IMPLEMENTATION OF NET METERING (IMPORT AND EXPORT)

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Abstract- Energy is imperative to our daily life for all living organisms. The sun is directly or indirectly source of all energy available on earth .In net metering fist importance gives to using self making electricity by renewable energy source. The concept of net metering involves measuring the net energy between import and export of generated energy this can be done by using bi-direction meter [1]. When generation is more than consumer requirement, the excess energy is fed to grid that time meter units is increase to credit the consumer account. If generation is less than consumer requirement that time necessary energy is fed from grid and meter unit is decrease to pay the electricity board. It is bidirectional meter its result of reduction on bill. If export energy is greater than import energy then net energy show on meter in positive value and import energy is greater than export energy then net energy show on meter in negative value.

Keywords- *Net metering, Import, Export.*

I. INTRODUCTION

The world's economic growth depends on the energy sources. The consumption of the energy is directly proportional to the progress of manpower with ever growing population, improvement in the living standard of the humanity and industrialization of the developing countries. India is the country which has 3rd largest electricity generation capacity which is 1,400,800Gwh on 2016[2].According to 30.9.2017 scenario all India installed capacity is 329298.27MW,total Thermal capacity is 219449.51MW and total Renewable energy installed capacity is 58303.35MW[3]. The peak demand deficit during 2016-17 was 3,314MW [4].Due to demand and supply imbalance, transmission and distribution losses goes on increasing.

Hence lack of energy demand, commercial e.g. school, hospital, offices, shops and industries use generator as aback up to full fill our energy demand but its impact on environment and also cost is increase. With rising costs and environmental awareness, many of these buildings are choose for Solar (SPV) systems as back-up power in order to reduce their dependency on fuel generators [5], these systems which convert sunlight into electricity.

The net metering is depending on SPV system. By using net metering Consumer becomes generator for his own electricity requirements. There is reduction in electricity consumption from the grid and the consumer's net energy bill reduces.

II. NET METERING

Net metering is concept which record net energy between generated export energy and imported energy from grid [6]. By using solar we generate energy,if generated energy is more than requirement then excess energy is export to grid and generated energy is less than our requirement then we import energy from grid.

If we do not use net metering then we need second meter at the end of consumer to measure the energy send back to the grid. In this way two meters are used to measure the flow of energy in both directions. However, this problem can be solved by using net metering .It is capable of measure bidirectional flow of energy while recording both import and export of energy. The bidirectional meter is also known as net metering.

When we export energy the meter units increases and shows negative value on the meter and when we import energy from grid then the meter units decreases and shows positive value .At the time of billing, when the meter shows net units in negative value then the consumer have to pay to utility for that unit consumption. When the meter shows net units in negative value then the consumer receives credit from utility.

III. SYSTEM DESCRIPTION

The meter is used to measure the net energy between energy consumed from grid to load and excess energy from renewable energy to grid. The proposed system consist of controlling unit, measuring unit, microcontroller atmega328p, regulator LM7805CT,IC ADE 7758, divider circuit voltage channel, current transformer. The voltage and current measurement circuit feed the instantaneous values of voltage and current to microcontroller. The microcontroller calculates net energy by using instantaneous values of voltage and current. The net energy is displayed on LCD which is interfaced with

microcontroller.Fig.1 shows the block diagram of net metering system.

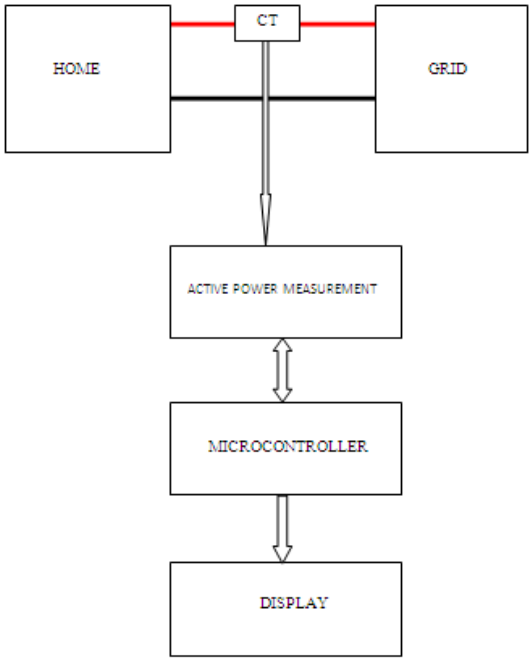

Fig.1 Block diagram

A. *Electric circuit*

1) Voltage measurement: The 230V AC supply is given to step down transformer. The step down transformer is of 12-0-12 V, 1A. It step down the 230V Ac to 12V AC. The step down voltage is given to rectifier. The output of rectifier is given to microcontroller through voltage regulator for voltage measurement [7].

2) Current measurement: The line current is approximately 0.13A. The current stepped down to fed the microcontroller; the current transformer ratio 1:3.4 is used to step down the current. The current from current transformer is rectified through rectifier.

3) Power supply circuit: 230V AC supply is stepped down to 12Vby step down transformer. The Bridge rectifier DB no. 107 converts AC to DC. To get ripple free DC voltage a capacitor is used as a filter. The output of the bridge rectifier is given to 5V regulator to regulate at 5V supply.

