Literature Survey on Intelligent Energy Metering System to Transfer Solar Power to DISCOMs

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Abstract - *Solar energy is emerged as a most important source of renewable energy and are now widely used for industrial and domestic applications. Such systems are based on a solar collector, they are designed to collect the sun's energy and to convert it into either electrical power or thermal energy. Here we are utilizing solar energy to at home. Usually power is sent by the department and billing will be done to the supplied load. The conventional Electrical billing system where the Electric Power bill given at the end of the month can be paid at Power distribution offices or at e-seva centers. This billing system is little time consuming and very expensive. This traditional Electrical billing system can be replaced with intelligent energy metering system by utilizing the solar power at home and also to send the remaining amount of power to the electricity department if at all excess amount of power is produced. We are using ATmega328 as our controller. This is the heart of the entire system. The reading of the meter at our home is noted down by the controller which we are consuming and the amount we are producing is also being noted. If the production is equal to the consumption at home then there will be no bill to be paid at that month. If the production is less than the consumption then bill will be produced to the remaining number of units and if there is excess power that can be diverted to others and also can get the money from the department. All this will be displayed on the LCD. This project uses regulated 5V, 500mA power supply. 7805 three terminal voltage regulators are used for voltage regulation. Bridge wave rectifier is used to rectify the ac output of secondary step-down transformer.*

Key Words: solar panel, Arduino Uno, LCD, Energy Meter.

1. INTRODUCTION

As the sources of conventional energy exhaust day by day, reimpose to another source of energy like solar and wind energy has become need of the time. The paper aims to survey the scheme for residential consumers based on the current costs and applicable electricity tariff in India. Solar-powered lighting systems are already available in rural as well as urban areas. These include solar lamp, solar home lighting systems. All of them consist of 4 components: solar photovoltaic module, rechargeable battery, charge controller and load. In the solar-powered lighting system, the solar charge controller plays an important role as the system's overall success depends mainly on it. It is considered as an indispensable link between the solar panel, battery and load. Solar energy is becoming increasingly profitable with the increasing cost and continuous depletion of the non-renewable energy resources and the growing demand of other renewable energy sources such as solar wind and ocean tidal wave. However, in spite of the multiple benefits of solar energy, solar panels which capture sunlight are stationary. These stationary as well as expensive solar panels are unable to extract the maximum solar energy as there is no stability of weather conditions. The power output of solar panels is maximum when it is aligned perpendicularly to the direction of sun rays as both the area of lightning of sunlight on solar panels and intensity of sun-rays is maximum in this case. It has been found out that the efficiency of solar panels improves by 30-60 percent when we use a mobile solar tracking system instead of a stationary array of solar panels. The design and implementation of a power efficient solar tracker is therefore a challenge unsettled to the immobility of the solar panels.

2. LITERATURE SURVEY

It's the foremost preliminary step in our project where we research different paper on intelligent energy net metering system. While doing this we go through a many international Journal papers and research for it.

Basically, we studied 10 reference papers regarding this subject & we got some information so, by considering this information we are using it in this project with following table,

Table1: Literature Survey of Solar System

Sr.no	Title of Paper	Author	Publication	Year	Technology
1	Enhancement of energy generation from two-layer solar panels	Pragya Sharma , Tirumalachetty Harinarayana	International Journal of Renewable Energy Research	2012	Energy generation from two-layer solar panels. Advantages: - ➢ The energy generation is 252 kWh/day for 756 sq. m area. Disadvantages: - Power generation is dependent parameter.
2	A review of net metering mechanism for electricity renewable energy sources	Andreas Poullikkas , George Kourtis, Ioannis Hadjipaschalis	International Journal of Energy and Environment	2013	Net metering schemes around the world in renewable energy sources. Advantages: - ➢ understood the schemes about net metering. ➢ analysis of the competitive electricity markets Disadvantages:- complexity
3	Grid Connected Roof Top Solar Power Generation: A Review	Radhey Shyam, Meena Singh, Jeetendra Singh Rathore, Shivani Johri	International Journal of Engineering Development and Research	2014	Photovoltaic roof-top installations at the tail-end of the grid. Advantages: - ➢ Clean energy generation. ➢ Consumer becomes generator Disadvantages: - energy production rate is reduced.
4	A Micromirror Solar Cell as Electrostatic Mems Power Supply	S. Suresh, R. Suresh Kumar	International Journal of Emerging Technology in Computer Science & Electronics	2014	Piezoelectric effect and bimetallic effect . Advantages: - ➢ Greyscales & mirror is toggled on and off very quickly. Disadvantage: - ➢ The incident heat flux with the alternating legs
5	Will Net Metering Model for Residential Rooftop Solar PV Projects Work in Delhi? A Financial Analysis	Kapil Narula, B. Sudhakara Reddy	International Journal of Renewable Energy Research	2015	Model for Residential projects in Delhi. Advantages:- ➢ Analysis & idea about solar project Disadvantages:- ➢ Costing ➢ Size
6	Microcontroller Based Solar Power Inverters	Ruchika Thukral, Gulshan Kumar, Ankit Gupta	International Journal of Electrical Engineering & Technology (IJEET)	2015	Power inverters & single-chip microcontroller based system. Advantages: - ➢ Reliable & Easy to Implement. Disadvantages: - cost & size

