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Analyzing the Effect of Parametric Variation on Performance of Grid Connected Solar PV System in Indian Scenario

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Abstract: ***The performance and economy of a solar photovoltaic system depends on location and geographic parameters. Predicting energy efficiency is important for effective planning and evaluation rates. The proposed study explores the performance evaluation of three interconnected geographically connected photovoltaic solar systems. In Jaipur, Kolkata and Chennai have been testing a 1 MW solar PV system for a year.***
Simulations were performed using PV Syst (a software tool developed by the University of Geneva) and hourly weather data was obtained from NASA and METEONORM.
The loss map for energy production and calculations shows the significant impact of geography on the performance and economics of solar PV systems.
The monthly performance of the system indicates the impact of changes in weather parameters on radiation and ambient temperature performance and energy system performance. In order to optimize system performance, the annual power generation per unit of electricity at different locations was compared and discussed.
Keywords: Loss Analysis, PV-Syst, Grid Connected System, Yield.

I. INTRODUCTION

A Solar Photovoltaic (PV) is electronic PV device that converts the light energy into electric energy. The first solar panel power satellite was launched 1958 through the “Hoffman electronics”. Solar power is the one of the best options. because sun ray never reserves and decrease. On the other hand benefit of solar radiation available in our atmosphere in free of cost. The regular price hike in fuel and global warming and environmental pollution leads the path towards the use of renewable energy sources. Solar Pv system consists of an arrangement of several components, including solar panels to absorb and convert sunlight into electricity, a solar inverter to change the electric current from DC to AC, as well as mounting, cabling and other electrical accessories to set up a working system.

The term "photovoltaic" combines two terms - "photo" means light and "volt" means voltage. The photovoltaic system in this discussion uses photovoltaic cells to convert sunlight directly into electrical energy. Made of crystalline silicon. Solar cells are also known as photovoltaic (PV) cells.

It is a static device with no moving parts. The photovoltaic system is designed to power the load. The load can be AC or DC. It takes place during the day or night or twice. Photovoltaic systems can only be supplied during the day. We need consumables because we have batteries and electricity that can be stored and used. Solar photovoltaic (PV) devices generate electricity directly from sunlight through electronic processes, and the process naturally occurs in certain types of materials, called semiconductors. The electrons in these materials are released by solar energy and can be sensed by electrical circuits to power electrical equipment or generate electricity to the grid.

II. GRID CONNECTED PV SYSTEM

Grid connected PV system is a system when grid is connected to PV system and also called utility-interactive systems. In this type of system consist of PV array and inverter. Utility-interactive systems deal with AC. Grid connected system deals with very high power applications, so is tough to store this much of power in battery.Two types of semiconductor materials one is N-type semiconductor make solar cell and other is P-type semiconductor material for generation of electricity but Solar cell is manufacturing by different materials.

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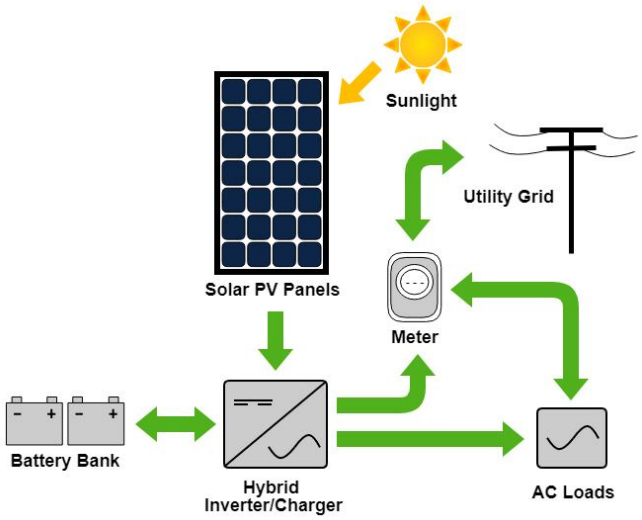


Figure1.Outline of Solar PV System

The inverter is used to convert the direct current (DC) generated by the solar panel into a load of alternating current (AC). Today, many investors on the market are based on battery connections and network systems. Investors need to determine the magnitude of the expected power level to be processed and are compatible with the conditions on the network side. Other components include JS mounting systems, wiring, switches, disconnectors and system monitors. These components have not been studied in detail. The use of DC
cables should at least maintain high resistance losses and costs [39]. For the central inverter, there is also a junction box between the matrix and the inverter fuse to protect against voltage overload. In a network system, the grid itself is like an infinite energy store. Excess energy can be supplied to the grid.

