Net Meter Base Solar Pv System: Mgicoet Shegaon

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***Abstract*—** Net metering is new approach in power system. It basically save the energy consumption charges & it is also beneficial in energy conservation so this system hits the two important targets. This is best alternative for energy crises in power system, in this paper solar net meter synchronize with power grid. The two inverter sets each having capacity of 20 KW is used. MGICOET peak load demand is 33kw (variable).

Keywords- *netmeter , solar PV system , Inverter, Grid .*

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I. INTRODUCTION

In recent years solar PV systems became viable and attractive. Utility scale plants are being set up worldwide with promotional mechanisms which are set up on ground surface. Available roof-top area on the buildings can also be used for setting up solar PV power plants, and thus dispensing with the requirement of free land area. The electricity generated from SPV systems can also be fed to the distribution. [1]

II. DETAILS ABOUT TYPES

There are two different types of tariff metering arrangements that can be used for development of rooftop solar PV projects such as gross and net metering. Both net-metering and gross metering concepts have been implemented for solar PV system.

i. In a gross metering arrangement, the entire energy generated by rooftop solar PV system is fed directly into the electrical grid and the system owner is benefited by feed-in-tariff based on sale of power to the utility.

ii. In a net-metering arrangement, the focus is primarily on self-consumption of electricity generation by the consumer. The excess/surplus is either sold to or banked with the local utility. Net metering arrangements. [2]

III. CONSTRUCTION OF SOLAR PV NET METER PROJECT AT MGICOET SHEGAON:

Based on available roof area solar PV panels will be installed on the roof of the MGICOET Shegaon building. The output of the panels (DC electricity) connects to the power conditioning unit / inverter which converts DC to AC. The inverter output will be connected to the control panel or distribution board of the building to utilize the power. The inverter synchronizes with grid. If the solar power is more than the load requirement, the excess power is automatically fed to the grid. For larger capacity systems connection through step up transformer and switch yard may be required to feed the power to grid.

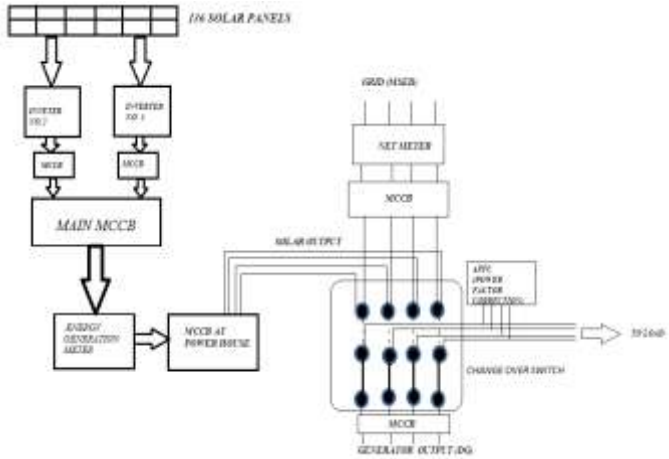

Figure.1 Net meter base solar pv system: MGICOET shegaon.

IV. SOALAR PROJECT IMPORTATNT COMPONENTS

i. Solar panel
ii. Inverter
iii. Protection scheme
iv. APFC circuitry

i. Solar panel

Figure 2.Solar panels

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TABLE: I SOLAR PANEL SPECIFICATIONS

No.of solar panels	136
Peak Power Wa_s-Pmax (Wp)	295
Power Output Tolerance-Pmax (%)	0/+3
Maximum Power Voltage-Vmp(V)	35.80
Maximum Power Current-Imp (A)	8.25
Open Circuit Voltage-Voc (V)	45.20
Short Circuit Current-lsc (A)	8.80
Encapsulated Solar Cell Efficiency-ηc (%)	17.1
Module Efficiency-ηm (%)	15.1

ii. Inverter used in solar PV net metering Project

Figure 3. Solar inverter20KW

TABLE: II DC DATA OF INVERTER

Recommended max. PV power, KWp	21.6
MPPT range,	4 0 -850
DC start voltage, V	350
Max. DC voltage, V Yes	1000
Max. DC current, A	41
MPP tracker	1
Number of DC connections	6 x MC4

TABLE III: AC DATA OF INVERTER

Rated AC power, kVA	19.2
Max. AC active power, kW	19.2
AC grid connection	3AC 400 V + N, 50–60 Hz
Rated power factor	1
Max. AC current, A	3 x 29
European efficiency, %	97.8
Feed-in starting power,W	20
Night time power consumption W	< 0.5

iii. Protection scheme

The protection is provided through MCCB connected between solar and MSEDCL .The solar requires the MSEDCL pulse for certain operation. At the time of power cut from MSEDCL solar will be out of synchronization so ultimately MSEDCL side protected and solar will not inject power at time of power cut. Change over switch is important link it disconnect the solar and MSEDCL at the same time. So when generator comes into operation solar and MSEDCL will be out of service. Without operating change over their will be no operation, it is a safety device. [2]

iv. APFC circuitry

This scheme is used for provide control on power factor it is basically capacitor bank operated automatically by using controllers. The power factor is maintained at 0.99 leading value

V. MPPT.

Maximum Power Point Tracking, frequently point to as MPPT, is an electronic system that starts the Photovoltaic (PV) modules in a manner that allows the modules to produce all the power they are adaptable.MPPT is not a mechanical tracking system that "physically moves" the modules to point them more openly at the sun. MPPT is a fully electronic system that varies the electrical operating point of the modules so that the modules are able to deliver maximum available power. Extra power harvested from the modules is then made available as increased battery charge current. MPPT can be used as a mediator with a mechanical tracking system, but the two systems are completely differ from each other. A typical solar panel converts only 30 to 40 percent of the incident solar irradiation into electrical energy. Maximum power point tracking technique is used to improve the efficiency of the solar panel. According to Maximum Power Transfer theorem, the output power of a circuit is maximum when the Thevenin impedance of the circuit (source impedance) matches with the load impedance. Hence our difficulty of tracking the maximum power point reduces to an impedance matching

problem. In the source side we are using a boost convertor connected to a solar panel in order to enhance the output voltage so that it can be used for different applications like motor load. By correcting the duty cycle of the boost converter appropriately we can match the source impedance with that of the load impedance.

