ISSN 2395-1621

On grid solar power plant installation on commercial rooftop

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ABSTRACT

As the world faces an impending dearth of the fossil fuels, most immediately oil, alternative sources of energy must be found. The solar energy is produced by the sunlight is a non-vanishing renewable source of energy which is eco-friendly every hour enough sunlight energy reaches the earth to meet the world's energy demand for a whole year. In today's generation we needed electricity every hour. This solar energy is generated by as per application like industrial, commercial and residential. It's can easily energy drawn from direct sunlight so it's very efficient. Solar energy is the one of the known renewable forms of the energy with its source being the sun. This paper describes about solar energy, solar plant, various equipment's required for installation of plant and step by step procedure for installation

ARTICLE INFO

Article History

Received: 30th May 2021

Received in revised form :

30th May 2021

Accepted: 2nd June 2021

Published online :

3rd June 2021

Keywords: On-grid, Solar energy, Solar photovoltaic system, system sizing.

I. INTRODUCTION

Solar energy utilization in India is becoming more popular day by day in all means ranging from small scale to commercial scale usage. This is due to the advantages of solar energy. Basically, solar power plant has three types on-grid, off-grid and hybrid. Solar energy is infinite, provides clean energy without emitting greenhouse gases, that may save peoples money on their electricity bills. There are basically three types of solar power plant:

a) On-grid

b) Off-grid

c) Hybrid solar power plant

On-grid –Grid-tie or grid-connected solar system, in this system utility acts like battery source.

Off-grid- Dc power generated by solar panels is converted by inverter and use to run electrical requirements, but when the load of house or business is less, the excess amount of DC power is stored in the battery, which useful at night time. This stored power can be later use during power outage or even the panels are not able to generate power.

Hybrid: Hybrid solar systems enable you to store solar energy and use it when you're home during the evening when the cost of electricity is typically at the peak rate. On-grid power plant is easy to install and cost-effective, however its ideal in spaces where there is continuous power supply.

The generated power during the daytime can be utilized fully by powering the building loads and excess can be fed to the grid as long as the grid is available.

The grid interactive rooftop solar system can work on net-metering basis where in the beneficiary pays to the utility on net meter reading basis only. The entire energy generated by the rooftop solar PV system is fed directly into the electrical grid and the system owner is benefited by feed-in-tariff based on the sale of the power to the utility. In a net-metering arrangement, the focus is primarily on self-consumption of electricity generation by the consumer.

In this paper, the study is an attempt to understand the awareness, perception and concerns of commercial sector of satara city for installation of rooftop solar system Besides, the study also explores the financial viability of the model by comparing the capital cost of this solar system with the cost saving resulting from the use of the system

II. LITERATURE REVIEW

Before proceeding to carry the installation of on-grid solar power plant, a few related simulation studies were reviewed to the understand the concept.

A study predicts the solar cell generates power supply signal output at the same phase, magnitude and the frequency as the grid to operate in connection to the grid. The first step in the design of a photovoltaic system is determining is the site we are considering has good solar potential. The heart of a photovoltaic system is the solar module.

Solar PV module:

Many photovoltaic cells are wired together by the manufacturer to produce solar module. solar modules are wired together in series to form strings. Strings of modules are connected in parallel to form an array. In solar system two types PV modules -Crystalline and Thin-film. Crystalline PV modules are more efficient and use less space.

Array structure:

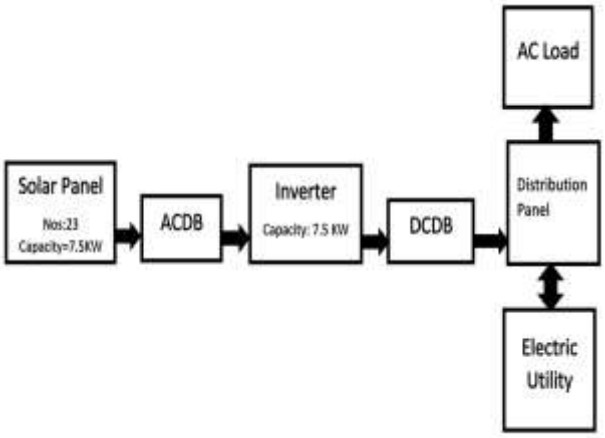
Solar panels are joined into arrays and commonly mounted. The structure should be designed to allow simple and easy replacement of PV module and occupy less space. Total weight of structure on roof should be less than 60 Kg/m*2.

The structure should have min. clearance of 0.30m from roof level. In case of installing high- efficient solar power plants, it's very important to determine the parameters of location where the powerplant will be installed.

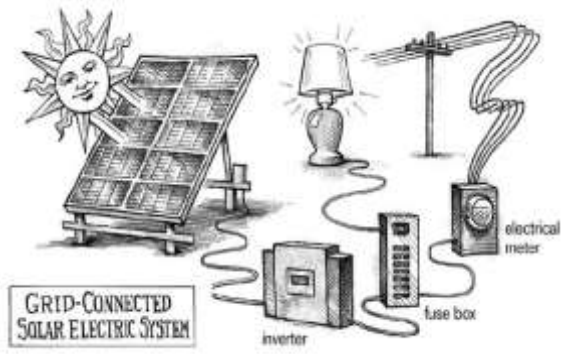
Solar radiation varies with location, in India generally, 4-7 KWh/m*2/day solar insolation is required and Tilt angle is set at +5 for winter and -5 for the summer. Roof design might be flat, pitch, semi-pitch each will have a different productivity.

