Design of Net Energy Metering System for a Hybrid Energy Storage System

Chandragiri Radha Charan, Palla Tejaswini

Abstract: The expectation for everyday comforts and success of a country fluctuate legitimately with the expansion in the utilization of intensity. The power necessity of the world is expanding at a disturbing rate because of mechanical development, expanded and broad utilization of electrical device. As per world vitality report, around 80% of our vitality is received from regular non-renewable energy sources like oil, gaseous petrol and coal . It is evident from the current scenario that world will have to face the shortage of resources within no time. Hence, it is a call for an alternative vitality source search and there are many such attempts in recent times. The best elective source is sun powered vitality. This targets in structuring a hybrid Energy Storage System with Net Metering billing methodology to make the client profit from Variable Rate Electricity. Net energy metering system is an uncommon charging game plan that furnishes acknowledge to clients for sun powered PV frameworks for the full retail estimation of the power their framework creates. Under NEM, client's electric meter monitors how much power is devoured by the client and how much abundance power is produced by the framework and sent go into the electric utility lattice.

Keywords: Energy storage systems [ESS], net energy metering [NEM], time-of-use [TOU], Vitality.

I. INTRODUCTION

Vitality is one of the significant contributions for the monetary economical improvement of any nation. On account of the creating nations, the energy part expect a basic significance in perspective on the regularly expanding vitality needs requiring gigantic ventures to meet them, Regular essential vitality sources are coal, oil, gas, and biomass. Other imperativeness sources accessible incorporate atomic vitality from radioactive substances, warm vitality put away in inside of the earth, and potential vitality because of gravity of earth [1]. Sustainable power source is the energy derived from sources that are basically limitless. Instances of inexhaustible assets incorporate breeze power, sun based force, geothermal energy, tidal force and hydroelectric force. The most significant element of sustainable power source is that it tends to be bridled without the arrival of harmful contamination. Hence, the developing countries these days are into the utilization of sustainable or renewable energy sources for its energy requirements [3]. Part of it, this is to use multiple types of renewable energy sources simultaneously in order to avail the maximum benefit. Here, three energy sources say solar, wind and tidal

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as the three type of sources in action. To such a system including three different energy sources acting simultaneously, an uncommon billing system [4] is designed when the system [2] is connected to the utility grid. The design of such a billing system is based on a methodology of taking the net energy into count and the time of use into count not the peak or base values. Hence this is mainly to design a hybrid energy storage system with a special billing setup named Net Energy Metering system [5].

II. BLOCK DIAGRAM OF THE SYSTEM

Fig. 1. Block diagram of net energy metering system with hybrid energy storage system

The above system is precisely designed to achieve the following two:
1. Intelligent power sharing system with electricity grid.
2. Net billing on LCD after deducting energy given to the grid.

The major building blocks of the design are Solar panel, Charge Controller Energy Meters, Crystal oscillator, Home grid system, LCD with drive. The system consists of two input blocks. One is the Energy Meter getting operated through Inverter which in turn gets operated through the energy from the Solar Panel. The customer gives this electricity to the utility.

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This amount of electricity will be billed by the Microcontroller with the help of Energy Meter Reading. The other input block is the Energy Meter from the normal Mains supply through which the Microcontroller calculates the number of units the user has used and does the billing work. The Microcontroller now displays the Net amount to be paid by the customer i.e., the net amount of electricity the customer exported to the utility subtracted from the net amount of electricity the customer has consumed during that billing period. The net amount is displayed on LCD.

The three energy sources say solar, wind and tidal are privately connected to battery through charging circuit as in fig 4.and the charging circuit is as shown in fig 2.
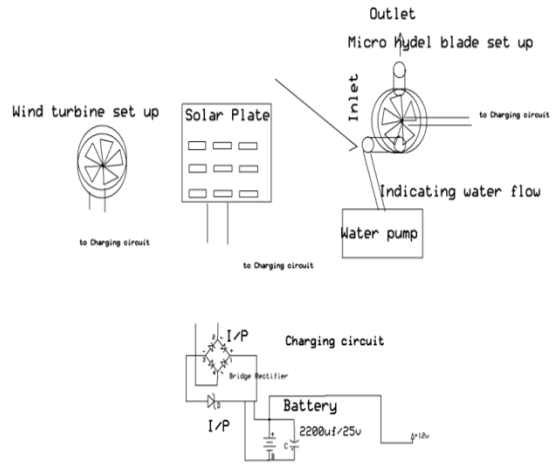

Fig. 4.Schematic diagram of solar, wind and tidal energy sources connected to battery through charging circuit

III. EXPERIMENTAL RESULTS

The fig. 5 below shows the LCD displaying the initial condition i.e. Designing of Net metering system as soon as the net energy metering unit is ON.
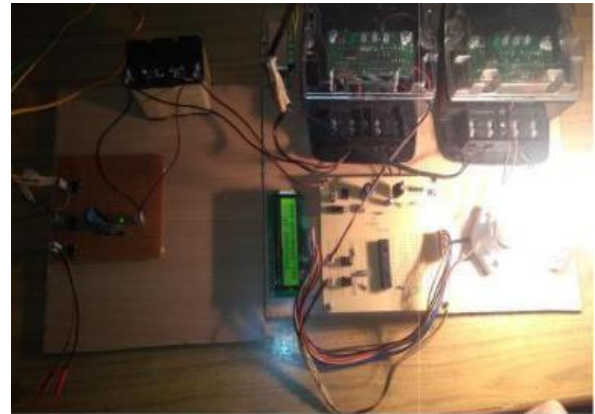

Fig. 5.LCD displaying the initial condition

The fig. 6 shown below explains the energy utilized for home loads and energy given to utility displayed by LCD.