III. SYSTEMMODEL

To use PVSYST and study the performance potential of photovoltaic and solar thermal systems, irradiation data and precise global temperatures are critical. In PVSYST, both wind speed and diffuse radiation are optional.

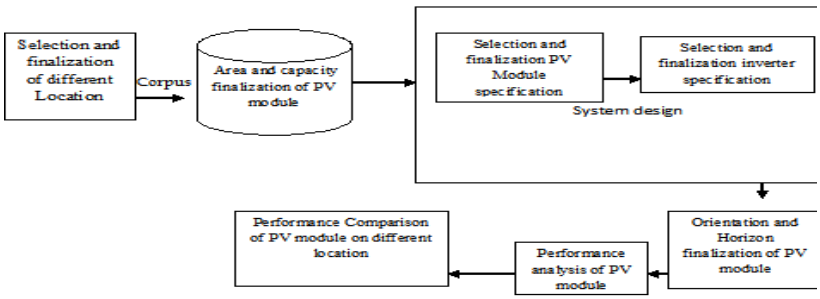


Figure 2.Architecture of the Proposed Grid Connected Solar PV System

PVSYST uses the irradiance data imported in PVSYST to create irregular markers using imported functional weather data. Unless otherwise stated, the information in this chapter is the PVSYST Contextual Help Manual. The layout and simulation of network-connected solar PV systems was extended using the following data sets. *Meteological Data*-Meteonorm software provides monthly weather data for every point on the planet. They also use a stochastic model to provide time-based data based on synthetic generation. If there is a station in a given venue, Meteonorm will use interpolation between the three stations. Satellite data from five geostationary satellites was used as a supplement when soil data was poor. 8 km horizontal resolution. Soil measurement uncertainty ranges from 1% to 10% (Meteonorm results [46]) and satellite data ranges from 3% to 4% (low latitude). For terrestrial interpolation, the uncertainty is 1% over a distance of 2 km, 6% to 100 km, and 8% for distances greater than 2000 km. Horizontal diffuse illumination was calculated using the Perez model to separate the global radiation beam and the diffuse component.

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Input parameters of geographical location					
Project Site	Latitude (N)	Longitude (E)	Altitude (m)	fixed Tilted panel	
				Panel tilt	Azimuth tilt
Jaipur	26.9124^0 N	75.7873^0 E	431m	30^0	0.0
Kolkata	22.5726^0 N	88.3639^0 E	9m	22^0	0.0
Chennai	13.0827^0 N	80.2707^0 E	6.7m	10^0	0.0