The six most important issues that need to be addressed when we think about investing in solar panel installation that is, maintenance, surroundings, insolation, coverage, costs, and recycling.

III. BLOCK DIAGRAM



a)



b)

Fig.1: On-grid solar power plant a) Block Diagram b)Schematic Diagram

IV. LIST OF COMPONENTS

Solar PV system includes different components that should be selected according to system type, site location and applications. A balance-of-system that wired together to form the entire fully Functional system capable of supplying electric power and these components are:

1.PV module: It is made from semiconductor and convert sunlight to electricity. The PV converts sunlight into DC electricity. The most common PV modules include single and polycrystalline silicon and amorphous silicon with other technologies entering the market.

2. Inverter: Converts DC output of PV panels into a clean AC current for AC appliances or fed back into grid line. It one of the solar energy systems main elements, as the solar panels generate dc-voltage.
Inverters are different by the output wave format, output power and installation type. It is also called power conditioner because it changes the form of the electric power. The efficiency of all the inverters reaches their normal efficiency (around 90%) when the load demand is greater than about 50% of rated load.

3.Net meter: Net meter is a solar incentive that allows you to Store energy in the electricity grid. Net metering policy make solar energy more attractive and affordable for users. It not only brings down the energy cost drastically, but also helps create small power generation units in almost every nook and corner of the country.
In Net Metering, the grid acts as a huge 'bank' and 'stores' our extra solar power for times when we don't have enough. This eliminates the need for the expensive battery backup system should be sufficient for power outages.

4. ACDB and DCDB: ACDB and DCDB both are important components of solar system. ACDB and DCDB are basically safety circuit boxes which prevent our appliances.
DCDB is installed between solar panel and solar inverter. While ACDB is installed after the solar inverter but before connected load.

5. Load: Is electrical appliances that connected to solar PV system such as lights, radio, TV, computer, fans, refrigerator, etc.

Sr.No.	Component	Quantity
1	Solar panels (monocrystalline) Each panel-330W	23
2	Inverter (7.5 KWh)	1
3	DC Fuse (32 Amp)	1
4	Inverter MCB (32 Amp)	1
5	Energy meter (3 phase, 0-60Amp)	1
6	MCB (32 Amp, 415V)	1
7	ICTP (32 Amp)	1
8	Net meter	1
9	MCB (63Amp, 415V)	1
10	ACDB and DCDB with surge protector	1

V. CALCULATION

Sizing of the inverter: The power of devices that may run at the time is;

P Total= 7012Watt

The inverter needed must be able to handle about 7012Watt at 7500W, polycab inverter, PSIT-8K.

Inverter convert AC power to DC power but in this process, inverter required some energy which is consider as loess happened in inverter.

Load energy required = 8 KWh per day

Consider 20% energy loss in inverter,

Loss = 8*0.2 = 1.6

Therefore, the total energy should be supplied to inverter is,

8+1.6 = 9.6 KWh/day

Hence solar panels must be generate = 9.6 KWh/day

Losses in solar panels = 25%

= 9.6*0.25

= 2.4 KWh/day

Total energy solar panels must be generated,

= 9.6+2.4

= 12 KWh/day

At given location, solar radiation = 1.6 KWh/m^2/day

Hours of solar radiation = 5.5 h/day

Total Power of solar panels

= Total energy must be generated by panels/Solar radiation

= 12/1.6 KW

= 7.5 KW

Now, each panel has 330W capacity hence we get,

Total number of panels = 7500W / 330W

= 22.72~ 23 Panels

The PV array of the system consists of 23 panels as 1st string contain 12 panels and 2nd string consists 11 panels.

VI. METHODOLOGY

In PV solar power plant, we used solar cells and by combining solar cells, modules are formed and that modules are nothing but the solar panels. One solar panel can generate 250W to 350W power. So, according to our requirement we can connect no.of solar panels together and generate electricity.

The solar panel is installed on the rooftop roof-top, after the estimation of electricity bills and calculation. PV system consists of various electrical and mechanical components which helps the process of energy conversion efficiently and effectively. The components of PV system include the PV arrays mounted on the roof, charge controller, and power converter devices the solar panel captures the entire sunlight incident on it. and then convert this sunlight energy into electrical energy with the help of semiconductor layers.

The inverter converts DC energy into AC then this energy is given to load along with the utility supply. There is no battery in the whole setup so the power generated from the solar panel is directly consumed by the load In case power is generated by solar excess than a requirement, then excess energy is exported to power quality. On the other hand, if load requirements are more than what power generated by solar, then power is imported from the utility. Net metering is provided for importing and exporting power.

VII.EXPECTED RESULT

i. Saving per annum Rs. 45000 to 57000 per year

(Considering the average tariff of Rs. 5 per unit)

ii. It will generate about 9000-11000 units per year

iii. Payback period: 5 to 7 years

VIII. REFERENCES

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