7	Microcontroller Based Automatic Solar Tracking System with Mirror Booster	Protik Kumar Das, Mir Ahasan Habib, Mohammed Mynuddin	International Journal of Sustainable and Green Energy	2015	Automatic Solar tracking & Booster . Advantages: - ➢ Power Generation. ➢ Mirror Boosting Disadvantages: - ➢ Effect due to rain
8	Exploring the impact of Net metering with Hybrid Solar-wind-Grid based distributed Generation	Akshay Kumar Sahoo, Satya Prasad ,Sibashish purohit ,Lala jigyansu ray,	International Research Journal of Engineering and Technology	2016	Bi-directional net metering system. Advantages: - ➢ More power generation than windmills. ➢ Reduced Power loss. Disadvantages: - ➢ Low generation rate.
9	PIC16F72 Microcontroller Based Solar Powered UPS	Santhosh Kumar, M. L. Sudheer	International Journal of Electrical Systems & Control (IJESC)	2016	Maximum Voltage Amplifier. Battery Charge using Boost Charging Method. Advantages: - ➢ More efficiency & energy storage Disadvantages: - ➢ Microcontroller and ups are very costly .
10	A smart street lighting system using solar energy.	Fares S. El-Faouri, Munther Sharaiha, Daoud Bargouth	PES Innovative Smart Grid Technologies Conference Europe (ISGT)	2016	Street lightning using solar energy system Advantages: - ➢ Opposed to conventional fossil-based sources. Disadvantage: - Production rate is dependent parameter.

The paper entitled as 'Enhancement of energy generation from two layers solar' (2012) was based upon energy generation using two layers solar, it provides energy generation from single layer is 252Kwh/day and it increases up to 445Kwh/day, but with cost of power generation parameter [1].The paper entitled as 'A review of net metering mechanism for electricity renewable energy sources'(2013) was based upon Analysis of net metering schemes & study of competitive electricity markets around the world, but with cost of complexity[2].The paper entitled as 'Grid Connected Roof Top Solar Power Generation: A Review' (2014) was based upon photovoltaic rooftop installation at the tail end of the grid and It provide generation of environmental clean energy and consumer becomes generator for his own electricity requirement , but drawback of energy production [3]. The Paper entitled as 'A Micro mirror Solar Cell as an Electrostatic Mems Power Supply'(2014) was based upon Piezoelectric effect and bimetallic effect where it provides Grayscales & mirror is toggled on and off very quickly for system [4].The paper entitled as' Will Net Metering Model for Residential Rooftop Solar PV Projects Work in Delhi? A Financial Analysis' (2015)was based upon residential projects of solar system. It provides idea and analysis of projects in Delhi [5].

In survey paper entitled as 'Microcontroller Based Solar Power Inverters' (2015) was based upon power inverters and single chip microcontroller. It provides reliable and easy implementation of system but it's costing was more than other system [6].The paper entitled as 'Microcontroller Based Automatic Solar Tracking System with Mirror Booster' was based on automatic solar tracking and mirror boosting technology. It provides more power generation with respect to other system, but with cost of rainy season's effect and price [7].The paper entitled as 'Exploring the impact of net metering with Hybrid Solar-wind-Grid based distributed Generation' was based upon Bi-directional net metering system .It provides more power generation than windmills and reduced power loss ,but with cost of low generation rate [8].The paper entitled as 'PIC16F72 Microcontroller Based Solar Powered UPS'(2016) was based upon maximum voltage amplifier and Boost charging method. It provides more efficiency and power storage [9].The paper entitled as 'A smart street lighting system using solar energy 'was based on smart street light system of solar .It provides opposition to conventional fossil-based sources ,but with cost of dependent parameter of energy production rate[10].

3. COMPARISON OF THREE ENERGY METERS:

There are different types of utility meters for solar are available in the market but we have to choose it according to our requirement. These are as follows,

Table.2: Different energy meters

Sr.no	Types of Energy Meter	Parameter	Cost (.RS)
1	Net Meter	Feed-in-Tariff with combine meter. (according to agency rate)	1100
2	Bi-directional Meter	If there is excess generation then payments are allowed by utility single meter with three display screens.	3500
3	Dual Meter	Two separate meter which do not communicate i.e. production meter and consumption meter with two meters.	5500

Solar system Net meters show the net consumption of power in the household. A net meter does not tell you how much solar electricity you pushed out to the grid, or how much "regular electricity" you took in from the grid. It indicates the difference between the two, or net usage. The cool thing is that your net meter actually runs backwards if you are producing more solar energy than you are using at that point in time. The net meter has two displays, the first display shows all 8s and simply checks the meters working properly. If something different found other than an 8, then contact your respective electricity board. The second register shows our net usage and determines how much you pay on your electric bill. If you used 100 kWh of energy but generated 60 kWh of those with our solar system, the net meter will display 40 kWh. Solar system bi-directional meter Bi-directional meters have three display screens as test screen, power coming in and power going out from grid. In a dual metering, you have two separate meters that do not communicate with each other.

