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Evaluation of Net Metering for Solar Rooftop Systems

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Abstract: ***A bidirectional metre that can record both import and export energy values is utilized by net metering mechanisms. Using self-produced renewable energy and selling any surplus to the grid are the main goals of net metering. There is a decrease in electricity costs as a result. In net metering, solar photovoltaic systems are heavily utilised. The cleanest, most abundant, most environmentally friendly source of renewable energy is solar energy. In the interest of deciding whether net metering is feasible in India, the notion of net metering using a solar system and data analysis are studied in this research. The study also examines the annual savings in electricity and the viability of solar rooftop photovoltaic systems from an economic perspective. This paper's study examines various solar tracking system tracking mechanisms in detail. The two main categories of solar tracking systems are single axis trackers and dual axis trackers. A single axis tracker is an area near the equator where there is little variation in the sun's precise position. Dual axis trackers are designed for locations where the sun's movement is during the day from east to west, and during the seasons from east to north or south.***
Keywords: Solar panel, generator, battery charger, battery, and net meters

I. INTRODUCTION

The world is currently facing an acute shortage of fossil energy, a lack of energy, dangerous impacts from rising levels of greenhouse gas emissions, and sharply rising oil prices. Hence, the research of alternative energy sources with high efficiency and low pollution is essential. Among the many sources of renewable energy, solar photovoltaic (PV) system energy is the only renewable resource that is clean, limitless, and environmentally benign, making it the most important sustainable resource.

There are numerous electricity shortages in India. Power outages that hinder economic growth are widespread in India and affect the majority of the country. Peak power deficiency in 2014 is 6103 MW at 4.5%. It is 1655 MW with 8.6% on building roof tops in some locations, such the state of Maharashtra, to reduce the load required. Solar energy is significant in that it is a natural resource. Supplying energy free of GHG emissions and contaminants. A solar cell module in a photovoltaic system is made up of solar cells that are either connected in parallel or in series. These modules are then joined to form an array and combined with auxiliary electrical and electronic parts, such as charge regulators, batteries, and converters, to build photovoltaic system. The solar systems can either link to the grid or function independently. The building uses the majority of the electricity produced during peak hours, with any extra being fed into the grid. When there is not enough power generated, electricity is taken from the grid. Captive loads are met in this situation by using grid power. The grid functions as this system's battery backup. Agreement is made for imported or exported grid energy by the mechanism. In an ideal world, grid-connected solar PV systems don't need backup batteries because the grid can supply excess electricity when needed and vice versa. A minimum battery backup of one hour of load capacity is strongly advised for the benefit of system performance and dependability with the help of self-produced energy, utility users can offset all or part of their electricity use under the net metering policy. A strategy known as net metering enables utility customers to offset all or a portion of their electricity use with electricity produced on-site using renewable energy sources. A metre that can spin and measure energy flow in both directions is how net metering functions. The idea of net metering entails calculating the difference in net energy between the import of power from a distribution licensee over a specific time period and the export of energy that was generated. Bidirectional metres, which have the ability to record both energy import and export, can be used to do this. The extra energy produced is fed into the system when volume increases customer demand.

II. SCOPE AND RELEVANCE

1) Design, supply, installation, commissioning, and a five-year full warranty are included in the scope of work. According to the technical specifications listed in this bid, maintain and operate a rooftop SPV system that is net metered and linked to the grid, either without a battery or with a battery backup for an hour's worth of connected load.

2) The selected bidder will be responsible for wiring up to the distribution board from the SPV Rooftop system (s). Every solar power installation must have a maximum cable length of 25m, and the bidder is responsible for providing any additional cable length that may be needed.

3) Performance evaluation of the entire system

III. LITERATURE REVIEW

Jagruti Thakur's paper, "SUSTAINABLE NET METERING MODEL FOR DIVERSIFIED INDIA," makes a revision to India's net metering regulation while taking into account the wants and needs of the vast majority of the population. so that everyone may access renewable energy. The existence of feed-in tariff rules has made green energy a reality in many developed nations. The consumers are divided into three categories in this paper: A, B, and C. With category C being the highest among the three groups and category A representing the lower class in terms of lifestyle. The information for categories A and B came from villages, suburban areas, and townships, respectively, whereas category C's information came from a township. For categories A, B, and C, the number of family members ranged from 4 to 10 for category A, 2 to 16, and 2 to 6 for category B. Apart from this, the average number of family members spending the day at home ranged from 1-6 for category A, 0-4 for category B, and 0-2 for category C, with the exception of one instance where there were 8 family members, including two maids.

