

# Smart Energy Meter using Embedded with GSM and Zigbee

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**Abstract-**Net metering is a mechanism used to reduce the electric bills of the customer. In this method we can generate electricity by our own and utilizing the power whenever we need. It also allows the power producers to sell the power to the grid. Photo voltaic cell is used in net metering for residential implementation. In this method a single net meter is used to calculate the power consumed and the power which is used from the grid. The photo voltaic installation is mainly depends on the cost and efficiency of generating system. It is pollution free and renewable. The bidirectional meter measures the electricity consumed and the generated electricity. We proposed bidirectional power flow by home to grid using PV. Whenever PV source is higher than the normal usage of home we can give back it to grid. Our advance metering will calculate the billing procedures. The PV plant is connected to the grid through the concept of net metering. The complex contemporary system for measurement of generated and consumed electric energy is also presented in the paper. This system is realized using the bidirectional electricity meter. The final electricity bill is calculated by the meter and send message to our mobiles using GSM and it is also updated to power house and the power house send message to the customers. The net metering is useful for locations with high consumptions.

**Keywords:** Net- metering, grid parity, photo voltaic.

## I INTRODUCTION

The economy Solar photovoltaic can make significant contributions towards some of the most energy problems. The electricity utilities are unable to meet this rapidly increasing demand. Solar photovoltaic system which converts light energy into electrical energy. The main advantage of photo voltaic system is that they are abundant, pollution free, and renewable. They produce electric power without forming hazards and are installed on the roof-top space of buildings to meet the minimum load requirement. The photovoltaic installation mainly depends on the cost and efficiency of the system.

The roof-top solar photo voltaic system is easy to install and maintain, have long life, capacity also enhanced to meet increased requirement of electricity. Bidirectional meter which is used to calculate the energy consumed by the customer and also used to calculate the energy generated by the customer. This project is more useful where more power is needed. In this project only one meter is used for calculating the generated power and usage power. Net metering should be provided to the customers in order to promote the solar installations. The electricity generated from PV systems can also be fed to the distributions or

transmission grid after conditioning to suit grid integration. The photovoltaic (PV) solar energy is one of the most distinctive RES, which main characteristic is the unlimited availability, possibility to have the installations in close proximity of consumer and without the need for significant investments in existing infrastructures. Over the years, the technological maturity and increase in energy efficiency of PV modules made this kind of investments cost-effective even on the level of household consumers. In combination with adequate policy instruments the significant increase in installation of small-scale PV plants.

## II EXISTING SYSTEM

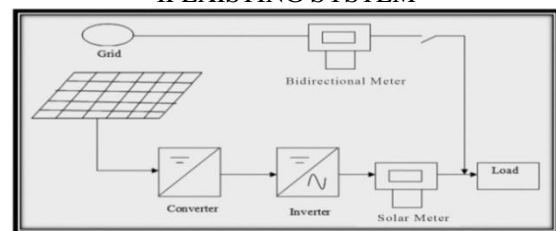


Fig:1 Net metering system

The power from the photo voltaic cell can be stored and used for the future use. The monthly billing of the electricity used can be calculated by manual method. The two meters is used for total calculation of power consumed and the power generated by the customer. Two meters first generation meter has to be installed after inverter at the generator end, second is bidirectional meter with AMR compatibility for import/export measurement. A novel type of meter card to trace generation details, the card may also have details of customer's bank account number to which GBI is credited from TEDA. Both GBI and power credits will be allowed for domestic consumers.

## THEORETICAL ANALYSIS

The feasibility of implementing of implementing net metering for residential photovoltaic system is greatly influenced by the power supply. The lack of uninterrupted power supply is a main problem in our daily life. The problem includes demand side management due to sudden invocation of captive power units. The meter cost together with direction meter and generation meter have to be paid by the customer. If the import power is more than the export power then the net energy consumed has to be billed as per the tariff order. If the export power is more than the import power then the net energy generated may be considered as a power credit and carried over to the next billing cycle. The

power credited will be passed over up to the end of the financial year. The consumer is responsible for any defects in the solar photo voltaic system. Net metering implementation can be done in residential system by considering several factors as per TANGEDCO. Excess energy generation if any available at the end of the year may be paid by the TANGEDCO.