Different MPPT techniques

There are various techniques used to track the Maximum Power Point. Most popular techniques of MPPT are:

1) Perturb and observe (hill climbing method)
2) Incremental Conductance method
3) Fractional short circuit current
4) Fractional open circuit voltage
5) Neural networks

VI. NET METER ARRANGEMENT

Two meters would have to be installed by the solar power generator. One is for measuring solar generation and the other is for Import/Export measurement. The first meter, the solar generation meter, has to be installed at the generator end after the inverter at the ground floor of the premises to facilitate easy access for meter reading. The point of solar power injection may be in between the load and the Import/Export (Bi-directional) meter. The second meter is a bi-directional meter (single phase or three phases as per requirement) and is accepted for commercial settlements. These meters should be MRI and AMR compliant. If the consumer wishes to have a record of the reading taken, he shall be allowed to do so by the licensee. This meter will replace the existing consumer meter. The first and the second meter have to be installed at the same location where the present meter for consumption is installed. The cost of these meters shall be borne by the consumer/MSEDCL. [4]

Advantages of net meter

1. Financial benefit for the system owner

Since the system owner is charged for the net energy consumed from the utility grid, the owner gets financial benefits. E.g. if energy generation < energy consumed: owner pays just for the net amount. If energy generation > energy consumed: the owner gets credit for excess generation.

2. Avoid the use of batteries

In a grid connected solar PV system, any excess energy generated can be fed back to local utility grid and can be taken back at later stage when required. Thus, there is no need to store the surplus energy in batteries for later use, thus, avoiding the heavy costs of batteries. Also, since batteries are eliminated, the maintenance costs of the system also reduce to a great extent. Batteries may be required only when there are frequent power fluctuations/outages. (Please note, in a battery less grid connected system, if there is a power outage and the grid fails, your solar power system has to stop generating power to ensure safety of).

3. Produce more today, use that tomorrow

Typically, a solar power system produces more energy in summer and comparatively less energy in winter. E.g. if in summer, solar power generates 100 units and load requirement is 80 units, then 20 units can be fed back to the grid. In winter, solar power generates only 60 units and load requirement is 80 units, then 20 units can be taken from the grid. Thus, overall excess generation from solar power system is taken care of and a net unit consumed from the grid becomes zero.

VII. BILLING AND PAYMENT

The consumer shall receive a net import/export bill indicating either net export to the Grid or net import from the Grid. In case of net import bill, i.e. electricity supplied by the distribution licensee exceeds the electricity generated by the eligible consumers solar rooftop system, the distribution licensee shall raise invoice for the net electricity consumption after taking into account any carry forward from previous billing periods in the same financial year. The consumer shall settle the same as per existing norms. If it is a net export bill, then credit amount shall be carried forward to next month for adjustment against next month's import bill. No interest will be payable on this credit forward amount. Net credit available in account of the consumer will be finally adjusted in April of the next year, subject to the cap stated above. If the eligible consumer is under the ambit of time of day tariff, the electricity consumption in any time – block peak, off-peak or normal shall be first set off with the solar generation in the same time block. Any excess generation over consumption in any time block, over and above the usage in that time block shall be adjusted at the lowest applicable tariff across all the slots. This will safeguard the interest of the utility.

VIII. INTERCONNECTION & CAPACITY LIMITS

Net-metering facility shall be extended to the solar power system installed in establishments /consumers connected to the electrical grid. These consumers are the "eligible consumers" for the purpose of net-metering. Interconnection framework for net-metering shall address parameters including connecting voltage level, any minimum technical standards for interconnection as indicated by the Commission in DRC (Terms & Conditions for Determination of Tariff for Grid Connected Solar Photo Voltaic Project) Regulations, 2013 and Delhi Electricity Supply Code, 2007 and as per technical standards for Connectivity of Distributed Generation resources Regulations 2013 notified by Central Electricity Authority. The capacity of an individual rooftop PV system would be the available capacity of the service line connection, i.e. the sanctioned load of the consumer. The installation of net metered rooftop solar systems on consumer premises will utilize the same service line for excess power injection into the Grid which is currently being used by the consumer for drawl of power from utility network. If a higher capacity than the sanctioned load of the consumer is installed, then the consumer would have to pay SLD charges. [5]

IX. CONCLUSION

Typically, a solar power system produces more energy in summer seasons and comparatively less energy in winter season. If in summer, solar power generates 1000 units and load requirement is 800 units, then 200 units can be fed back to the grid. In winter, solar power generates only 600

units and load requirement is 800 units, then 200 units can be taken from the grid. Thus, overall excess generation from solar power system is taken care of and net units consumed from the grid becomes zero.so energy billing can be control so some benefits like energy conservation , pollution control and cost saving in energy consumption is easily achieved by this project.

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