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ROOF TOP SOLAR PV PLANT DESIGN USING PV SYS

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ABSTRACT

The high energy demand and the constant depletion of the fossil fuels lead us to shift our focus to renewable energy sources which are not only the future unlimited source of energy, it is also eco-friendly and available for the environment. Hydro and Wind though are renewable sources but are area specific. Solar energy on the other hand can be installed in any place. The major issue with the solar energy is the requirement of land which is scarcely available in the world and even costly to get. But floating solar plants can be installed in any water bodies which will not only reduce the cost of the land but will increase the amount of generation with the cooling effect of water. This paper concentrates upon the design parameters of the floating platform but will also focus upon the effect of panel shade on the ecosystem.

Keywords: Renewable Energy , Photovoltaic system, Solar panels, PVSYST.

I. INTRODUCTION

India is a land of bountiful sunlight. It is sunny for an average of 300 days a year in most parts of a country. Unsurprisingly, solar energy is the headliner in the country's renewable energy (RE) strategy. India is now looking at 175GW of solar installation by 2022. The penetration of solar energy in India is increasing to help meet the national goal of 40% non fossil fuel based capacity [1].Solar energy is simply the light and heat that come from the sun. Solar power is the conversation of energy from sunlight into electricity, either directly using photovoltaics (PV), indirectly using concentrated solar power, or a combination. Concentrated solar power systems use lenses or mirrors and solar tracking systems to focus a large area of sunlight into a small beam. Photovoltaic cells convert light into an electric current using the photovoltaic effect [2].

PHOTO VOLTAIC CELLS

A photovoltaic cell is made of semiconductor materials that absorb the photons emitted by the sun and generate a flow of electrons. Photons are elementary particles. When the photons strike a semiconductor material like silicon, they release the electrons from its atoms, leaving behind a vacant space. The stray electrons move around randomly looking for another "hole" to fill. When the electrons are excited by the photons, they are swept to the n-side by an electric field, while the holes drift to the p-side. The electrons and holes are directed to the electrical contacts applied to both sides before flowing to the external circuit in the form of electrical energy. This produces direct current. An anti-reflective coating is added to the top of the cell to minimize photon loss due to surface reflection.

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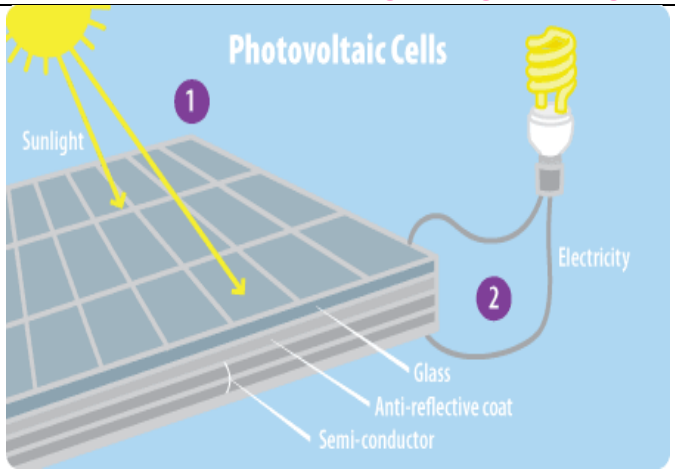

Fig. 1. Photo voltaic cells

FUNCTION OF PV CELL

The PV solar panels generate direct current (DC) electricity. With DC electricity, electrons flow in one direction around a circuit. This example shows a battery powering a light bulb. The electrons move from the negative side of the battery, through the lamp, and return to the positive side ofthe battery. With AC (alternating current) electricity, electrons are pushed and pulled, periodically reversing direction, much like the cylinder of a car's engine. Generators create AC electricity when a coil of wire is spun next to a magnet. Many different energy sources can "turn the handle" of this generator, such as gas or diesel fuel, hydroelectricity, nuclear, coal, wind, or solar. AC electricity was generally chosen for electrical power grid, primarily because it is less expensive to transmit over long distances. However, solar panels create DC electricity.