If the payback duration for each category is taken into account for category A, two respondents' payback periods were unattainable while the rest's ranged from 8.4 to 19.8 years. In the instance of category B, the payback period fell within the range of 8.8 to 12.3 years within the time period of analysis. The payback period for category C was between 8.3 and 10.5 years. The repayment term must necessarily be shorter than 8.5 years.

IV. OBJECTIVES OF PROPOSED WORK

A rooftop solar panel makes it easier to generate more electricity than what consumers need. Nevertheless, the electricity generated by solar panels is wasted since there is no enough storage system. This issue is resolved by the solar net metering system by feeding the additional power into the grid.

V. METHODOLOGY

A strategy known as net metering enables utility customers to partially or completely offset their energy usage with their own pv-generated electricity. A metre that can spin and record energy flow in both ways is used in net metering. When a customer is to use more energy than they are producing and taking it from the electric grid, the metre rotates forward. Otherwise, it spins backward. When power is returned to the grid (i.e. Using less energy than they are producing). The consumer is only charged for the net amount of electricity utilised at the conclusion of a given month. In addition to using a pv system to offset a home's energy use, net metering only works for grid-connected systems. What makes it so advantageous is that any extra energy transmitted to the utility can be sold back at a profit. Energy producers profit from this positive balance if there is more energy production than consumption. For instance, recs (renewable energy credits) are deposited to the customer's account for the subsequent billing period. If there is a surplus at the end of the year, the customer may pay for the total rec collected at an avoidance cost rate or retail cost rate, or the total rec collected may be transferred and utilised as compensation, depending on the utility policy.

A. Schematic and Layout Diagram of Hydropower Plant

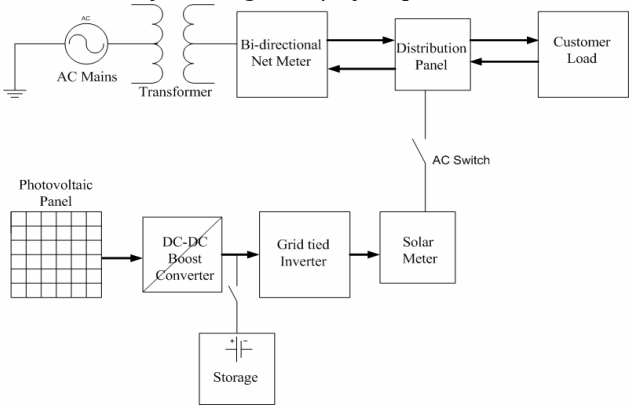

Figure A: Schematic of Hydropower Plant.

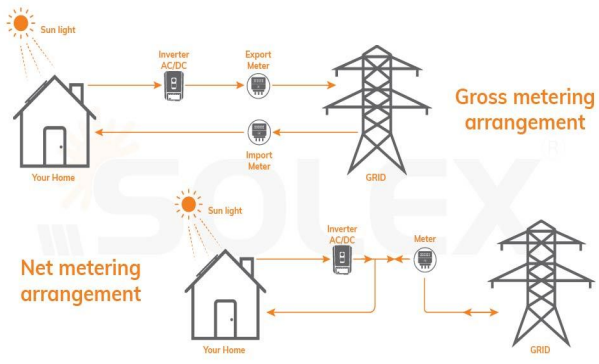

Figure B: Layout of Hydropower Plant.

B. Layout of Hydroelectric Power Plant

A rooftop solar panel simplifies the process to generate more electricity than what consumers need. Nevertheless, the electricity generated by solar panels is wasted since there is no enough storage system. This issue is resolved by the solar net metering system by diverting the additional power into the grid. Each and every net metering solar power installation is wired into the electrical grid. The bidirectional electric metre rotates in the opposite direction to measure the transfer of the additional electricity from the solar metre to the grid. Your bill is credited with the electricity that was moved. This implies that you only need to pay for the additional unit of electricity you use when you need to utilise the electricity later. The bidirectional electric metre also maintains track of all power transfers. As a result, you don't need to regularly maintain your power utility.

