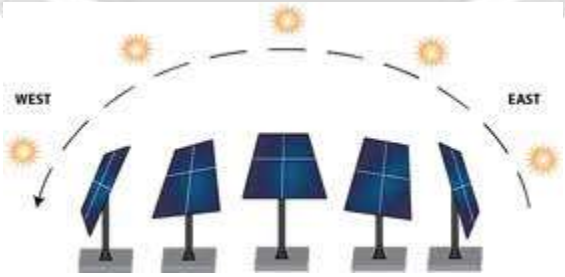

Fig -2: Dual axis solar tracker

Solar tracker drives, can be divided into three main types depending on the type of drive and sensing or positioning system that they incorporate. Passive Trackers: Use the sun's radiation to heat gases¬ that move the tracker across the sky. Active Trackers: Use electric or hydraulic drives and¬ some type of gearing or actuator to move the tracker. Open Loop Trackers: Use no sensing but instead¬ determine the position of the sun through pre recorded

data for a particular site. Passive Trackers: Passive trackers use a compressed gas fluid in two canisters each place in west and east of the tracker.

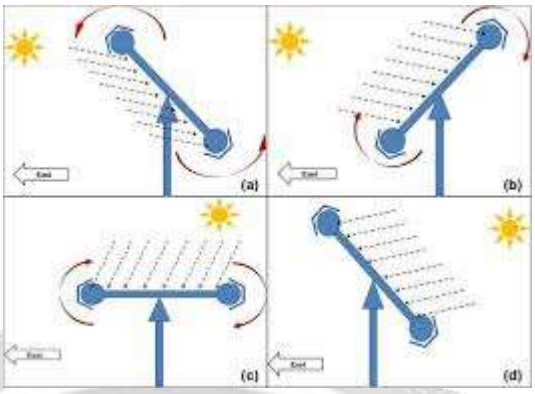

Fig-3: Passive solar tracking mechanism.

The mechanism is in such a way that if one side cylinder is heated other side piston rises causing the panel to tilt over the sunny side. This affects the balance of the tracker and caused it to tilt. This system is very reliable and needs little maintenance. Active trackers measure the light intensity from the sun by using light sensors to determine where the solar modules should be pointing. Light sensors are positioned on the tracker at various locations in specially shaped holders. If the sun is not facing the tracker directly there will be a difference in light intensity on one light sensor compared to another and this causes to determine in which direction the tracker has to tilt with the help of the stepper or dc motor in order to be facing the sun.
Light dependent resistor is made of a high resistance semiconductor. It can also be referred to as a photoconductor. If light falling on the device is of the high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance. Hence, light dependent resistors is very useful in light sensor circuits. LDR is very high resistance, sometimes a sensor is a device that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument.

3. CONCLUSIONS

Despite being perceived as a less exciting infrastructural component of the solar industry, solar tracking has seen a number of technological and mechanical breakthroughs that promise increased growth due to lower costs and increased weather resistance. In any environmental condition the automatic solar tracking system is a way much better implementation than the fixed panel. Automatic solar tracking system offers a prototype for implementing a large array type solar tracker.

4. REFERENCES

[1]. M. Serhan and L. El-Chaar (2010): Two axes Sun Tracking System: Comparison with a fixed system. International Conference on Renewable Energies and Power Quality, at Granada Spain on 23-25 March, 2010.

[2]. Goetzberger, A., Hebling, C., Schock, H. (2002). Photovoltaic materials, history, status and outlook. Materials Science and Engineering: R: Reports.

[3]. Otieno O. R (2015). Solar tracker for solar panel. (Unpublished Project). University of Nairobi, Kenya.

[4]. Mousazadeh, H., Keyhani, A., Javadi, A., Mobli, H., Abrinia, K., Sharifi, A. (2009). A review of principle and sun-tracking methods for maximizing solar systems output. Renewable and Sustainable Energy Reviews, volume13, pp: 1800–1818.

[5]. Al Mohamad, Ali. 2004. "Efficiency Improvements of Photo-Voltaic Panels Using a Sun-Tracking System." *Applied Energy* 79 (3): 345–354. doi:10.1016/j.apenergy.2003.12.004. [Crossref], [Web of Science ®] , [Google Scholar]

[6]. International Journal of Scientific and Research Publications, Volume 5, Issue 3, March 2015 1 ISSN 2250-3153