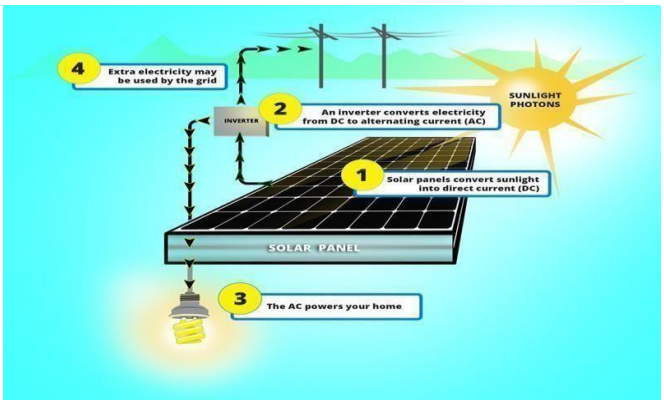

Fig.2. Function of PV cell

CLASSIFICATION OF PV SYSTEM

Off-grid systems: The systems are not connected to grid and have a battery bank .

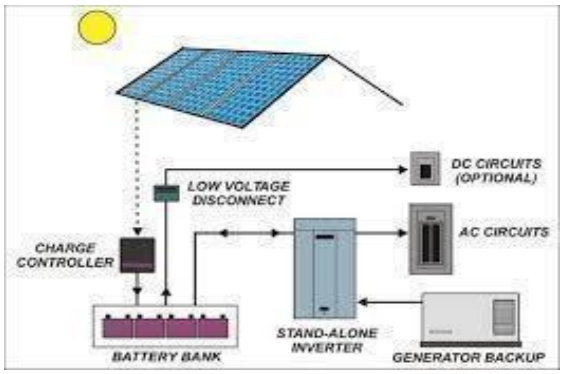

Fig.3. Off-grid system

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Grid-connected systems:

In this case, the solar power system is coupled with grid which provides the reference power source as well as a storage mechanism which can supply electrical power whenever solar radiation is not available

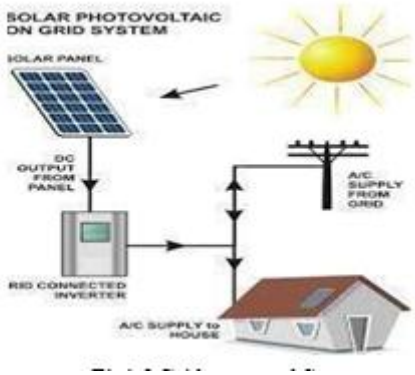

Fig.4.ongrid

SOLAR ROOFTOP PV NET METERING

The typical grid interactive PV system is connected through LT consumer panel, where in the consumer ac loads are also connected. The Lt panel is also connected to utility side through grid meter. The electricity produced by solar is consumed by loads. In case the consumer has dg set ,it can also be connected to the same Lt panel and electricity can be fed by dg set along with solar PV in the absence of grid electricity