A great strategy to encourage the use of sustainable energy is through net metering. It provides both consumers and the environment with the following advantages:

1) *It eliminates the Need for a Storage Battery:* Owners of solar panels do not need to spend money on batteries to store additional power. The metering energy inverter makes it simple to feed the grid with extra electricity. People can use power whenever they need it without having to pay extra.
2) *It Creates Financial Credit:* For those who have a large solar panel installation, metering energy is a terrific opportunity to make a passive income. By producing several units of power, users can earn money from the state government or the electric department or credit for future use.
3) *It requires little upkeep:* A practical choice for using electricity is net metering. Also, compared to a non-grid system, the maintenance cost is lower when excess power is sent to the electrical grid.

Each state in India has a varied net metering installation process since different power distribution firms and electric departments have different policies. The typical procedure, however, consists of the following steps:

a) In order to request approval to install a rooftop solar panel, applicants must submit an application to the SDO.
b) The sub-divisional officer must give applicants the approval receipt to be collected.
c) After application and acceptance, SDO completes the site verification in three days.
d) Within 15 days of receiving the application, the SDO approves following the site inspection.
e) Within three days of completing the net metering form, the consumer and SDO sign a net metering agreement.
f) Consumers must submit a solar system certificate, property papers, an installation certificate, fees, and other documents after installing a solar system.
g) Finally, a JE makes a site visit to go at the solar panel installation. The JE authorises the installation of a metering energy system if all requirements are met.

To effectively track their solar metering energy application, applicants must adhere to the provided checklist:

- *Stage-1*

Apply with a properly signed document.
proof of occupation and roof rights are required.
ID proof with the applicant's signature.
a copy of the most recent electric bill.
The NOC of the owner or co-owners must be submitted by applicants who are co-tenants or co-owners of real estate.
contract that a registered customer signs and a notary public attests to.
a picture of the applicant.

- *Stage-2*

submit a registration form with the registered consumer's proper attestation.
letter requesting a punishment for subsidies.
a PPA for RESCO and an EPC for CAPEX.
obtaining a letter for an application for energy metering.
Before installing solar panels, a coloured photo of the location was taken, clearly identifying the date and time.
Project report in the tender document's Annexure-D format.
Diagram of the solar power plant in one line.
Certification of the PV module inverters as a system.

details of the solar PV module and inverter.
Agreement on non-judicial stamp paper for an energy metering connection.

VI. ADVANTAGES

1) For many families, owning a domestic solar energy system is even more appealing and cheap thanks to net metering. It can reduce homeowners' annual utility costs by several hundred dollars, and it makes the process of administering and accounting for the energy going to and from the utility much simpler.
2) The system is simple and reasonably priced. It makes it possible for consumers to receive fair compensation for the electrical energy they generate without needing to install an additional metre or a costly battery storage system.
3) With net metering, you can get paid for any energy that your system generates but that your house doesn't consume. Although there may be some differences in the rules for your utility's net metering programme, most utilities enable you to roll over the credits each month. If you still have credits left over at the end of the year, you can decide whether to receive a check for the energy your panels generated or to keep rolling them over.
4) It encourages energy users to participate actively in the generation of alternative energy, preserving natural energy resources and safeguarding the environment.

VII. APPLICATIONS

When you have a rooftop solar system, it can frequently produce more electricity during the day than you use. With net metering, the homeowner only pays for the "net" amount of energy used each month, which is the difference between the amount of energy the solar power system produces and the amount of energy used by the house during the billing period. You will see the metre running backwards when your home or company is net-metered, and depending on local regulations, you may receive a credit to offset the electricity you consume from the grid when it's cloudy or at night. Then, only your "net" energy use is charged to you. The extra energy produced is returned to the grid for use by your neighbours.

VIII. RESULTS

Since solar energy doesn't harm the environment or produce greenhouse gases, we should encourage its use. One of the most reliable, affordable, and clean energy sources is solar energy.
More solar electrical energy is advantageous for a number of reasons, including the fact that it is a clean, renewable source of energy that does not contribute to global warming or climate change.

