International Journal of Scientific Research and Engineering Development-– Volume 5 Issue 4, July- Aug 2022
Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

Developing Solar Photovoltaic Systems - Investigating Modelling and Sizing Techniques and Power and Technical Challenges

[1]Ruchi Dhiman, [2]Dr Geena Sharma
[1]Student, [2]HOD
[1,2]Electrical engineering department
[1,2]Baddi University of Emerging Sciences & Technology, India.

Abstract- This paper mainly focuses on Solar Photovoltaic Systems and its various aspects that were analyzed before. Solar power is the most growing sector in eco friendly energy production. The light that comes from the sun directly falls on the surface of the solar panel, and then it creates electricity, through the process that is called Photovoltaic effect. Each panel produces very small amount of electricity, but a lot of panels connected together can supply electricity to a average household demand of 24 hours. This process is called Solar Array. Firstly, the electricity that produced from the solar panel is in form of Direct current (DC), however, it can be changed to Alternative Current (AC) via an inverter. This paper also discusses about various challenges and techniques that are countering them.

Keywords:
Solar Photovoltaic System, Modelling and Sizing techniques of Solar PV andRunning Solar PV

I. INTRODUCTION

In recent times, solar system is considered as the most popular natural renewable and eco friendly to use for daily use. It could possible only because of heavy development of technology and its implementation in this matter. Solar Photovoltaic system is a technology to supply usable solar power as electricity at the household power needed sockets. This system consists of solar panel to soak up the solar power via the sunlight and then there is an inverter to change and use the power as required. This inverter also changes the power as direct current or alternative current whichever needed. PV system is designed to only convert the solar power to electricity. These solar panels do not work in any other aspect other than converting the solar power to electricity. Though this is a very easy process to run, but still some challenges are always there to the evolving techniques.

II. AIMS AND OBJECTIVES

The aim of this paper is to review some previous works that were done on the topic of solar photovoltaic system to achieve the real view about the technical and power related challenges, hence the organisations or researchers that are working for the development of this system will find out the technical errors and they will also get clear view about the certain sector to be upgraded.

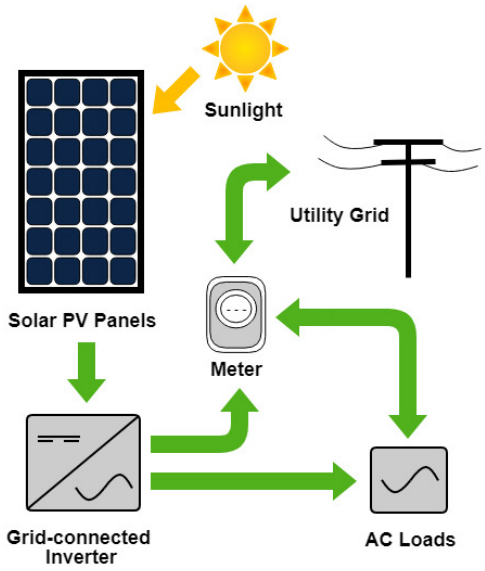

Figure 1: Solar photovoltaic system

(Source: [4])

The objective of this paper is all about a review on the Solar Photovoltaic system and itsall methods of operation. It also gives an idea about the current challenges so that the developers of this project can focus on the particular priority of advancement.

III. METHODOLOGY

The method to review this topic was carried out with the three screening phrases method. The first screening was done by taking more than 11 articles from different websites such as Google scholar, Scopus science database, Gate that is related to Web of science and research gate The information that is taken from various websites was a brief description about the Solar PV installation, methods, types and also its advantages and disadvantages.

- **Inclusion and Exclusion of data:** While collecting data for this topic it was obvious to include data from the websites that provide data for free of cost. The subscription added websites were not reachable for collection due to its subscription cost. The data that was shared before 2018 was not taken at this article. As all

 ©IJSRED:All Rights are Reserved

the current incidents or uploaded topics are only allowed in this article. As the English language is only readable here. That is why in spite of a lot of data available about the same topic, could not considerable in this article.

