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Net Metering Technology

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Abstract— *Solar system- flexible conversion, clean energy, solar energy is abundant in nature .solar energy is converted into electrical energy by photovoltaic cells. The excess energy generated by solar energy can be fed to other agencies. The amount of power sold to the grid can be measured by net metering. Net metering is a billing system that allows electric customers to sell to their electric utility excess electricity generated by their DG (distributed generation) system rooftop solar installations are the most common type of DG promoted with net metering.Net-metered customers generally are credited for the electricity they sell to the grid. With their electric meter essentially spinning backwards to provide a credit against the electricity that these customers must buy from their electric utility at night or during other periods when their electricity use exceeds their system's output. Customers are only billed for their "net" energy use. Consumer becomes generator for his own electricity requirements reduction in electricity consumption from the grid. Electric utilities must invest in their distribution systems to avoid overloading circuits, causing voltage regulation or power quality problems, or jeopardizing the safety of the public or utility employees. However, if net-metered customers do not contribute to the fixed costs of maintaining the grid and keeping it operating reliably, a utility's remaining customers will face higher rates to pay for these costs. Grid tie solar inverter islanding protective system -an islanding mode is a condition in a distributed generation (DG) which the energy resource continues to supply to the local load even though utility grid has been disconnected without allowing back up power of solar energy to the line.*

Keywords— Net Metering, Grid, solar installation, DG promoted, billing system.

I. INTRODUCTION

For earth and residents of the earth the sun is a primary source of energy. The energy radiated by the sun is in the form of electromagnetic waves, heat, light and lots of ultraviolet radiations. This radiated energy from the sun can be utilised for generation of electrical energy. Basically this is non-conventional and renewable type of energy source. The vast amount of energy liberated by the sun because of chemical – nuclear reaction taking place in its core i.e. a process of thermo nuclear fusion (similar to hydrogen bomb) . Due to this reaction sun radiates $3.5x\ 10^{23}$ kw energy into space and only $2x10^{14}$ kw reaches to earth. This $2x10^{14}$ kw energy is equivalent to burning of some 17 million tonnes of coal. If this energy or part of energy is utilised by human being it could drive the civilization forever.

Solar power is the conversion of sunlight into electricity, either directly using photovoltaic (PV), or indirectly using concentrated solar power (CSP).

II. TYPES OF PHOTOVOLTAIC SYSTEM-

The PV systems are generally classified according to their functional and operational requirement, their components configuration and how the equipment is connected to other power sources and electrical loads. Also weather they are stand alone system or grid connected system.

III. GRID CONNECTED PV SYSTEM

Whenever the sun shines (and even in overcast weather), the solar cells generate electricity. The grid connect inverter converts the DC electricity produced by the solar panels into 240VAC electricity, which can then be used by the property/household.

If a grid connect system is producing more power than is being consumed, the surplus is fed into the mains power grid. Some Electricity companies will meter the electricity fed into the grid by your system and provide a credit on your bill.

When the solar cells are not producing power, for example at night, your power is supplied by the mains power grid as usual. The energy retailer charges the usual rate for the power used.

IV. NET METERING

Net metering is a billing system that allows electric customers to sell to their electric utility excess electricity generated by their DG (distributed generation) system. Rooftop solar installations are the most common type of DG promoted with net metering.

Basically, the meter rolls backward and forward recording the energy flowing between a customer's renewable energy system and the utility's power grid. The utility company then allows the customer to receive credit for excess energy

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produced.

V. THE SERVICE CONNECTION METER:

For solar net-metering to be implemented the existing service connection meter needs to be replaced with a meter that can measure both energy import (from the grid to the consumer) and energy export (from the consumer to the grid). These meters are known as bidirectional energy meters or import-export energy meters.

VI. THE ELECTRICITY BILL WITH SOLAR NET-METERING

6.1 How Does Net Metering Impact Customer Bills?

Customer electric bills are based on the electric utility's cost of providing electric service. This includes the cost of the fuels used to generate electricity and the cost to transport and deliver the electricity to the customer. Costs also include the maintenance of the grid, as well as utility programs for low-income assistance, energy efficiency, environmental improvements, and other public benefits.

