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Energy Generation and Utilization By Solar Power, Wind Power and Grid power

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Abstract*— Today the world is progressing at very fast rate with use of conventional sources of energy .But using them creates environmental pollution and these sources are present in limited quantity. So now a days most of the countries are suffering from lack of energy problems. In India population growth rate is very high so energy requirement is also high. .Such large amount of energy consumption requires large amount of energy generation. For energy generation we cannot solely depends on single energy source or non-renewable energy sources .Renewable energy sources are available in plenty, free of cost and pollution free. We have to use hybrid systems that uses renewable energy sources along with non-renewable energy sources. In this paper hybrid system is used which consists of solar and wind energy as well as grid energy which provides sufficient power to connected loads. System monitors the usage of electricity. Hybrid power system is developed by focussing on home appliances .Load is driven by battery voltage which can be charged by either solar power or wind power. This system can be fix in home where every customer has one RFID card. Each RFID card has specific amount of power based on customer requirements. Customer can use power from AC mains supply when there is lack of power which is generated from Solar or wind. Information regarding amount of power generated by renewable energy sources, amount of grid power consumed by load, battery power is provided to customer. Based on amount of energy remaining controller performs switching operation between PV power, wind power.

Index Terms *- Renewable energy, energy management, solar power, wind energy, grid power*

I. INTRODUCTION

As global warming is increasing day by day many countries are looking at sustainable energy solutions which preserve the earth for the future generations. Hybrid renewable energy systems (HRES) are becoming popular as stand-alone power systems for providing electricity in remote areas due to advances in renewable energy technologies and subsequent rise in prices of petroleum products. In India Renewable Power plants constituted 27.25% of total installed capacity and Non-Renewable Power Plants constituted the remaining 72.75%.Other than hydro power, wind and photovoltaic energy holds the most potential to meet our energy demands. Solar energy and wind energy are proven to be clean, unlimited and environmental friendly. If any type of energy is considered individually then it shows drawbacks. So problems can be overcome by using such energy sources together brings us a new system called as hybrid power system. To prevent consumers from lagging of power and to meet their demands, hybrid system is an exact solution [1]. Hence a hybrid power system is a combination of any two or more energy sources.

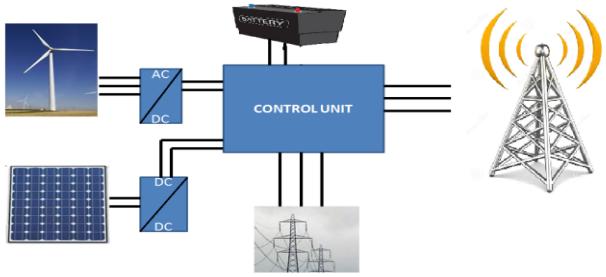

Fig 1. Basic block diagram of hybrid power system

Hybrid energy stations have proven to be advantageous for decreasing the depletion rate of fossil fuels, as well as supplying energy to remote rural areas, without harming the environment [2]. If we compare renewable energy sources and fossil fuel sources, it can be found that if we use 1kW/h of energy generated by renewable energy sources then we can save 1kg of Energy resources like oil, gas, coal, etc. providing the main sources of today's energy in the world and this should be changed in near future using renewable sources. When level of carbon dioxide is very high and when such high level of CO_2 emitted then it can have dangerous effects on weather and it can result in changes in environment. For these reasons, renewable sources should be developed further and be used in the world as a replacement source. In this paper study is focused on analysis of energy use as well as management of energy.

II. LITERATURE SURVEY

The renewable power generating systems are advantageous because they are reliable and environmentally clean. The hybrid power generation systems are reliable and as it combination of two energy sources it satisfies the load demand very closely in all seasons and also minimize the size of the system components and hence reduce the total capital cost[3]. The hybrid power generating systems are cost effective compared to standalone systems. A great research has been done on systems like solar photovoltaic, wind, biogas based diesel generator, bio-diesel generator and hybrid systems.

Varun Gaur [4] carried out research on hybrid (Solar PV-Diesel) mini grid system. System results were analyzed in Philippines. Location of Philippines makes it high solar potential zone. The PV system can act as a clean substitute of Diesel (standalone Solar PV) or fuel saver on a Diesel generator powered mini-grid (solar-Diesel hybrid). Study was focused on to assess the Off Grid electrification scenario in Philippines, with the focus on Diesel Mini Grids in selected islands and understand the impact of injecting Solar PV into the existing Diesel Mini Grids in Philippine Islands, with

focus on the impact on levelized cost of electricity generation[5] .

