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Performance Study on Roof Mounted Residential Photovoltaic System of 35KW Capacity

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ABSTRACT: Industrialization and growth in the population leads huge demand in the global energy .Solar photovoltaic systems are becoming increasingly popular as industries try to decrease their carbon footprint Moreover rapidly increase in the renewable technology opening up new opportunities for utilization of renewable energy resources. Solar energy is the most abundant, inexhaustible and clean of all the energy resource. The ability to generate electricity from sunlight is a relatively new and exciting technology that offers many new opportunities in generating green 'electricity. This technology is called solar photovoltaic.[1] PV offers the ability to generate electricity in a clean, quiet and renewable way. It makes use if the abundant energy from the sun, to generate electricity. The major objective of this review study is to distinguish between different kinds of material like polycrystalline, mono crystaline and thin film with their properties and working efficiency. [3]This case study represents a proposed generic framework that fulfil senergy demand problem. Also the objective of this paper is to maximize power generation while minimizing the system cost. [3]

KEYWORDS: Renewable energy, Solar Panel, PV material, Roof mounts system, 35kw

I.INTRODUCTION

Energy is required for different range of application. Solar photovoltaic (PV) systems generate electricity from the sun for use in any residential or commercial applications. It can have much form like heat, electrical, chemical, light and so on. Since the use of energy has become integral part of our life its supply should be secure and sustainable. Therefore, development of clean, secure, affordable energy should be our priority. Government of India target of 100GW of solar energy by 2022.The major states involve up rise the solar status are Rajasthan, Madhya Pradesh, Gujarat, Uttar Pradesh and Kerala. Small player companies are focusing major on Solar Roof top as major population in India searching for cheap and long lasting electricity and doesn't want to purely depend on grid connected system. [1].

This study focuses on the optimization of the Designing layout of residential flat rooftop solar PV system.The optimization of solar PV generation on large roofs involves different parameters, including total load size the system size, the panel tilt angles, spacing between the panels, tilt angel of the panels ,loss of generation due to shading effect, total cost of the panel installation, ,energy saving by the panels etc.[2]

II.SOLAR PV MATERIAL

Solar PV materials are classified as follows:

- Polycrystalline PV material
- Mono-crystalline PV material
- Thin film PV material

a) POLYCRYSTALLINE PV MATERIAL

Also sometimes known as multicrystalline cells, polycrystalline silicon cells are made from cells cut from an ingot of melted and recrystallized silicon. The ingots are then saw-cut into very thin wafers and assembled into complete cells. They are generally cheaper to produce than monocrystalline cells, due to the simpler manufacturing process, but they tend to be slightly less efficient, with average efficiencies of around 12%.

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b) MONO-CRYSTALLINE SILICON PV PANELS

These are made using cells sliced from a single cylindrical crystal of silicon. This is the most efficient photovoltaic technology, typically converting around 15% of the sun's energy into electricity. The manufacturing process required to produce mono-crystalline silicon is complicated, resulting in slightly higher costs than other technologies.

c) THIN FILM PV PANEL

A number of other materials such as cadmium telluride (CdTe) and copper indium diselenide (CIS) are now being used for PV modules. The attraction of these technologies is that relatively inexpensive industrial processes, certainly in comparison to crystalline silicon technologies, can manufacture them yet they typically offer higher module efficiencies than amorphous silicon. Most offer a slightly lower efficiency: CIS is typically 10-13% efficient and CdTe around 8 or 9%. A disadvantage is the use of highly toxic metals such as Cadmium and the need for both carefully controlled manufacturing and end-of-life disposal; although a typical CdTe module contains only 0.1% Cadmium, which is reported to be lower than is found in a single AA-sized NiCad battery. The table No. 1 will give you a comparison between various types of solar photovoltaic panels. [4]
In India, the most commonly available panels are polycrystalline/ multi-crystalline.

Sr.No	Property	Multi/ Polycrystalline	Mono Crystalline	Thin Film (CdTe, CIGS, Amorphous crystalline etc)
1	Efficiency	Moderate (13-15%)	Highest	Lowest
2	Cost	Moderate	Highest	Lowest
3	Area occupied per kW	Moderate (apprx 100 sq.ft)	Lowest	Highest
4	High Temperature Performance	Poor	poor	Better
5	Generation in diffused light	Average	Average	Better

Table No: 1

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III.FACTORS AFFECTING SOLAR PANEL OUTPUT

Sr no	Factors	Remarks
1	Direction	For panels that have fixed position without any sun tracking mechanism, they should face south direction for better output throughout the year.
2	Tilt/ Angle of inclination	Preferably according to the latitude of the place .
3	Shading	Even a small part of shaded panel, affects the entire output of the panels largely. Ensure the panels are placed such that there is no shadow on them throughout the day. Even a single partially shaded panel affects the output of all other solar panels in the system. Also, ensure that there is no dust etc on the panel to avoid shading.
4	Temperature	Higher the temperature, lower will be the output from solar panels. Usually, panels are rated according to standard test conditions (i.e temperature: 25 degree Celsius, insolation 1000W/m2, Air Mass: 1.5). Hence, if temperature is higher than this, your panels may give less than rated output.