In general, every electric customer has an electric meter that records the amount of power delivered by their electric utility. As electricity is used, the meter spins forward, much like a car's odometer records miles traveled. In the case of an electric meter, the meter records energy use in kilowatt-hours (kWh).

Net-metered customers generally are credited for the electricity they sell to the grid, with their electric meter essentially spinning backwards to provide a credit against the electricity that these customers must buy from their electric utility at night or during other periods when their electricity use exceeds their system's output. Customers are only billed for their "net" energy use.

That means that when rooftop solar or other DG customers generate electricity, they avoid paying for the utility's power, which is fair because they did not use it. But, they also avoid paying for all of the fixed costs of the grid that delivers power when they need it and/or takes the excess power they sell back to the utility.As a result, these grid costs are shifted to those customers without rooftop solar or other DG systems through higher utility bills, which is not fair.

With solar net-metering the Consumer pays for the difference between import and export energy (the net-metered energy). Example: a Consumer imports during a billing cycle 900 kWh (units) and exports 500 kWh. The electricity bill will be for 400 kWh. If the export energy exceeds the import energy, the excess of import kWh will be carried over to the next billing cycle.

6.2 What Are Distributed Generation (DG) Systems?

DG systems are small-scale, on-site power sources located at or near customers' homes or businesses. Some common examples include rooftop solar panels, energy storage devices, fuel cells, microturbines, small wind, and combined heat and power systems.

Customers with these types of generation systems connect to the local electric grid and use the grid both to buy power from their local electric utility during times when their DG systems are not producing enough to meet their needs and to sell power to their utility when their systems are producing more electricity than is needed. To be clear, the utility's grid infrastructure is the mechanism by which all buying and selling is actually accomplished.

6.3 How Does Distributed Generation Affect the Grid?

As the use of rooftop solar and other DG systems increases, so, too, does the two-way flow of power on the electric distribution system. To ensure the safe and reliable delivery of electricity, an electric utility's distribution system must be able to safely manage and control the flow of two-way power. At the same time, electric utilities face integration challenges associated with the fluctuating levels of power created by variable wind and solar DG systems.

Electric utilities must invest in their distribution systems to avoid overloading circuits, causing voltage regulation or power quality problems, or jeopardizing the safety of the public or utility employees. However, if net-metered customers do not contribute to the fixed costs of maintaining the grid and keeping it operating reliably, a utility's remaining customers will face higher rates to pay for these costs.

6.4 Maintenance Requirements:

There are no moving parts in the system and it requires only minimal attention.

Depending upon the dust level, the system requires periodic cleaning.

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VII. ADVANTAGES

The grid connected roof top solar PV system would fulfil the partial / full power needs

of large scale buildings. The following are some of the benefits of roof top SPV systems:

1) Generation of environmentally clean energy.
2) Consumer becomes generator for his own electricity requirements.
3) Reduction in electricity consumption from the grid.
4) Feeding excess power to the grid

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VIII. DISADVANTAGES

1) Dependent on the grid.
2) The utility could even decide to stop allowing net metering and leave your home energy system all but useless.
3) Cost of net metering equipment is to be bared by the consumers themselves.

IX. ENERGY STORAGE

Net metering systems can have energy storage integrated, to store some of the power locally (i.e. from the renewable energy source connected to the system) rather than selling everything back to the mains electricity grid. Often, the batteries used are industrial deep cycle batteries as these last for 10 to 20 years.Lead-acid batteries are often also still used, but last much less long (5 years or so). Lithium-ion batteries are sometimes also used, but too have a relatively short lifespan. Finally, nickel-iron batteries last the longest with a lifespan of up to 40 years.
Indian states of Tamil Nadu, Karnataka, and Andhra Pradesh have started implementation of net metering, and the policy has been announced by the respective state electricity boards in 2014.

X. CONCLUSION

As the power produced by solar energy using PV systems is difficult and costly to store, this net metering provides opportunity to supply the excess power produced to grid and when solar power is not sufficient or unavailable, power can be drawn from grid. Thus creating an opportunity of two-way supply and making solar energy more reliable.

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