Table 1 : Input Parameters of Geographical Locations

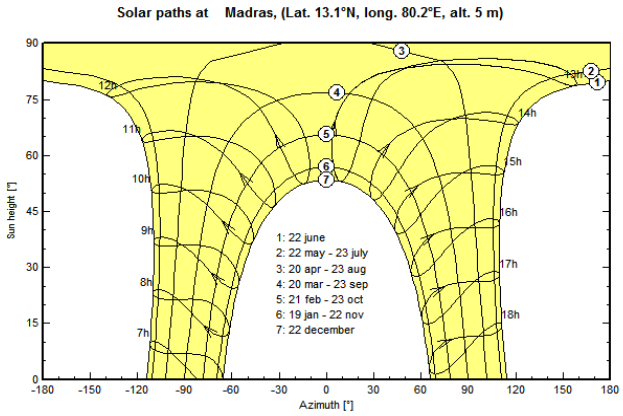


Figure3.Solar Path at Kolkata

1) *Selection of Solar Panel*- In PV systems, the preset is based on area or power. Depending on the size, the panel is selected based on the rated power and operating voltage.
2) *Selection of Inverter*- In PV syst the selection of inverter is done in accordance with the selection of pv panel.The rating of invereter should match with the specifications of panel.
3) *Orientation and Horizon*-In the proposed work study, we have simulated a 1 MWp fixed tilt system that has been selected for fixed tilted linear shading. Photovoltaic systems have been established in Jaipur (26.9124°N, 75.7873°E and 431m), Kolkata (22.57260 N, 88.36390 E and 9 m) and Chennai (13.0827°N, 80.2707°E and 6.7 m) with latitude and altitude Height and altitude. Again, it is also developed for other places. The time zone is selected according to the Indian Standard Time (IST). In the next section, the stepwise integration of the mathematical equivalent model for a given grid-connected system in PV Syst is discussed.

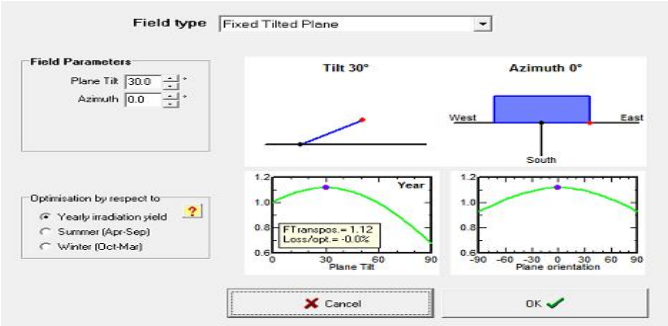


Figure 4. Orientation and Horizon finalization of PV module

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IV. SIMULATION & RESULT

The overall simulation has been performed on PVSyst 5.74. 1 MWp simulation results can be divided into three categories Production forecast/simulation, Loss simulation, and Economic simulationThese simulations were conducted for Jaipur, Calcutta, and Chennai for 1 MWp grid-connected solar PV systems so that we can analyze and compare performance.

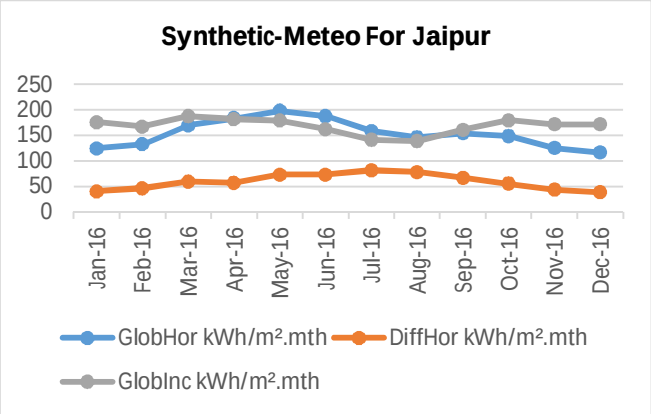


Figure 5.Design of Solar PV over Area

Losses Simulation-The yearly nominal yield and actual yield has been simulated using pv syst software for three different locations. The plot of yield has been characterized as normaized poroduction and main results.