Alexey Kupriyanov [6] presented hybrid power system for telecomm application. The system utilizes deep cyclic batteries with the capability to perform a large number of discharge and recharge cycles and provide a high rate recharge acceptance. Main part of this system is HCC ((Hybrid Site Controller) controller. It is a microcontroller which manages all parameters and monitors whole system.

Kemmoku [7] , calculated energy input and losses from direct solar isolation and the difference between the module (PV panel) temperature and atmospheric temperature. It is found that on fine day and cloudy day the module temperature rises rapidly with increasing direct solar radiation. The temperature variation takes place normally and it is noted that the highest daily module temperature varies even with the small influences in the weather conditions or wind speed. He found that the efficiency of the concentrator PV system increases with the increase in solar radiation & electrical efficiency decreases with the increase in temperature. About 0.3 % of efficiency of the system is lost when the module temperature rises by 1 °C.

Sandeep Kumar, Vijay Kumar Garg [8] presented a paper which describes a hybrid model for solar wind power generation system. This paper proposes a hybrid energy system combining solar photovoltaic and wind turbine as a small scale alternative source of electrical energy where conventional generation is not practical. Simulation of the hybrid system under investigation was carried out by using PSIM software. This paper helps to study the influencing factors in design of a hybrid-solar power system (HSWPS) for grind linked applications.

III. HYBRID POWER SYSTEM

A. *Block Diagram*

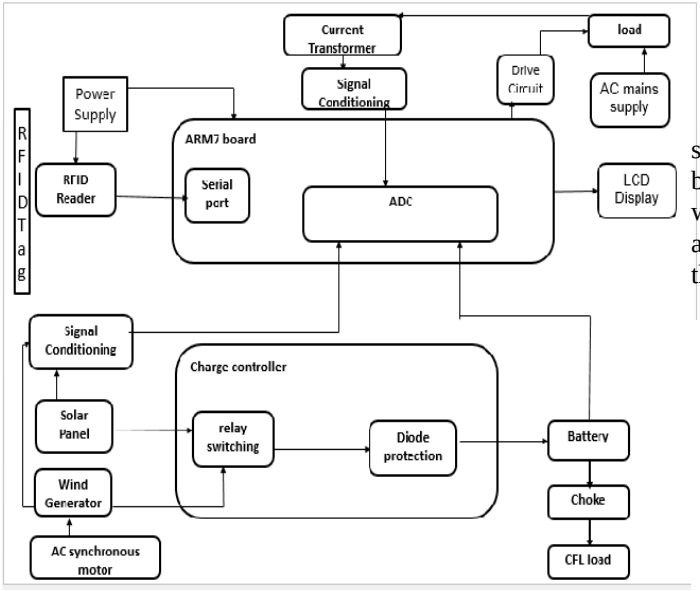

Fig.2 Block diagram for hybrid power system

While developing a system for monitoring purpose and for controlling purpose various key points needed to be considered like voltage, current, temperature change etc. Main and key part in this system is controller unit. The system uses ARM-7 board which is 16-bit/32-bit ARM7TDMI-S microcontroller. ARM7-TDMI (Thumb Debug Multiplier ICE processor) is a 32-bit CPU.It is based on reduced instruction set computer principles. The RISC instruction set and related decode mechanism are much simpler than those of Complex Instruction Set Computer (CISC) designs. It is having different features like 3-Stage Instruction pipeline, Von-Neumann Architecture, Average Instruction cycle time is around 32ns with frequency 60 MHz. There is operation switch between ARM stage and the THUMB stage. LPC 2138 has an On-chip integrated oscillator with an external crystal from 1 to 25 MHz in-System Programming/In-Application Programming (ISP/IAP) via on-chip boot loader software[9].It is having 8 to 40 kB of on-chip static RAM and 32 to 512 kB of on-chip flash program memory,128 bit wide interface/accelerator enables high speed 60 MHz operation.

B. *Charge Controller unit*

A charge controller or charge regulator limits the rate at which electric current is added to or drawn from electric batteries. It eliminates overcharging and may prevent against overvoltage, which can reduce battery performance or lifespan, and may pose a safety risk [10]. It may also prevent completely draining ("deep discharging") a battery, or perform controlled discharges, depending on the technology of battery, which protect battery life [11].