CATEGORY	CONSUMPTION	DESCRIPTION
A	Low	Utilities consuming below 200 units/month
B	Medium	Utilities consuming from 201 to 500 units/month
C	High	Utilities consuming 501 to 800 units/month

Table1 consumption pattern categories

**PROPOSED SYSTEM**

Proposed system of this paper deals with efficient usage of electricity and it reduces man made error. The proposed system makes dual meter into single meter and meter can do the calculations and send messages to the customer mobiles via GSM. The consumer can easily access their electricity from anywhere through their mobile phones. GSM is a digital mobile telephone system that is widely used for mobile communication and in our project GSM is used to receive messages from the power station of how much of energy is consumed and generated by the customer. This project focuses on renewable energy system consisting of solar photovoltaic cells, DC to DC boost converter and inverter coupled to the load system. A photovoltaic cell and a DC to DC converter is designed for the purpose of boosting the photovoltaic cells. Proposed system helps for fast transmission and access of billings from anywhere and it also reduces man power. Zigbee is a low cost, low power, wireless network used to transmit information to the power house about the electricity bills of the customer.

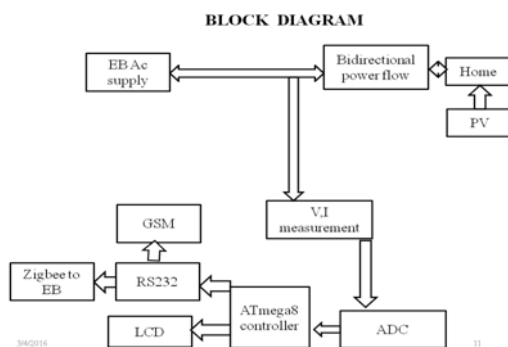


Fig:2 Block diagram of smart meter

The proposed block consists of a single meter which is used to calculate the energy consumed and generated energy by the consumer. Current transformers are used extensively for measuring current and monitoring the operation of the power grid. The energy from the photovoltaic system can be stored by using batteries and can be used for future use. The excess energy from the system can send back to the grid and credits

the customer account. An RS-232 port was once a standard features data storage, un-interruptible power supplies, and other peripheral devices. Some RS-232 devices are still found especially in industrial machines or scientific instruments.

**ADVANTAGES OF PROPOSED SYSTEM**

- Efficient and easily installed
- Easy way to generate electricity
- Avoid environmental hazards
- Power loss is less due to wireless system
- Complete usage of renewable energy

**METHODOLOGY**

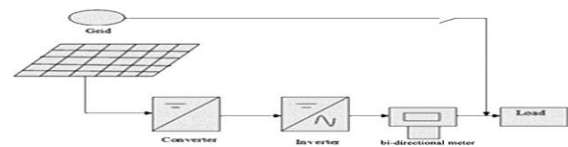


Fig:3 Block diagram of PV systems

Solar cells have many applications and have long been used in situation where electrical power from the grid is unavailable. The solar photovoltaic system is placed on the roof top of the buildings and it is easy to install, maintain and have long life. Each cell of the solar photovoltaic system absorbs energy from the sunlight and sends the absorbed energy to the converter, which convert high voltage electrical energy into low voltage. The inverter used in this project is used to convert AC to DC voltage which supplies electricity to the home. The bidirectional meter used for calculating the energy consumed and energy generated by the consumer. The remaining power is fed back to the grid.

**CONCLUSION**

This paper presents the structure of the implemented PV system for production, transmission and consumption of electric energy in small-scale industrial facilities. Currently, the PV system is with the output power but the production scaling in a function of consumption needs will be the subject of further research. The orientation toward the concept of net metering resulted with the integration of bidirectional meter and the development of software solution for data acquisition and storage. By introducing the system for bidirectional metering and its further development, conditions have been met for the development of system hybrid management that allows optimization and adjustment of consumption in relation to optimal electric energy production from the PV modules within the small-scale industrial on-grid systems.

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