Net Metering in Grid Connected Solar PV System

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ABSTRACT

In India, power demand is increasing day by day. To fulfill this demand we are using renewable energy source i.e. solar, as it is available abundant in nature. But at night time, for reliability of supply we are using storage batteries, and ultimately this increases the cost of system. So, here we are using net metering mechanism. It is a billing mechanism. If the solar generates surplus amount of power then that has to be supplied to grid and exported power must recorded. In this paper the bidirectional net meter in grid connected solar PV systemis proposed that keeps record of electricity imported from grid and electricity exported to grid.

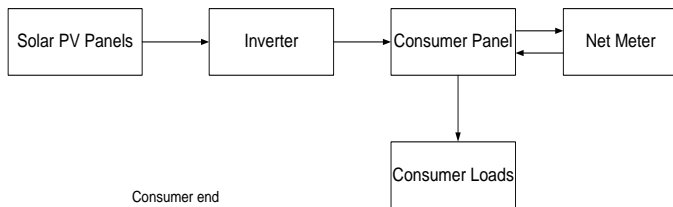**Keywords :** Net Meter, Solar Energy, Solar PV System.

I. INTRODUCTION

Renewable power generation has become an ultimatum in recent years. In recent times many energy experts, scientists, engineers and activists actively promote a 100% renewable energy vision. The recent reports suggest that, we have already used almost 2/3 of our carbon budget and at the current projected rate; this entire budget will be used by the year 2040. So it is essential that we move rapidly towards a renewable energy [1]. The renewable energy which is abundantly available in nature is solar energy. Solar energy is pollution free and causes no greenhouse gases to be emitted after installation. It reduced dependence on foreign oil and fossil fuel. Solar panels last over 30 years so no maintenance is required. Access power can be sold back to the power company if grid intertied. Solar Photo Voltaic systems which convert sunlight into electricity are usually installed on the existing roof-top space of buildings to meet the minimum load requirement India is facing a major growth in the photovoltaic sector. The Indian government has set a motivated target of achieving 20 GW of grid-connected and 2 GW of off-grid PV capacity by 2022[2]. Net metering is a billing mechanism which allows small consumers who generate some or all of their own electricity to use that electricity anytime, instead of when it is generated.

II. BASIC NET METERING SYSTEM

Fig 1 outlines the net metering concept. The system mainly consists of five modules- solar PV modules/panels for converting sunlight into dc supply, inverter for converting DC to AC so that it can be used at home or supplied to grid or both, home, bidirectional meter and grid. Storage system like battery can also be included in the system. Energy flow between solar panel, inverter and home is unidirectional while it is bidirectional between home, meter and grid.

Consumer end

IV. ALGORITHM FOR NET METERING

Algorithm explains the working of net meter in calculating the net power exchange between the utility and consumer. The algorithm takes the values from solar meter and bidirectional meter. The values are used to calculate the solar power PPV and utility power Putility. [5]

1: Measure the values of I_{pv} and V_{pv} to calculate PV power P_{pv} P_{pv} = Vi*Ii*cosØ, where I is any time instant

2: Measure the values of $V_{utility}$ and $I_{utility}$ to calculate utility power $P_{utility}$ $P_{utility}$=Vutility * Iutiliy * cosØ, where k is any time instant.

3: Said the load of the building as P_{Load} = 2KW.

4: **if** $P_{pv} > P_{Load}$ **then** the supply is sent back to the grid and net meter displays 'reverse'

5: **else** $P_{pv} \leq P_{Load}$ The supply is received from the utility grid and net meter displays 'forword'

6: **end if**

7: check the above condition after 30sec. The net units power as calculated as :

$$P_{net} = P_{pv} - P_{utility}$$

The power seen from grid terminal is as in (1) subjected to the constraint according to (2). The tariff rate in general is expressed as (3). [3]. The meter balance is also calculated on the basis of constraints as in (4). The payback period is calculated through as in (5).

$$Pgrid = Pused - Pgen \quad (1)$$
$$Pgen \leq Pgemin \quad (2)$$
$$Ttotal = Tf + Twc + Tec + Tra \quad (3)$$
$$Nb = Pb - Ttotal \quad If\ Pgrid > 0$$
$$Nb = Pb - Ttotal \quad If\ Pgrid < 0 \quad (4)$$
$$Nb = Pb \quad If\ Pgrid = 0$$
$$Tpayback = \frac{Csolar - Cincen}{Csaving * 364.25} \quad (5)$$

III. IMPLEMENTATION OF NET METERING

The first net meter has been installed in the premises of Verdean industries Limited, located in Adhere(Mumbai) by "Tata Power Company". In march, the civic body had installed 25KW solar metering at its Vatic Nagar Word Office and Majiwada, Manmade, it will also introduce this new power generation technique at Umbra and Anandibai Joshi hospital in Vartak Nagar to meet its energy requirements.

Many utilities are permitting to residential PV plant to be connected to grid by implementing a net metering system. The net metering system allows home owner to sell excess energy being produce by the PV plant back to the utility as the same rate at which the home owner purchases it from the utility [4].

V. Net Metering Benefits

1. The system is easy and inexpensive. It enables people to get real value for the energy they produce, without having to installed a second meter on an expensive battery storage system.

2. To allows homeowners and businesses to produce energy, which takes some of the pressure off the grid, especially during period of peak consumption.

3. Each home can potentially power two or three other homes. If enough home in a neighborhood use renewable energy and net metering, the neighborhood could potentially become self-reliant.

4. It encourages consumers to play an active role in alternative energy production, which both

protects the environment and helps preserve natural energy resources.

5. Homes that use net metering tend to the more aware of, and therefore more conscientious about their energy consumption.

6. It saves utility companies money on meter installation, reading and billing cost.

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