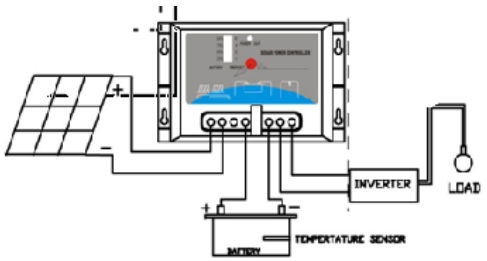

Fig.3 Charge Controller

It is a unit which controls the battery charging from solar cell or wind generator and also controls the battery drain by load. The simple Charge controller checks the battery whether it requires charging and if yes it checks the availability of solar power or wind power and starts charging the battery.

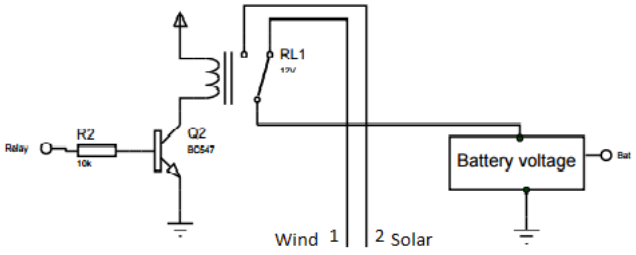

Fig.4 Circuit for relay switching

In fig.4 Relay pin is connected to controller. Based on solar voltage or wind voltage relay performs switching operation. Common terminal of relay is connected to Battery. Normally closed terminal is connected to Solar panel which is

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set to zero. Battery will be charged by solar power while normally open terminal is connected to wind generator. When wind power is more as compared to solar power then controller changes the state from zero to one. Current flows through base terminal of relay and here relay changes contact from NC to NO .Now battery will be charged by power generated by wind

C .Drive circuit for AC Load

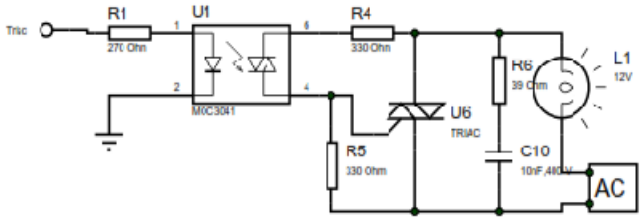

Fig.5 Circuit for Triac a*s switch*

In fig.5 Optoisolator is used as zero voltage crossing bilateral triac driver.MOC3041 is used with a triac in the interface of logic systems to lamp powered from AC mains supply.

D.RFID card reader

The RFID Reader Module can be used in a wide variety of hobbyist and commercial applications, including access control, automatic identification, robotics, navigation, inventory tracking, payment systems, and car immobilization. Here RFID card reader is used for payment systems. An RFID reader is a network connected device (fixed or mobile) with an antenna that sends power as well as data and commands to the tags. Each customer owns a card. Customer will add specific amount which then belongs to his/her card. According to the power condition customer will use power generated by renewable energy sources. If climate conditions are not proper to generate power by either renewable energy source then customer will get access to grid power. Deduction in power will be takes place according to the use of grid power .

IV. RESULT

Fig. 6 Display of current present in load and battery voltage

In Fig. 6 load is in OFF state. So current transformer value is zero ampere. By solar power Battery voltage is charged up to 1024mV.

Fig. 7 Display of time and power from grid supply

In Fig.7 card provided to customer read by RFID card reader then power assigned to customer will be provided to LOAD through AC mains supply. Here LCD display shows power assigned to customer which is 500W plus 263W of power which is unused.

Fig. 8 Display of voltage generated by solar or wind sources

In Fig. 8 Voltage generated by solar power is 4118mV & by wind power is 6593mV

Fig. 9 Display of voltage remaning after uitization

As shown in fig.9 power generated by solar or wind is consumed by attached load so now solar voltage displayed on LCD is 2674mV while voltage of wind is zero volts.

V. CONCLUSION

Environmental friendly solution are becoming more prominent than ever .This paper presents a system configuration for hybrid solar\wind & grid energy system. This configuration allows the system to supply the load

separately or simultaneously depending on availability of energy sources. Thus objective behind developing Hybrid model is to power all consumer appliances. In this power systems AC load and DC load have driven separately. The goal is to meet the load of different applications using designed hybrid system, while minimizing costs. Depending on different power situations, this hybrid system is designed to generate continuous power from PV solar module (solar panels), wind, battery, and the grid

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