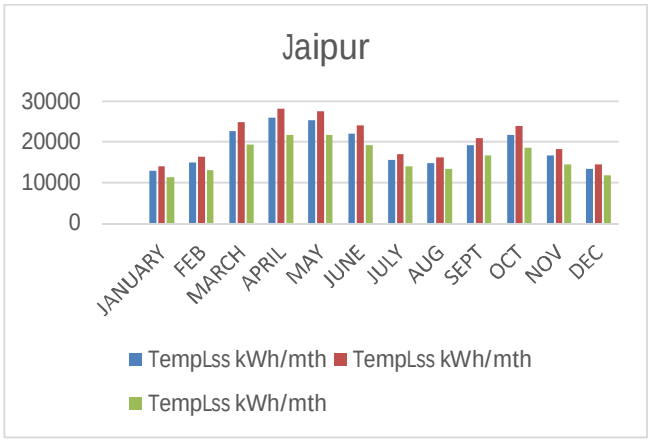


Figure 6. Loss diagram for Jaipur

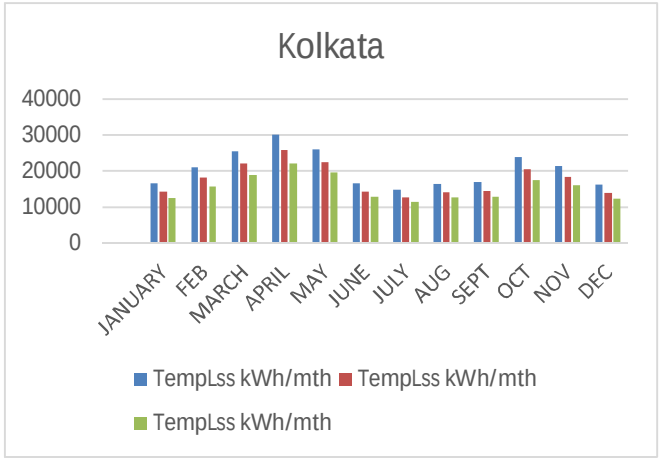


Figure 7.Loss diagram for Kolkata

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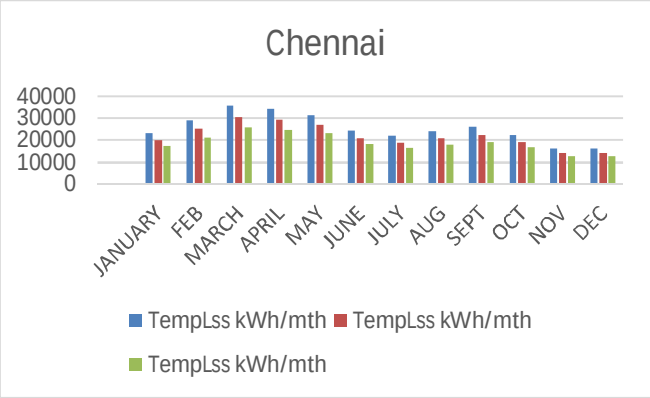


Figure 8.Loss diagram for Chennai

The table 3 compares parameters namely performance ratio, temperature dependent losses and energy output (Inverter) for different PV technology and compare it with values in three different cities namely- Jaipur, Kolkata and Chennai

Table 3 Comparision of Simulation/Forecasting

Parameters	Yearly Average Forecasted Value			Yearly Average Forecasted Value			Yearly Average Forecasted Value		
	MONO-SI			POLY-SI			THIN-FILM		
Location →	J	K	C	J	K	C	J	K	C
PR	0.78	0.79	0.78	0.79	0.77	0.76	0.83	0.82	0.81
Temp-Losses ↓	245966	245204	306276	225144	211263	263603	195225	184900	227225
Energy Output(Inverter)	1598388	1475457	1602721	1577089	1447493	1569329	1670100	1538342	1676859

* J- Jaipur, K- Kolkata and C- Chennai.

V. CONCLUSION

We infer from the above data from the PV SYST software. For thin film modules, Jaipur's performance is better than other venues. For polysilicone modules, Jaipur has the best performance ratio. Compared to a single silicone component, Kolkata's performance is better than other sites. For single-unit silicone modules, the temperature-dependent loss at the Kolkata site is minimal. For the silicone module, the temperature-dependent loss of Kolkata is minimal for the film silica gel module, and the temperature dependence loss of the Kolkata site is minimal. For film modules, Chennai's final production is the highest compared to other parts. For silicone modules, Jaipur's final production is the highest compared to other locations. For mono silica modules, Chennai's final production is the highest compared to other parts. For thin film modules, Chennai's energy output works best on co. Compared with other parts. For polysilicone modules, Jaipur's energy output is optimal compared to other parts. For mono silica gel modules, Chennai's energy output is optimal compared to other parts. So we can see that the thin film module is the best, but the disadvantage of the thin film module is that it requires more area than other module technologies.