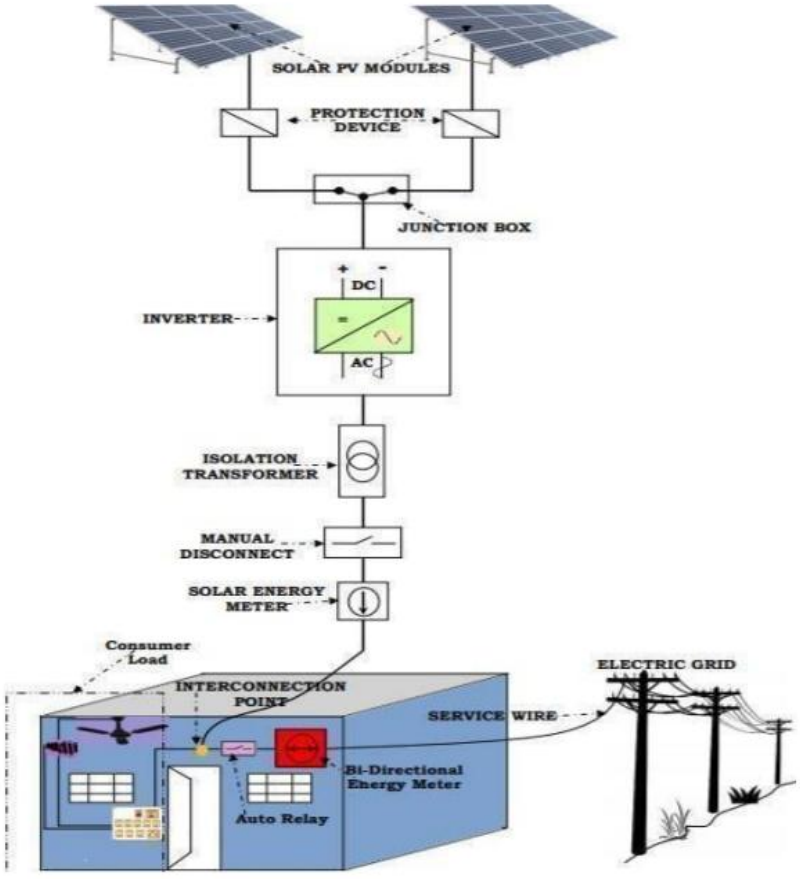

Fig. 5. LT metering

SOLAR ROOFTOP PV SYSTEM HT NET METERING

The typical grid interactive PV system is connected through HT consumer panel as shoen in figure 6

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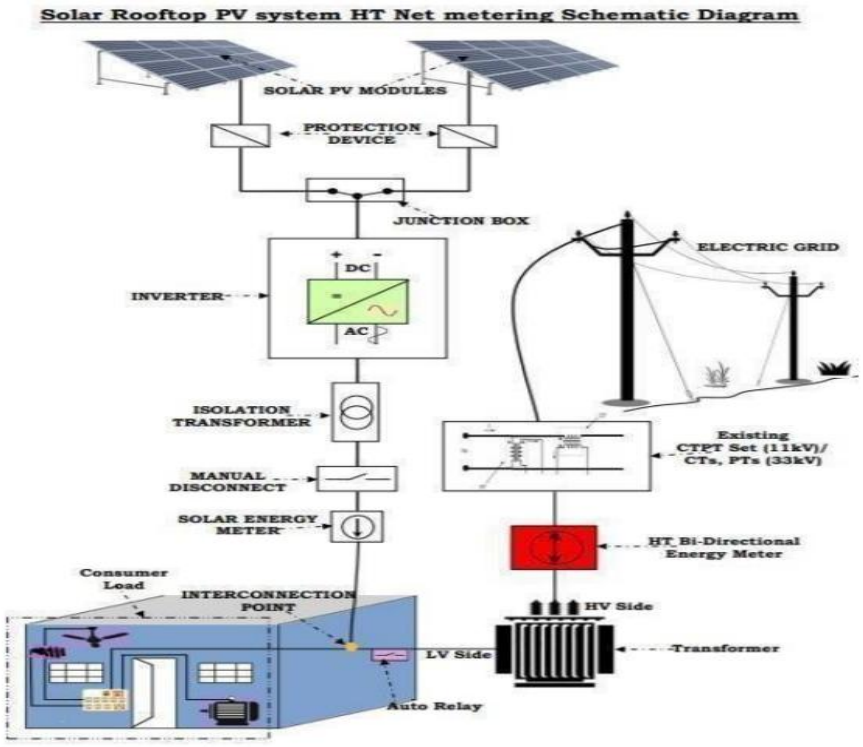

Fig.6 HT metering Scheme

II. METHODOLOGY

There are several software applications used by engineers, project owners, financiers, and architects for designing and modelling solar PV systems. PV Syst is often considered one of the most preferred and used tools in this space. For more than two decades it has enabled users to, size-simulate-and-study PV systems, perform in depth design and analysis, and generate detailed reports.

The process of designing a Solar Edge system in PV syst includes the following basic steps

Step 1: Project – define the location and meteorological data.

Step 2: Orientation – define module azimuth and tilt.

Step 3: System – choose the PV modules, inverters and electrical design.

Step 4: Module Layout – create the electrical string connections according to the 3D scene.

Step 5: Detailed Losses – mismatch. Ensure the mismatch loss is set to 0% for a Solar Edge system.