Table No: 2

A.CASE STUDY

- Location Of site: Pimple Gurav,Pimpri Chinchwad, Pune.
- Fronious Inverter/ power conditioning unit size 35 kw total capacity.
- Solar PV module – Each module of 330wp. Equitant total capacity of 35 kw. Polycrystalline silicon material.
- Module mounting structure-Aluminium/galvanized M.S structure.
- Tilt with 18 Degree
- Inverter efficiency 98%
- DCDB 5 Input 5 output
- ACDB
- Dc & Ac cables of 4 sqmm & 6 sqmm
-

The eventual application of PV modules is to use them in a system which can supply electrical energy to a set of loads. In most cases, system components, other than the PV modules, like batteries, charge controller, inverters, etc. are required to achieve reliable sources of power. Figure 1 shows the rooftop connection.

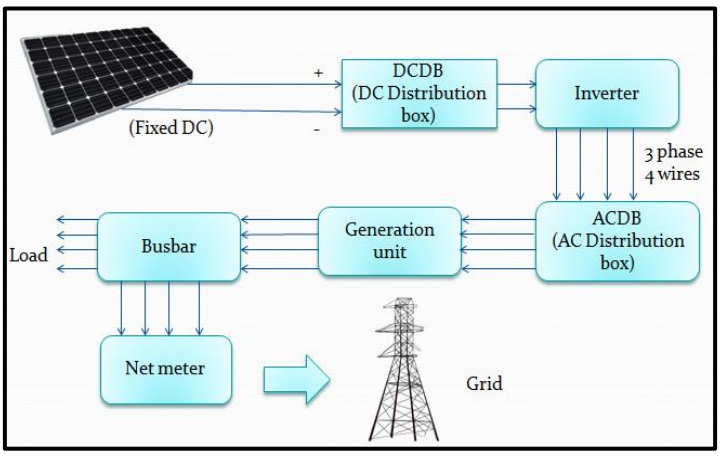

Figure:1

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B.DESIGN CALCULATIONS

At the site, there are 6 blocks of areas on which solar panels are to be mounted. Out of them 4 areas (1,2 & 5,6) are having approximately same dimensions.

1. Area=30ft*17ft=510 sq. ft. As 1kw=100sq.ft

X=510sq. ft. i.e. X=5kw. (where, X is energy to be generated from respective Area)
Each module has rating of 330wp
No. of modules required= 5000/330= 15 nos.

2. Area=43ft*19ft=817sq.ft

X=817sq.ft.=8.17k
No. of modules required= 8170/330=25 nos.