Fig. 6.LCD displaying the energy utilized for home loads (indicated as HOME) and energy given to utility grid (indicated as GOVT)
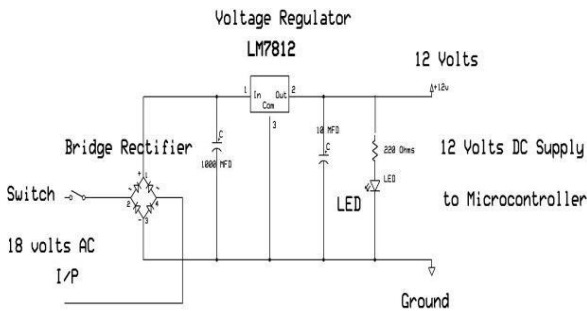

Fig. 2. Charging circuit

The interfacing of the microcontroller with the LCD display as well as energy meters is shown fig. 3.
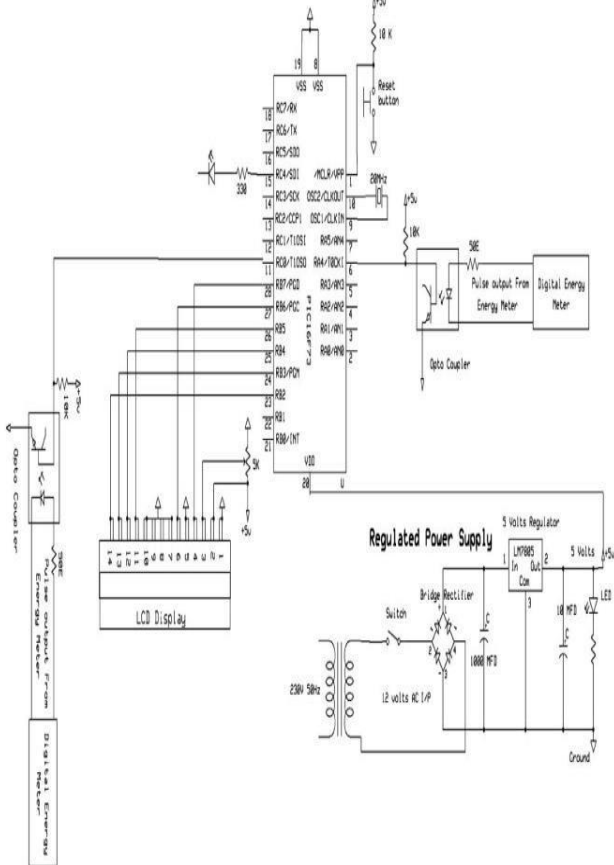

Fig. 3. Schematic diagram of interfacing PIC16F73 microcontroller with energy meter and LCD display

The below fig. 7 explains the net energy calculated by the microcontroller and also by whom the amount to be paid either by government to consumer or vice versa by Government pay units or consumer pay units.

Fig. 7.LCD displaying the net energy

The details mentioned in the below table-1 indicates the amount of energies provided to the home grid as well as to utility grid which results in the calculation of the net energy indicated by -sign in the above case explaining us the utility grid is in debt to home grid.

Table-1: Experimental model

Sl. No	HOME GRID	UTILITY GRID	NET ENERGY	PAYMENT CONDITION
1	0.003	0.006	-0.0021	Utility to home

IV. APPLICATIONS

This system can be practically implemented in real time in industries and domestic houses.
1.House electrical systems.
2.Railway electrical systems.
3.Remote controlling systems.
4.Phone Billing systems.

V. CONCLUSION

Incorporating highlights of all the equipment segments utilized have been created in it. Nearness of each module has been contemplated out and put cautiously, along these lines adding to the best working of the unit. Also, utilizing exceptionally propelled IC's with the assistance of developing innovation, the undertaking has been effectively actualized. In this manner the task has been effectively planned and tried. Under NEM, the client's electric meter monitors how much power is devoured by the client and how much abundance power is produced by the framework and sent go into the electric utility lattice. The advantages of employing these special billing methodologies have been checked on. The outcomes show vitality stockpiling can essentially decrease power cost by top shaving and burden moving for the business client and by putting away abundance sustainable power source for the private client. The affectability of yearly power cost to ESS's sizes is additionally examined. Future work around there would consider the vulnerabilities of estimate blunders just as incorporate a non-straight vitality stock piling model.

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