IX. CONCLUSION

This essay focuses mostly on green energy, which is more important for power generation in modern times due to a scarcity of traditional supplies. The generation will be carried out in a distributed manner because it depends on the availability of the resources. Gaining from the generation net metering concept is a developing field. It is a fact that a lot of people have a hard time believing that the world is really as it seems. Less utilisation results in a shorter payback period as generation increases. Net metering overall paints a picture of clean energy and the growth of a sustainable society.

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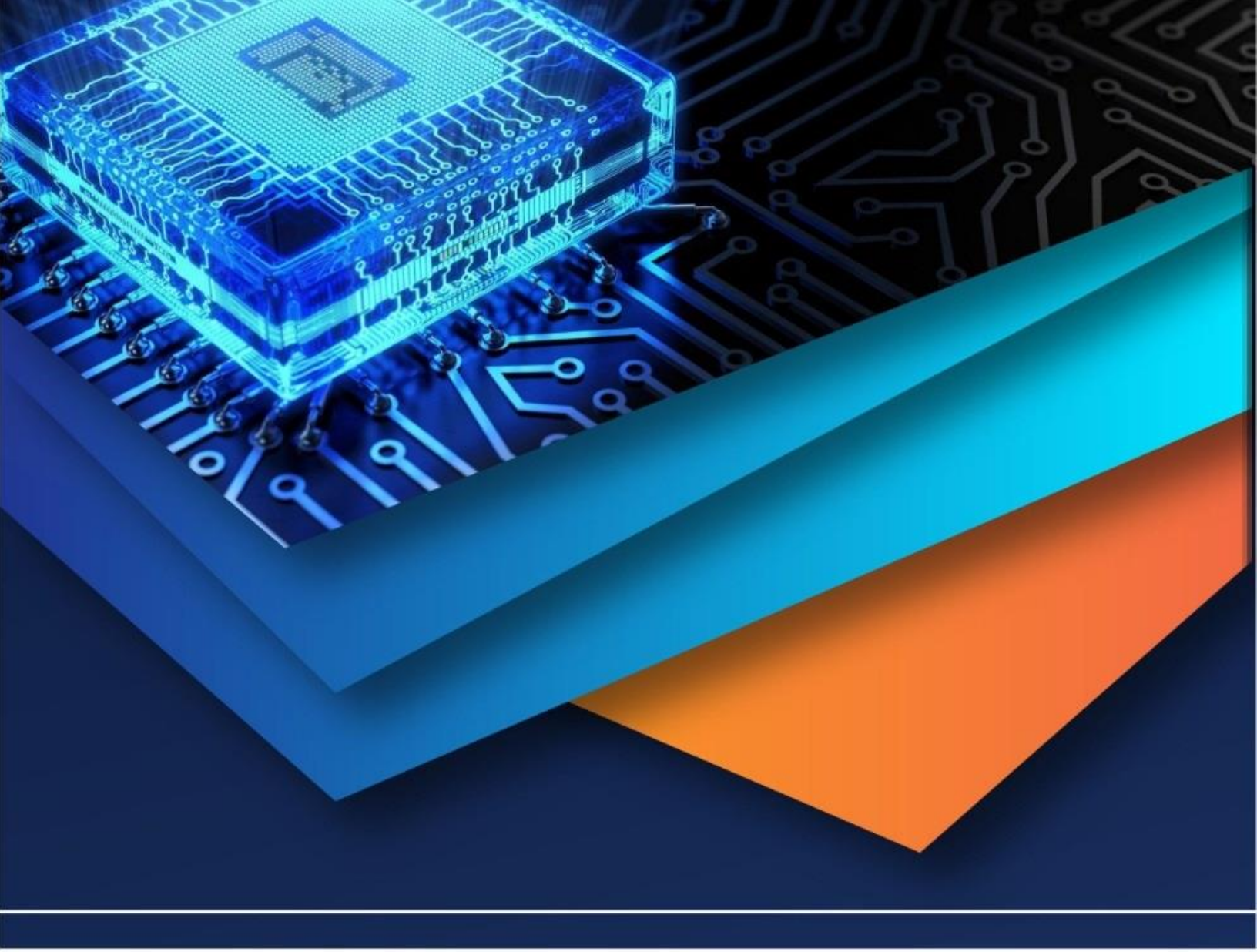

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