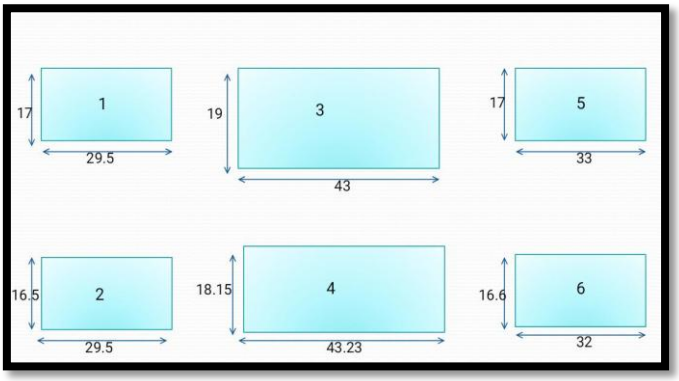

Figure:2

C.COMPONENTS

- **Inverter:**
  The inverter used here is Fronius grid tie inverter. Inverters play a crucial role in any solar energy system and are often considered to be the brains of a project. . An inverter's basic function is to "invert" the direct current (DC) output into alternating current (AC).
- **Solar ACDB:**
  It gives extra protection to the system in case of failure. ACDB is made up of breaker, isolator, voltage and current monitoring etc.ACDB installed after the inverter before the LT panel. Along with fuse, it has provision for surge protection. ACDB consist of energy meter, which gives information about usage of energy.
- **Solar DCDB:**
  For providing a protective fuse or circuit breaker for each circuit, DCDB is used DCDB control DC power from solar panels. It consist of isolator which protects the system under faulty condition, energy meter which gives information regarding exact PV array voltage and current obtaining.
- **Net Meter:**
  Net meter is bidirectional meter, which records the energy imported from grid to fulfill the load demand and excess energy that is exported energy to grid after self-consumption.
- **Mounting Structures:**
  There are various mounting structures for solar module like, Rooftop, Tin shade, single pole, Ground mounted structures. Out of this rooftop mounting structure is used, in which solar panel are mounted on rooftop with few inches gap with surface of roof and in parallel with it. This structure is easy to install as it uses only mechanical system of assembly with use of nu and bolt. This is highly durable with the use of Pre-galvanized steel for purlins and Aluminum clamps for module.

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RESULTS **53,891 kWh/Year***

Print Results

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Value ($)
January	6.42	4,932	14,797
February	6.97	4,690	14,071
March	7.19	5,197	15,590
April	6.98	4,856	14,569
May	6.64	5,002	15,007
June	5.02	3,895	11,684
July	4.51	3,739	11,217
August	4.48	3,717	11,151
September	5.42	4,205	12,614
October	6.01	4,643	13,930
November	5.79	4,379	13,138
December	6.02	4,635	13,905
Annual	5.95	53,890	$ 161,673

Figure:3

Location and Station Identification	
Requested Location	pimple gurav pune
Weather Data Source	Lat, Lon: 18.55, 73.85 3.4 mi
Latitude	18.55° N
Longitude	73.85° E
PV System Specifications *(Residential)*	
DC System Size	35 kW
Module Type	Standard
Array Type	Fixed (roof mount)
Array Tilt	18°
Array Azimuth	180°
System Losses	14%
Inverter Efficiency	96%
DC to AC Size Ratio	1.2
Economics	
Average Retail Electricity Rate	3.000 $/kWh
Performance Metrics	
Capacity Factor	17.6%

Figure:4

Results are obtained through **PV Watt Calculator** software.

IV.CONCLUSION

In this paper, a basic parameter analysis was conducted for PV systems integrated into Pimple Gurav Pune residential building's rooftop mounting. This help to maximize the energy production. For this purpose, simulations of roof-mounted PV systems were conducted using PV Watt calculator. The study shows that, proposed 35 kW PV system performs better by recording annual energy generation as 53891 kWh/year and with a capacity factor as 17.6%. Finally, the paper is concluded by highlighting the outcomes that would help to all to understand the importance of the solar panel installation system in this increasing demand world

REFERENCES

[1]T.K.Chattetjee,D.KMittra,'ANovelSolid-State Integrated Protection System for three phase Induction Motors', 2009 Third International Conference on Power Systems, Kharagpur,INDIADecember27-29.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.122|

||Volume 9, Issue 5, May 2020||

[2]I.Colak, R.Bayindir,A.Bekta,I.Sefa,G.Bal,"Protection of Induction Motor using PLC.",Power eng IEEE, pp.96-102,2007.
[3]M.Peltola,"Slip of AC induction motors and how to minimize it", ABB Drives Press Releases Technical Paper,2003,pp.1-7,ABB,NewBerlin.
[4]S.Sneha,S.Radhika,"Controlling and Protection of Three Phase Induction Motor Using PLC", IJRASET, Volume4 IssueXI,November2016,ISSN:2321-9653.
[5]A.Pawar,K.Pawar,P.Desai,"FaultDetectionofInduction MoorbyUsingPLC",IJTIR,Volume24,Issue2,April2017,e-ISSN:2321-1814.
[6] D.Kumar, A.Basit, A.Saleem, G.Abbas,"PLC Based Monitoring & Protection of 3-Phase Induction Motors against Various Abnormal
Conditions", IEEE 2019 International Conference on Computing, Mathematics and Engineering Technologies – iCoMET 2019.
[7] M. G. Ioannides, "Design and implementation of PLC-based monitor-ing control system for induction motor," IEEE Trans. Energy Convers., vol. 19, no. 3, pp. 469–476, Sep. 2004.
[8] " Text Book of Electrical Technology in S.I units "by B.L.Theraja.
[9]P. M. Sarma, S. Swathi, A. Sathish Kumar, and P.
Sridhar, "Simulation & Hardware Implementation of PLC Based Star- Delta Starter ",International Journal of Electronics, Electrical and Computational System IIJEECISSN 2348-117X,Volume 6, Issue 6June 2017.