Step 6: Simulation – view a summary of the system's energy

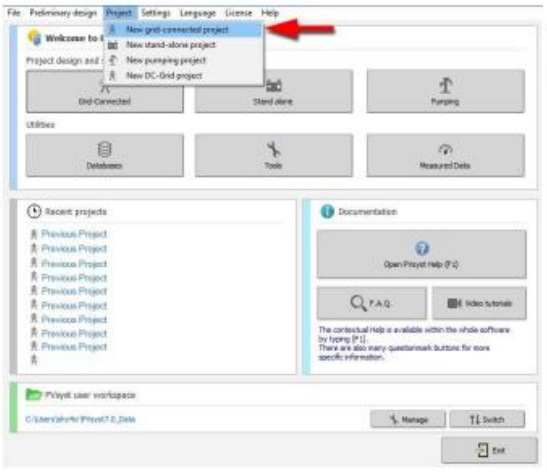

Fig. 7. Project menu

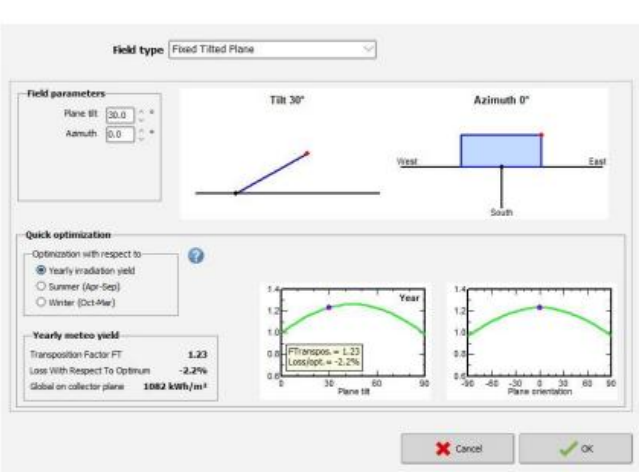

Fig. 8. Selection of Modulus

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III. SIMULATION RESULTS

DATA SHEET FOR THE (50 kW) SOLAR POWER PLANT FOR THE YEAR (2022) IN ACE ENGINEERING COLLEGE

1. Pvsyst-Simulation report

General parameters

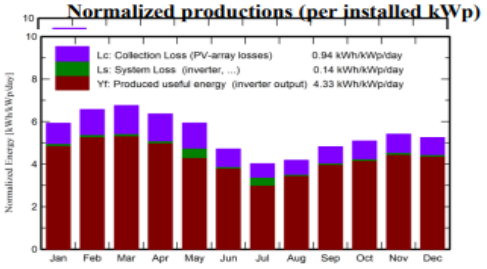
Grid-Connected System	**No 3D scene defined, no shadings**	
PV Field Orientation		
Orientation	**Sheds configuration**	**Models used**
Fixed plane	No 3D scene defined	Transposition Perez
Tilt/Azimuth 20 / 0 °		Diffuse Perez, Meteonorm
		Circumsolar separate
Horizon	**Near Shadings**	**User's needs**
Free Horizon	No Shadings	Unlimited load (grid)

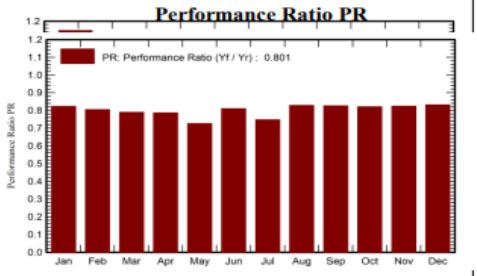
PV Array Characteristics

PV module		**Inverter**	
Manufacturer	Generic	Manufacturer	Generic
Model (Original PVsyst database)	Eldora VSP.72.315.03.04	Model (Original PVsyst database)	Solar Inverter M30A_230
Unit Nom. Power	315 Wp	Unit Nom. Power	30.0 kWac
Number of PV modules	160 units	Number of inverters	4 * MPPT 33% 1.3 unit
Nominal (STC)	50.4 kWp	Total power	40.0 kWac
Modules	8 Strings x 20 In series	Operating voltage	200-900 V
At operating cond. (50°C)		Max. power	33.0 kWac
Pmp	45.2 kWp	(=>35°C)	
U mpp	669 V	Pnom ratio (DC:AC)	1.26
I	68 A		

System Production

Produced Energy	79.74 MWh/year	Specific production	1582 kWh/kWp/year
		Performance Ratio PR	80.07 %





Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh	E_Grid MWh	PR ratio
January	149.9	51.16	23.43	183.7	179.5	7.770	7.620	0.823
February	159.1	52.28	26.35	184.1	179.9	7.614	7.467	0.805
March	196.5	68.79	29.80	209.6	204.7	8.503	8.339	0.789
April	193.6	79.80	32.04	190.9	185.8	7.709	7.562	0.786
May	198.6	89.08	33.62	184.0	178.3	7.434	6.733	0.726
June	155.5	82.06	29.34	141.4	136.5	5.882	5.773	0.810
July	135.3	86.05	27.51	124.8	120.2	5.290	4.700	0.747
August	135.4	83.29	26.47	129.6	125.3	5.519	5.414	0.829
September	142.5	85.36	26.39	144.7	140.3	6.140	6.025	0.826
October	144.3	72.73	26.42	157.8	154.0	6.651	6.522	0.820
November	137.4	56.82	24.28	162.6	158.9	6.885	6.754	0.824
December	132.8	55.73	23.08	162.9	159.1	6.960	6.829	0.832
Year	1881.1	863.16	27.40	1975.9	1922.5	82.357	79.739	0.801

Fig. 9. Data Sheet Produced Energy

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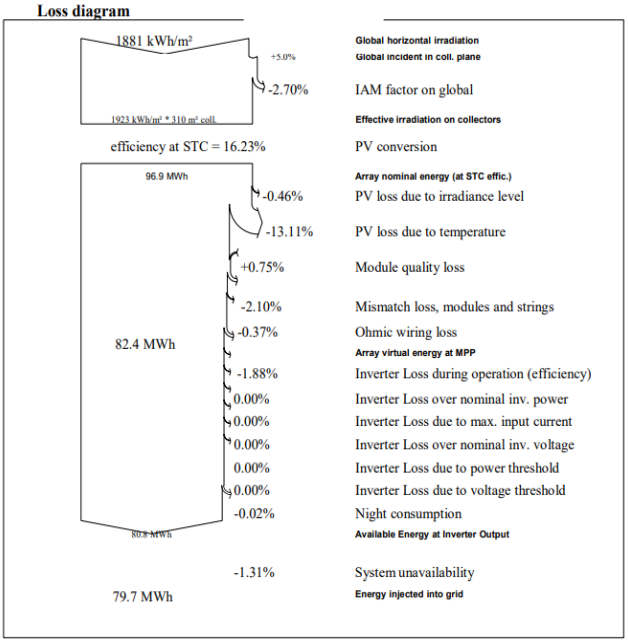

Fig. 10(A). Loss diagram

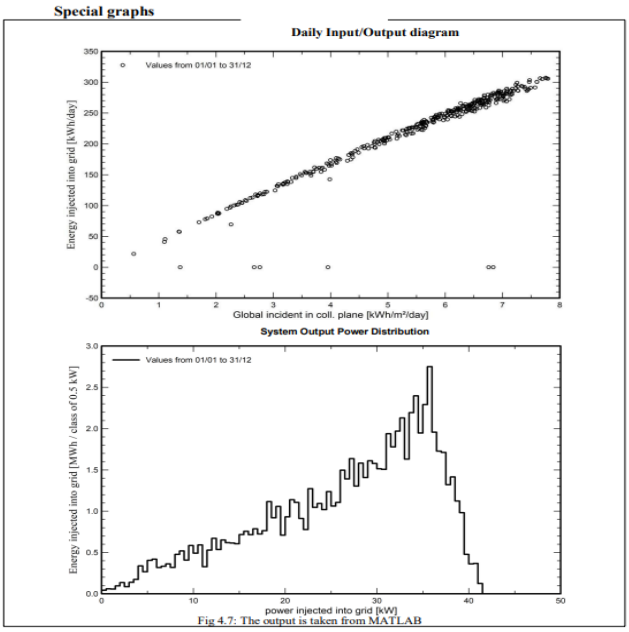

Fig. 10(B). Daily Input/output Diagram

IV. CONCLUSION

As the world is quickly moving towards renewable energy ,solar rooftop has been a key part. As it is efficient and also cost effective .Today , even people are concerned towards the climate change issues and are now trying to address this issue by moving towards renewable energy .As home comes first personal step to solve the issue .people are trying to install solar rooftops. Even the central has introduced policy for grid connected solar rooftop programme-which reserves finance assistance for the residential sector.Here ,the supply and demand side complexities are also addressed and there will be uninterrupted power supply.Even the state government is formulating regulations that encourage solar rooftop adoption. Most of the houses in our near future will be having installed solar panels. There is so much potential energy to be gained from using solar energy. If you are looking to move towards greener and safer environment, this is by far the easiest, simpliest and most inexpensive.

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