4. PROPOSED SYSTEM

The Proposed System for Intelligent Energy Metering system to Transfer Solar Power to DISCOMs is Shown Below,
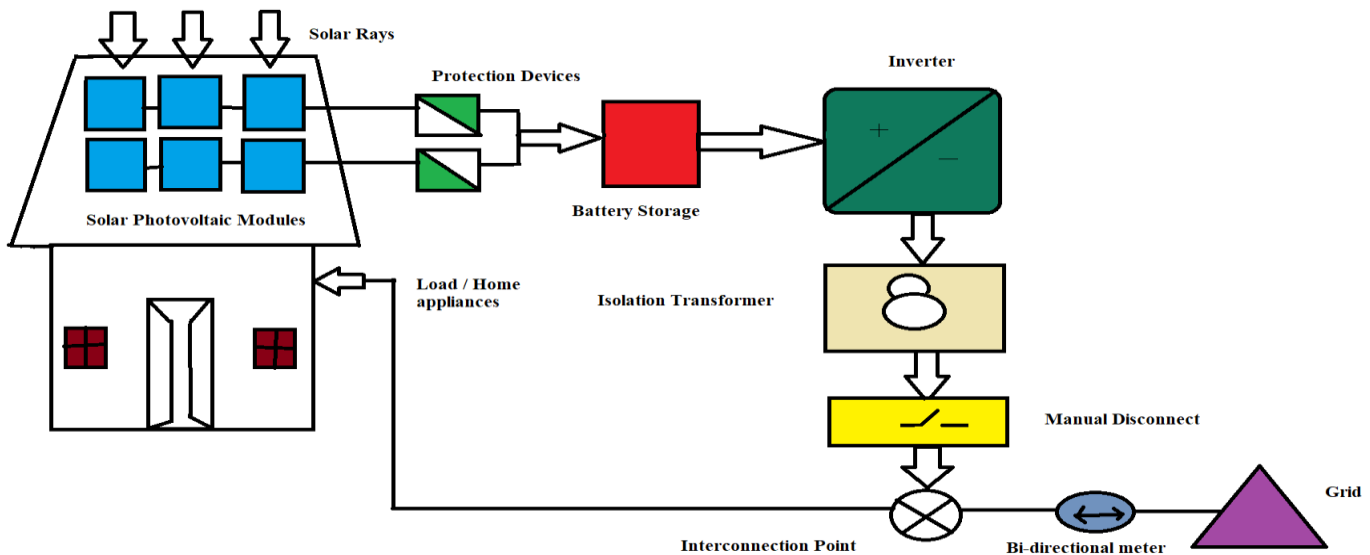

Fig .1: Intelligent energy metering system to transfer solar power to DISCOMs.

The proposed system is mainly based on ATmega 328.Solar panels are used to generate solar energy which is used for home appliances. Solar energy is stored in lead acid battery and get converted into AC through inverter just like regular energy for home appliances. There are two energy meters are used in proposed system. If the produced solar energy is not sufficient for customer use then customer can take power from mains energy and units get recorded on energy meter just like regular meter. But if the developed solar energy is more than need then customer can sell this energy to neighbor through another energy meter and can get money as per decided unit standard. LCD display will show number of units utilized or sell.

The 12-v adaptor is used for power supply. ATMEGA 328 is the heart of system which control system. The controller is 8-bit microcontroller and having RISC architecture. It is having inbuilt ADC so that we can since battery voltage also. 12V solar panel is used to convert solar energy into electric energy. This electric energy is stored in lead acid battery when appliances required energy then inverter is used to convert DC into AC energy. If the energy requirement is more then we can use mains electricity and units will be shown on second energy meter. If the energy generated is more than requirement then customer can sell that energy and energy meter will record units.

5. APPLICATIONS

- ➢ For Household Applications
- ➢ Street Lights
- ➢ Garden Lights
- ➢ Hotels, Hostels Applications

6. CONCLUSION

In this paper, we try to show the glimpse of the immense potential that Renewable energy resources hold. Some advancement which can significantly boost the practicality and effectiveness of the solution provided by our project are: Research can be done to increase the power output so as to make it more useful and dependable. Bulk production of the Micro-controller based solar power Inverter will further lower the cost. If implemented on a bigger scale, it can become quite economical. By this project we can establish effective way of generating power. All this will be done with no low man power. There will be collection of money after using the power because people they themselves will produce the power and the excess power will be sold.

7. REFERENCES

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