IV. REVIEW OF PREVIOUS PAPERS

Previously the topic of Solar Photovoltaic System was much more discussed by various researchers. Every paper was discussed in different manner with different research methods. Various aspects were discussed with different examples.

Findings in Developing Solar Photovoltaic System:

In discussing about the development of Solar PB model is the key source to fill the adequate need of energy all over the world [1]. Developing Solar Photovoltaic System is the common demand from the innovative researchers about this topic. Hence it is very important to produce a perfect solution to implement solar PVs according to the available resources and infrastructure. Various researchers stated many statements regarding this topic. Various reports indicated that solar electrified different public-Health posts and schools work more efficiently and provides much more service to the consumers[2].

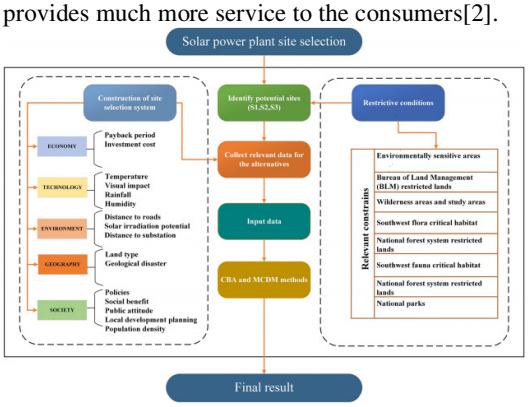

Figure 2:Solar plant system

(Source: [6])

Lehtola et al.(2019) stated that more than 92% rural Bangladeshis are getting much more and efficient light to work at night that affects with good result to the overall performance [3]. A study by Liu et al.(2019) stated that in Ghana, rural micro-enterpriseswere able to earn extra income of US$5-12/day because of implementation of solar PV [4].

In a study by Kazem et al (2020), it came out that rural household's electricity expenditure reduces74% less, because switching to solar energy [5]. There is a huge turn in all over the world towards solar photovoltaic system, due to very low maintenance cost and zero pollution produced through this process. Almost 77% people in rural areas are switching to solar power instead of non-solar electricity [6]. Till now it is clear that most of the cases, maximum number of people are turning towards solar energy due to its low maintenance cost, efficient fulfilment of daily electricity demand and also zero pollution contribution.

Findings in Modelling and Sizing Techniques while developing Solar Photovoltaic System

Modelling, simulation and sizing are the main phase to mount a PV system anywhere in the world; this helps the operator about the variations of the system in accordance with the climate and weather [7].There are lots of varieties of the method of modelling and increasing the development of solar panels.Linearization methods, artificial intelligence method, numerical methods, artificial neural methods, fuzzy methods and also generic algorithmetc are the varieties available onmodelling of solar PVs.In order to implement the model, many softwares are needed to analyse on what bases the project can be implemented. Some well knownsoftware for this purposeare like Solar Pro, PV-Design Pro, PV-Spice, PV CAD, However these softwares have some disadvantages too. If the whole world will look into the matter of how to invest in non-conventional power sources rather depended on the natural power source like coal can lead to a stability of power resource for the whole world[8]. In the present situation power source stability is the key of the strength of the country [9]. Like these softwares are very costly and they are available only in packages. Thus the person cannot buy the software only for the certain need [10].To complete the above needs Simulink / matlab type softwares can be used for this purpose. These softwares are the extremely user-friendly, create a particular model and also provides a lot of customization in the Solar PV system and also other disciplines in engineering. These softwares are available in academic, industrial and research purpose [11].

V. POWER AND TECHNICAL CHALLENGES WHILE DEVELOPING SOLAR PHOTOVOLTAIC SYSTEM

The presence of radiation is must for producing electricity from solar light because the radiation covers an important role in the function of solar energy system. The energy produced by the Solar PV changes with the change in solar reflection during the day time. This quantity of solar energy varies on the basis of weather change and its various parameters [12].Hence; raise methods play an direct role in increasing the trustworthiness of the solar system. The making capacity of Solar systems have faced a huge growth in demand of solar power due to rapid grow of need by the consumers, as advanced development of solar system is taking place with the upgraded software. Now approximately 9% of power generation has increased compared to previous times [13]. Solar energy can bring different technical improvement facilities to the power system of electricity as balance of voltage profiles;

 ©IJSRED:All Rights are Reserved

decrease quantity of power can bring losses and tariffs of electricity prices can reduce [14].