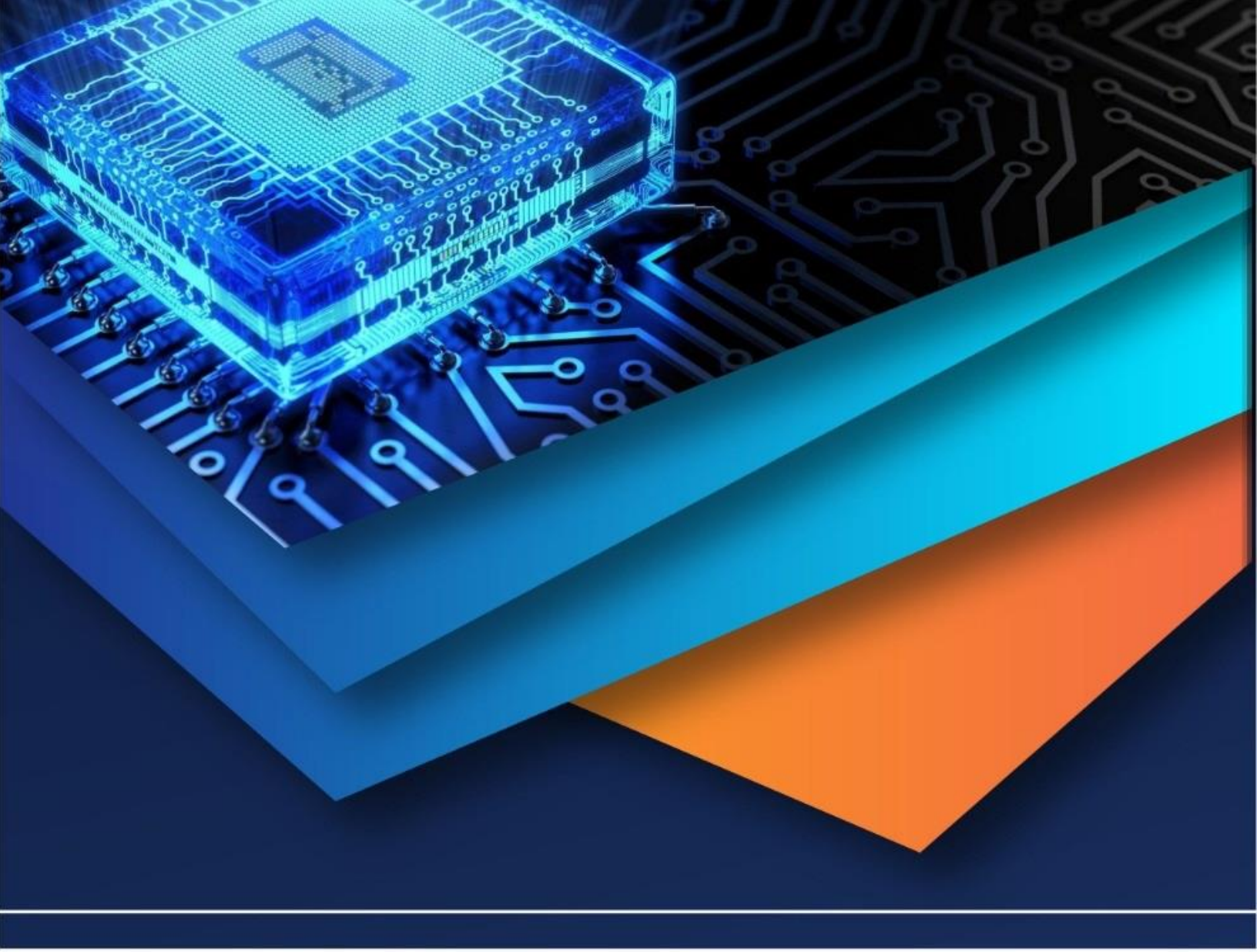
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