



Concept of Hybridization in Solar Power Generation, Efficiency Enhancement & Curbing Losses: A Review

Sadique Khan

Department of Chemistry, Govt. Polytechnic College, Shahdol, saqchem7806@gmail.com

Abstract: In the era of energy crisis, there is ongoing search for sustainable and cost effective sources of renewable energy. This paper presents a review on the use of solar energy for electricity generation, its installation with simple additional cost effective components to enhance the efficiency of the system, curbing losses incurred by heat and dust. Also, the concept of hybridization of renewable sources of energy is discussed.

Index Terms: Energy crisis, heat and dust losses, renewable energy, solar power generation, sustainable and cost-effective source.

INTRODUCTION

The Sun is the major source of energy on earth. Human beings, animals as well as plants use solar energy to carry out vital functions for their survival on the earth. Living beings use solar energy for producing food, as a source of natural heat and light etc. But in the 21st century, energy demand of technical and industrial areas are so high that fossil reserves and other conventional sources of energy are unable to fill the gap between demand and supply.

Here comes the use of renewable sources of energy i.e. solar energy, hydro energy and wind energy. Among which solar energy is proving to be the most promising and sustainable source of energy.

In this paper there is the review of various researches carried out in the area of efficiently improving the solar power generation system and concept of hybridization.

EFFICIENCY ENHANCEMENT IN SOLAR SYSTEM

By Intelligent Sun Tracking System

Author in the paper [1] develops a better form of photovoltaic

DOI: 10.37398/JSR.2021.650810

cell panel that is autonomous regarding optimal orientation information. This means the amount of electric energy generated from usual photovoltaic cell panel is increased to a certain level by using intelligent sun tracking system. Also, this system is much better in performance of the usual photovoltaic cell panels available in the market, like photovoltaic energy generated is monitored on-line by this intelligent sun tracking system.

EFFICIENCY ENHANCEMENT IN SOLAR SYSTEM BY CURBING LOSSES

Effect of Dust on Solar Panels

In the era of renewable energy, solar energy plays a vital role. These panels of photovoltaic cells are studied under various attributes like size, efficiency and design. Later, studies and research are also carried out regarding efficient performance of photovoltaic cell panels, i.e. increasing energy production by getting down the losses in the electricity generation. In [2] authors specifically studied the effect of dust particles deposited on the photovoltaic panel. Experimental calculation suggests that efficiency of solar panels increases considerably by removing dust from the solar panels.

Polycrystalline Panels and Water Immersion

In the paper [3] authors discuss and experimentally prove that the heat loss in the solar panels is, if controlled then leads to the efficiency optimization of the solar panel. Type of panel used in the experimentation is polycrystalline solar panels and to reduce the heat loss in power generation panels are submerged in distilled water. Now the efficiency of panels is calculated at different depths underwater. Thus experimentally calculated

results prove improvement in overall efficiency of the system by lowering the heat loss in power generation by solar panels.

Solar Energy Concentration By Simple Mirrors and Cooling

Author in [4] uses two techniques to increase the overall performance of the solar panels i.e. by increasing the efficiency of the solar panels with additional components like, mirrors and lenses, and decreasing the heat loss produced during power generation by using cooling mechanisms for panels and heat sinks.

Photovoltaic cell panels that use additional mirrors and lenses for accumulating the intensity of sun rays on the panel are known as “Concentrated Photovoltaic cells [CPV]”. These additional components are cost effective as well as easy to handle but significantly increases the efficiency of the system i.e. less number of CPV can generate higher amount of energy from the same number of conventional solar panels. Heat sinks, on the other hand, provide the cooling effect to the panel and reduce heat loss in the power generation, thus increasing the efficiency of the system.

The experimental result shows 32% efficiency increase if reflectors are used without sink and 52% efficiency increase if both reflectors and heat sink are used.

Solar Energy as Future Energy

Due to technological and industrial advancement and household use of individuals with their population increasing at an alarming rate, the world needs a sustainable and renewable source of clean energy. As the conventional source of energy i.e. fossil fuel reserves are on the verge of extinction and other non renewable sources of energy like nuclear energy are generally expensive. Thus solar energy is the best way to resolve the world’s energy crisis and every country is trying to adapt the power generation by solar energy.

In [5] authors review the solar power generation and its various attributes and research done under the field of photovoltaic panels, world energy scenario, applications etc.

HYBRIDIZATION

Author in [6] suggests some reliable methods to fill the gap of demand and supply in the field of energy. Renewable and sustainable sources of power generation like hydro electric power generation, solar power and wind mill power generation alone are geographically efficient i.e. their efficiency depends on the nature and climate of the area where these systems are installed. The change in the climatic condition of the area impacts the efficiency of the power generation to a large extent, thus creating a mismatch in the demand and supply scale of energy production and consumption.

To curb this energy mismatch hybridization of renewable electricity generation methods are done. Like, wind - solar, solar

– hydro, hydro – wind and wind – solar – hydro together. These hybridizations are also climate and geographically dependent but

The efficiency drop in a single system with the change in climate is more prominent than in hybrid power generation systems. Since the complementary nature of power generation maintains the efficiency of the overall system.

Thus a lot of research is being carried out in this area of hybridization of energy sources. Like different aspects and attributes of hybrid power generation like cost, concept, choice of hybrid based on geography of the area installed and future perspective as well.

CONCLUSIONS

According to the research carried out in various aspects of solar energy power generation, efficiency of the system can be increased by using additional components and curbing the losses. The area of hybridization is the most sustainable and partially independent of climate and geography of the place it is installed.

REFERENCES

- 1) Figueiredo, J. M. G., & Sa da Costa, J. M. G. (2008). Intelligent Sun – Tracking System for Efficiency Maximization of Photovoltaic Energy Production. *Renewable Energy and Power Quality Journal*, 1, 80-84.
- 2) Rajput, D. S. & Sudhakar K. (2013, April-June). Effect of Dust on the Performance of Solar PV Panel. Paper presented at the meeting of International Conference on Global Scenario in Environment and Energy, CODEN (USA).
- 3) Abdulgafar, S. A., Omar, O. S., & Yousif, K. M. (2014). Improving the Efficiency of Polycrystalline Solar Panel via Water Immersion Method. *International Journal of Innovative Research in Science, Engineering and Technology*, 3(1), 239-248.
- 4) Arshad, R., Tariq, S., Niaz M. U., & Jamil, M. (2014, April). Improvement in Solar Panel Efficiency Using Solar Concentration by Simple Mirrors and by Cooling. Presented at the meeting of 2014 International Conference on Robotics and Emerging Allied Technologies in Engineering (iCREATE), 292-295.
- 5) Kannan, N., & Vakeesan, D. (2016). Solar energy for future world: - A review. *Renewable and Sustainable Energy Reviews*, 62(C), 1092-1105.
- 6) Jurasz, J., Canales, F., Kies, A., Guezgouz, M., & Beluco, A. (2019). A review on the complementarity of renewable energy sources: Concept, metrics, application and future research directions. *Solar Energy*, 195, 703-724.
- 7) Alaleit, A., Alshangiti, Y., McKay, L., & Yunin D. Steenhuis, H., (2013). Solar Cells: A Case Study of Efficiency & the Effect on Cost. *International Association of Management of Technology – IAMOT, 2013 Proceedings*.
- 8) Shaikh, M. R., Shaikh, S., Waghmare, S., Labade, S., & Tekale, A. (2017). A Review Paper on Electricity

Generation from Solar Energy. International Journal for
Research in Applied Science and Engineering Technology,
887(IX), 1884-1889.
