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A Case Study on Power Generation through Grid Connected PV System

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Abstract: *Today's large dependency on fossil fuel moving the world towards global warming, rise in earth temperature, decreasing fossil fuel from earth surface and many more. To avoid this all issue we have to move towards the maximum use of green energy. This paper gives the brief information about how Grid tie PV System works the components used in it. Also we had discuss a case study of roof top 20 kW Grid tie PV system, which is mounted in GGSF campus on GGCOE building. Future power demand and extension required in system to fulfil the upcoming demand.*

Keywords: Fossil fuel, global warming, green energy, PV Grid tie System

I. INTRODUCTION

Due to industrialization, globalization, power demand is increasing day by day. But the source on which we are dependent is depleting, the more use of fossil fuel cause serious issue in environment which ultimately affects the human life. To fulfil the energy demand we have to focus more on alternative resource like solar, wind etc. The major role in green energy now a day's is captured by PV system. Solar photovoltaic (PV), now a day's play a vitalrole in the global technological scenario with the rising global demand for energy. A photovoltaic (PV) system directly converts sunlight into electricity. The elementary device of a PV system is the PV cell. Cells may be grouped to form panels or arrays. The voltage and current available at the terminals of a PV device may directly feed small loads such as lighting systems and DC motors or it canbe convert into AC with the help of Grid tie inverter.

What is a grid-tied solar system?

A grid-tied solar system is, as the name proposes, a solar energy system that is connected to the main electricity grid. They can operate without being connected to a solar battery, making them the most simple, cost-effective, and popular type of solar system.

Fig 1: Grid-Tie solar system

Solar PV technology is used for generating electricity from solar energy. A grid connected solar Photovoltaic system is simply a solar energy panel system that is connected to the main power supply (called the "grid"). The consumer of this system uses electricity from both the solar panel system as well as the electrical grid. This enables the user to draw energy from grid during as on a cloudy day or during the night. Similarly, during power cut, when power supply is shut, electricity can be drawn from the solar panel system.

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II. GRID-TIED SOLAR SYSTEM COMPONENTS

- **Solar panels**: The solar panels collect the sun's energy and produce DC electricity, which can then be converted into the AC electricity you need to power your home.
- **Racking/mounting**: The solar panel mounting system secures and stabilizes panels on your roof or the ground.
- **Wiring**: Wiring is required to conduct power between the solar panels and inverter, then transport it to the net meter/home.
- **Grid-tie Solar Inverter**: The inverter converts the DC electricity from your solar panels into AC electricity (the form required for your appliances and other electrical devices). Grid-tie solar inverters come in three types: microinverters, string inverters, and string inverters used with power optimizers. Today's grid-tie inverters are quite sophisticated, tracking the maximum power point of the modules to operate the system at peak efficiency and terminating the grid connection if grid power is interrupted from the utility.

III. SOLAR GRID TIE SYSTEM FOR GGSF CAMPUS

In GGSF Campus 20KW Grid tie Solar system is installed on GGSCOE building.

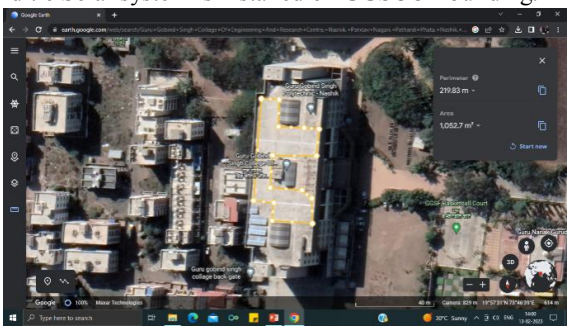

Fig. 2: GGSCOE Roof top area from Google

For this plant 325 wp capacity of single solar module of Vikram solar are used. Total 62 Solar module are used. The Grid tie inverter used in the system is of Delta make.

Table 1- PV Module Specification-

Brand	**Vikram Solar**
Number of Cell	72
Peak power	325 W
Max. Voltage	37.8 V
Max. Current	8.6 A
Open circuit voltage	46.2 V
Short circuit current	9.13 A
Module efficiency	16.75 %

Fig.3: 20 KW Grid Tie System

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Fig.4: Grid Tie Inverter

The Billing History is as shown below.

Table 2- Billing History

BILLING HISTORY			
Bill Month	Units	Bill Demand(KVA)	Bill Amount
DEC-22	20,466	90	3,64,805
NOV-22	19,699	108	3,79,377
OCT-22	17,326	111	3,50,278
SEP-22	23,015	116	4,37,325
AUG-22	19,899	105	3,78,621
JUL-22	18,970	98	3,55,617
JUN-22	19,457	96	3,59,588
MAY-22	20,901	114	3,65,112
APR-22	23,291	122	4,16,954
MAR-22	22,040	134	4,07,370
FEB-22	14,471	76	2,33,282
JAN-22	10,735	50	1,53,832

Avg.unit consumption per month- 19189 kwh = (19200approx.)

IV. SOLAR SYSTEM CALCULATION AS PER BILLING DATA AVAILABLE

Per day unit required- 640kwh
1 kw solar system generation- 4 to 5 Units/day.
System requirement for campus- 160Kw + new building (under construction)
Units generation from 160 Kw- 19200 Units / month
Sanction load – 350 Kw

V. PROPOSED SYSTEM FORM CALCULATION

From the data available and daily energy consumption, system requirement is approximately- 150 Kw.
Sample Payback Period-
Suppose- 150 Kw system price- 9000000/- approx.
Per Kw system installation price – 60,000/- approx.
saving from 150 Kw per month - 18000 units x 18.25/- rs Per unit charge = 3,28,500/-
Yearly bill saving = 328500 x 12= 39,42,000/-
Payback Period = Total System cost / billing amount per year
Payback period= 9000000/ 3942000 = 2.28 year = 27 months approx.
Grid-Tied Solar Systems: Benefits and Draw back-
Benefits of grid-tied solar systems
Least expensive type of solar energy system
Lowest installation costs
High potential savings (using net metering)
Quickest return on your investment

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Simplest system design
Drawback of grid-tied solar systems
If the grid experiences an outage, you will be without power (even during daylight hours).

VI. CONCLUSION

From the case study of 20 Kw grid connected PV system in GGSF campus, the suggestion is as per the current power consumption and future load demand we have to increase the system capacity upto 150 Kw grid tie system, which will fulfil our energy demand.

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