IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 5, March 2025

A Case Study on Power Generation through 200 KW Grid Connected PV System

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Abstract: *The adoption of grid-connected photovoltaic (PV) systems is gaining momentum worldwide due to their potential to meet growing energy demands while reducing greenhouse gas emissions. This review explores the technical, economic, and environmental aspects of implementing a 200 kW grid-connected PV system. It provides a comprehensive analysis of the current state of research, design methodologies, performance evaluation, and challenges associated with such systems.*

The review begins with an overview of PV technologies, including advancements in high-efficiency solar modules and inverter technologies that enhance system performance. Key design considerations, such as site selection, energy yield estimation, and system sizing, are examined. The operational performance of grid- connected PV systems is evaluated by reviewing case studies and data from installed systems.

The review concludes by identifying knowledge gaps and proposing future research directions to optimize the Performance and scalability of grid- connected PV systems. This study serves as a valuable resource for researchers, engineers, and policymakers aiming to advance the deployment of sustainable energy solutions globally

Keywords: Grid-connected PV systems, renewable energy, performance evaluation

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 vital role 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 can be 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.

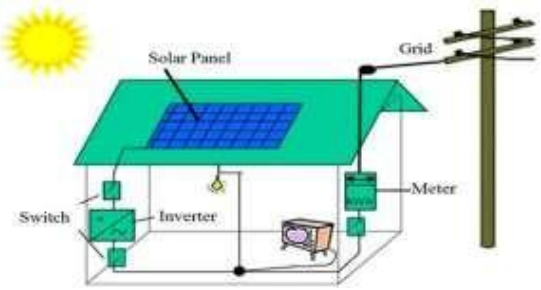

Fig 1: Grid-Tie solar system

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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.

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.

Solar Grid Tie System for GGSF Campus

Fig. 2: GGSCOE Roof top area from Google

In GGSF Campus 200KW Grid tie Solar system is installed on GGSCOE building. For this plant 550 wp capacity of single solar module of waaree solar are used. Total 364 Solar module are used. The Grid tie inverter used in the system is of Delta make.

Table 1- PV Module Specification-

Brand	**Waaree Solar**
Number of Cell	144
Peak power	550 W
Max. Voltage	42.03 V
Max. Current	13.08 A
Open circuit voltage	49.91 V
Short circuit current	13.96 A
Module efficiency	21.36 %

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Fig.3: 200 KW Grid Tie System

Fig.4: Grid Tie Inverter

The Billing History is as shown below.

Avg.unit consumption per year - 17831.83 kwh = (18000 approx.)
Solar system Calculation as per billing data available –
1 kw solar system generation- 5 Units/day.
System installed in campus- 200 KW

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Units generation from 200 KW- 30000 Units / month
Sanction load – 350 Kw

System Calculation
From the data available and daily energy consumption.
Sample Payback Period-
200 KW system price- 85,00,000/- approx.
Per Kw system installation price – 42,500/- approx.
saving from 200 KW per month - 30000 units x 18.25/- rs Per unit charge = 5,47,500/-
Yearly bill saving = 547500 x 12= 65,70,000/-
Payback Period =
Total System cost / billing amount per year
Payback period= 8500000/ 6570000 =
2.5 year.

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

II. CONCLUSION

From the case study of 200 Kw grid connected PV system in GGSF campus, the system highlights the critical aspects of its performance, efficiency and impact on energy sustainability. The system demonstrates the potential of solar energy to contribute significantly to renewable energy target and reduce dependency on conventional energy sources.

ACKNOWLEDGEMENT

Authors express their sincere thanks to S.Balbir Singh Chhabra President Guru Gobind Singh Foundation, Nashik, S.Kuljeet Singh Birdi Secretary Guru Gobind Singh Foundation, Nashik, and Prof.S.R.Upasni Principal Guru Gobind Singh Polytechnic Nashik for their keen interest and encouragement during the study of this project. The support rendered by Prof.S.A.Shastri HOD EE department & faculty members, EE department of Guru Gobind Singh Polytechnic are commendable.

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