VI. CONCLUSION

In recent years several investigations have rose in order to investigate and develop the performance of solar energy equipments. Hence, the enhancement and up gradation is quite a important concern for the developer because the solar energy behaves very inconsistent. Another concern to remember for the development of the technology and challenge related to power and technology are also discussed by via researchers. Many positive aspects rose in terms of growth of solar power. However, many negative points were also displayed while discussing about the whole system of solar power. After going through the entire study the conclusion displays that almost all over the world is accepting the solar power is due to its low maintenance cost and also its zero pollution based manufacturing process.

VII. REFERENCES

1. Al-Shahri, Omar A., et al. "Solar photovoltaic energy optimization methods, challenges and issues: A comprehensive review." *Journal of Cleaner Production* 284 (2021): 125465.
2. Alquthami, Thamer, R. Sreerama Kumar, and Abdullah Al Shaikh. "Mitigation of voltage rise due to high solar PV penetration in Saudi distribution network." *Electrical engineering* 102.2 (2020): 881-890.
3. Lehtola, Timo, and Ahmad Zahedi. "Solar energy and wind power supply supported by storage technology: A review." *Sustainable Energy Technologies and Assessments* 35 (2019): 25-31.
4. Liu, Jia, et al. "Overview on hybrid solar photovoltaic-electrical energy storage technologies for power supply to buildings." *Energy conversion and management* 187 (2019): 103-121.
5. Kazem, Hussein A., et al. "A review of dust accumulation and cleaning methods for solar photovoltaic systems." *Journal of Cleaner Production* 276 (2020): 123187.
6. Padmanathan, K., et al. "A sociocultural study on solar photovoltaic energy system in India: Stratification and policy implication." *Journal of cleaner production* 216 (2019): 461-481.
7. Imam, Amir A., and Yusuf A. Al-Turki. "Techno-economic feasibility assessment of grid-connected PV systems for residential buildings in Saudi Arabia—A case study." *Sustainability* 12.1 (2019): 262.
8. Gorjian, Shiva, et al. "Recent technical advancements, economics and environmental impacts of floating photovoltaic solar energy conversion systems." *Journal of Cleaner Production* 278 (2021): 124285.
9. Sohail, Madni, et al. "A comprehensive scientometric analysis on hybrid renewable energy systems in developing regions of the world." *Results in Engineering* (2022): 100481.
10. Mazzeo, Domenico, et al. "A literature review and statistical analysis of photovoltaic-wind hybrid renewable system research by considering the most relevant 550 articles: An upgradable matrix literature database." *Journal of Cleaner Production* 295 (2021): 126070.
11. Farrokhifar, Meisam, et al. "Optimal energy management and sizing of renewable energy and battery systems in residential sectors via a stochastic MILP model." *Electric Power Systems Research* 187 (2020): 106483.
12. Bandyopadhyay, Soumya, et al. "Techno-economical model based optimal sizing of PV-battery systems for microgrids." *IEEE Transactions on Sustainable Energy* 11.3 (2019): 1657-1668.
13. Basit, Muhammad Abdul, et al. "Limitations, challenges, and solution approaches in grid□connected renewable energy systems." *International Journal of Energy Research* 44.6 (2020): 4132-4162.
14. Madziga, Miriam, Abdulla Rahil, and Riyadh Mansoor. "Comparison between three off-grid hybrid systems (solar photovoltaic, diesel generator and battery storage system) for electrification for Gwakwani village, South Africa." *Environments* 5.5 (2018): 57.
15. Alramlawi, Mansour, and Pu Li. "Design optimization of a residential PV-battery microgrid with a detailed battery lifetime estimation model." *IEEE Transactions on Industry Applications* 56.2 (2020).

 ©IJSRED:All Rights are Reserved