4) Processing unit: In proposed system Atmega328p is used as processing unit. The input to Atmega328p is fed from current and voltage measurement circuit which process the input data and calculate the net energy by using appropriate software coding. The output of microcontroller displayed on LCD which is interfaced with microcontroller.

TABLE 1.SPECIFICATION OF MICROCONTROLLER

Microcontroller	**Atmega328P**
USB controller	ATMega16U2
Operating voltage	5V
Input voltage(recommended)	7-12V
Input voltage(limits)	6-20V
Digital I/o pins	14(of which 6 provider PWM output)
Analog Input pins	6
DC current per I/O pin	40mA
DC current for 3.3V pin	150mA
Flash memory	32KB (Atmega328)of which 0.5 KB used by boot loader
SRAM	2KB (Atmega328)
EEPROM	1KB(Atmega328)
Clock speed	16MHZ
Size	6.5cm*505cm

IV. HARDWARE IMPLEMENTATION AND RESULT

A 60W incandescent lamp is considered as a load. When switched on supply either from grid or solar the voltage and current is calculated by microcontroller through IC ADE7758.IC provides system calibration features for each phase, i.e.r.m.s. offset correction, phase calibration and power calibration. Also it is suitable to measure active, reactive and apparent power.Fig.2 shows the overall hardware setup of net metering system.

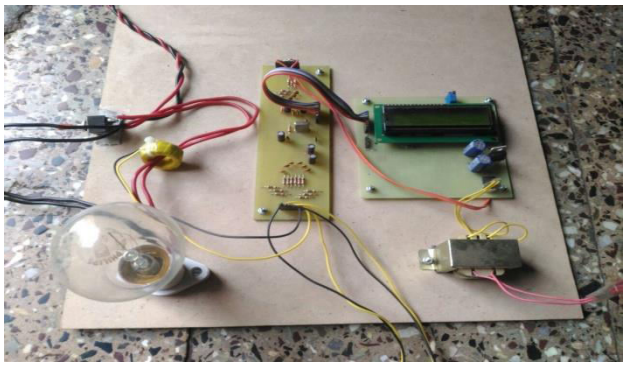

Fig2. Over all hardware

A) Test performance

1. **From solar to grid:** When energy is transferred from solar to grid (export)the delivered energy is calculated and it shown on LCD. The recorded energy is displayed below in Table2. Fig.3 shows the graph between export energy and time [1].

TABLE 2. ENERGY MEASURED FROM SOLAR TO GRID

Sr.No.	Time(sec)	Export Energy(Whr)
1	360	-1.6
2	420	-2.7
3	480	-4
4	540	-5.1
5	600	-6.3

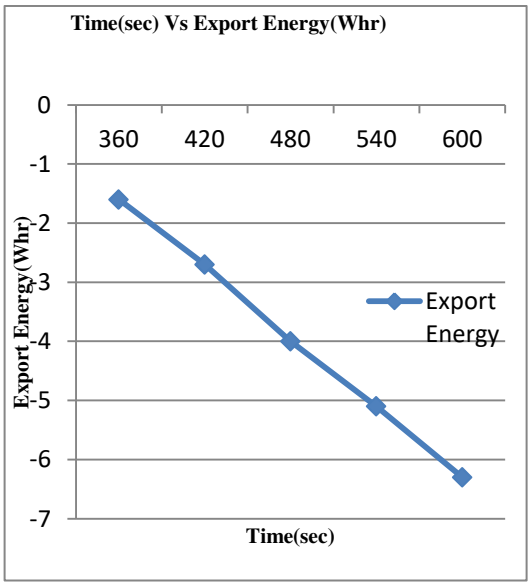

Fig.3.Graph for Export Energy

2. **from grid to load**

When energy is transfers from grid to load (import) the energy is calculates microcontroller and displayed on LCD. The recorded energy is displayed below and shows graph between import energy and time.

TABLE 3.ENERGY MEASURED FROM GRID TO SOLAR

Sr.No.	Time(sec)	Import Energy(Whr)
1	60	2
2	120	3.3
3	180	4.9
4	240	6
5	300	7.7

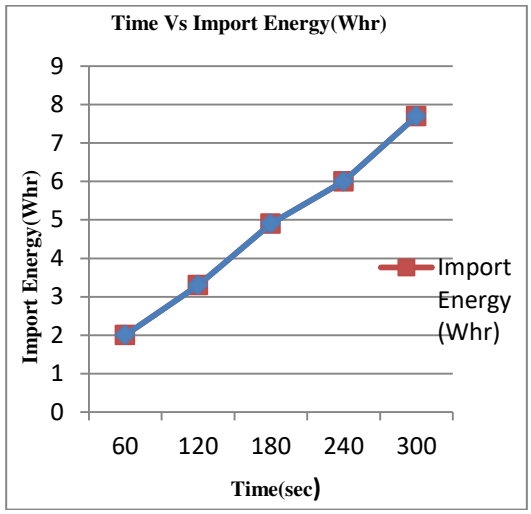

Fig.4. Graph for Import Energy

From the above table and graph, if the export energy increases than import energy then, the net energy will display in negative value and the consumer will receive credit from utility and if the import energy increases than export energy then the consumer have to pay to utility.

V. CONCLUSION

In this paper, the hardware configuration of net meter between solar PV and grid connected system designed and successfully implemented to calculate net difference between import and export energy. This proposed model is simple to take reading, reduction in electricity bill. There is increase of use of renewable energy and it reduces the strain on distribution system.

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