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Optimal Utilization of Hybrid Renewable Energy Resources in DC Micro Grid System

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ABSTRACT: In remote regions where a main distribution grid is not available, the implementation of Micro Grid with Renewable Energy Resources are very useful. In other words, it is a next-generation power system in which a small independent power grid is constructed by combining renewable energy resources such as solar and wind energy devices. The main objective of this paper is to utilize the renewable energy resources of solar and wind energy for envelop electrical appliances. In the proposed system we are, introducing optimal utilization of renewable energy resources by use the direct loading and the additional powers will be stored in the lead acid battery, in this way we are prove the optimal utilizations. This paper consists of Solar panel, Wind mill, battery, PIC controller, DC micro grid and IOT system for electrical parameter monitoring.

KEYWORDS:- Solar Panel, Wind Mill, Battery, PIC controller, DC micro grid and IOT system.

I. INTRODUCTION

Nowadays the power demand is increased gradually depends on the growing populations. With ever growing population, improvement in the living standard of humanity, Industrialization of the developing nations, the global demand for energy is expected to increase rather significantly in the near future. The primary source of energy is fossil fuel, however the finiteness of fossil fuel reserves and large scale environmental degradation caused by their widespread purpose, particularly global warming, Urban air pollution and acid rain, strongly suggests that harnessing of non-conventional, renewable and environment friendly energy resources is vital for steering the global energy supplies towards a sustainable path. Renewable energy is collected from renewable resources like sunlight, wind, rain, tides, waves, and geothermal heat. More than one energy sources is giving power to the load that the system called Hybrid energy system.

Photovoltaic cell using to convert the light energy to Electrical energy and produces DC voltage. Wind is freely available in nature, by using the wind power to convert wind energy to mechanical energy. In modern world there are different types of wind turbines available. Commonly used horizontal axis turbine and vertical axis wind turbines. The blade is play main function of energy conversion. It is provide clean and Eco-friendly energies. The output voltage is to maintain constant value continuously for uninterrupted loading, because of some cloudy weather condition and lower wind source is to reduce the output voltages in our energy sources. By using of Boost converter (DC-DC converter) is to maintain the constant output voltage. A DC micro grid is to connect the Solar, Wind and Battery sources. The load is connected from the DC Grid. The additional power is stored in the battery and it is used for un interrupt power to load, when the renewable energy is shutting of nature causes.

[2]

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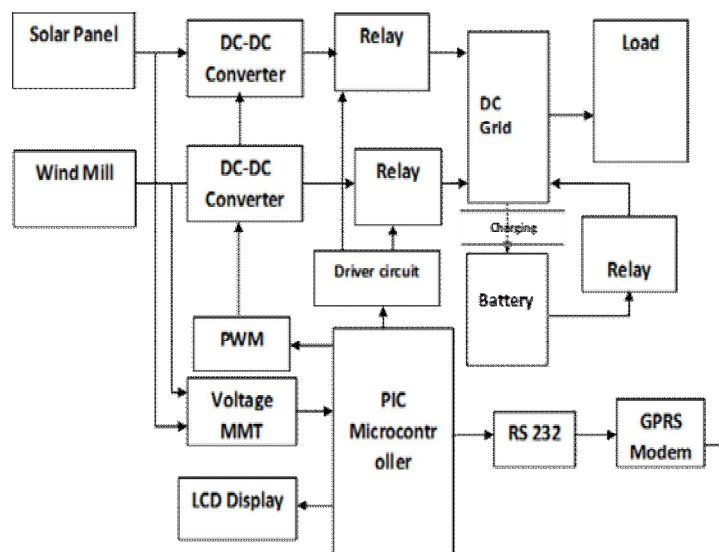
Hybrid Energy System:- The implement the DC micro grid distribution system in remote area/hill station from the hybrid renewable energy resources DC micro grid system to the user with affordable cost, more reliable and efficient electric supply. The nonconventional energy resources and their usage in India ranks sixth in the world in total energy consumption, whereas more than 70% of its primary energy needs are being met through imports, mainly in the form of crude oil and natural gas. Coming to the power generation in the country, India has increased installed power capacity from 1362 MW to over 344.69 GW since independence and electrified more than 597,463 villages. The total installed capacity the renewable energy power plants constitute 33.60% of power. In remote area the independent electrical grid only fulfill the electric power demands and receiving renewable energy is optimal utilization needed for economic growth our country. Here is optimally utilized renewable energy, reliable electric supply and uninterrupted electric supply from this DC micro grid, with lower cost.[2]

The Solar, Wind renewable resources is to generate electricity with lower cost without harming the nature. Solar energy has some drawbacks in night time, cloudy and rainy season. In this times we can't get the solar energy due to non-availability of sun light. To overcome this problem we are using more than one different energy sources. If any one of the connected source fails to generate the power other available source will maintain the power generation. In case the both resources had to fails, the battery source is backup to meet out the load and maintain the power demand in the DC micro grid. In the power system, batteries are a common form of storage technology. With batteries being modular, they are flexible, come in a variety of sizes and require little work to be installed. There are two main types of batteries, primary (non rechargeable) and secondary (rechargeable) batteries. [3]

The battery will be parallel charged by source taken from the grid, the charging can be done in when solar/ wind resources connected to grid. The battery charging time the supply could not be returned to the grid, only when the two sources fails to supply the power then it will be connected automatically. The available renewable energy is fully consumed by the user.

DC Micro grid :- DC micro grid is suitable for dc output type distributed generations and energy storages. Scope of this system to use DC micro grid in residential Houses/ remote area. A 12 V DC micro grid used in this system by connecting hybrid renewable energy resources will provide power. The load is connected from the DC micro grid. The hybrid energy can be shared itself. In this paper we built a small scale experimental. [4]

Block Diagram:-



Solar panel :- The basic principle of solar panel is convert light energy to electrical energy. The group of photovoltaic cell is called solar panel and it available in various size and watts cell depends upon our requirements. It is a flat surface mounted on roof tops towards sunlight. Nowadays the electricity demand is too high to optimum

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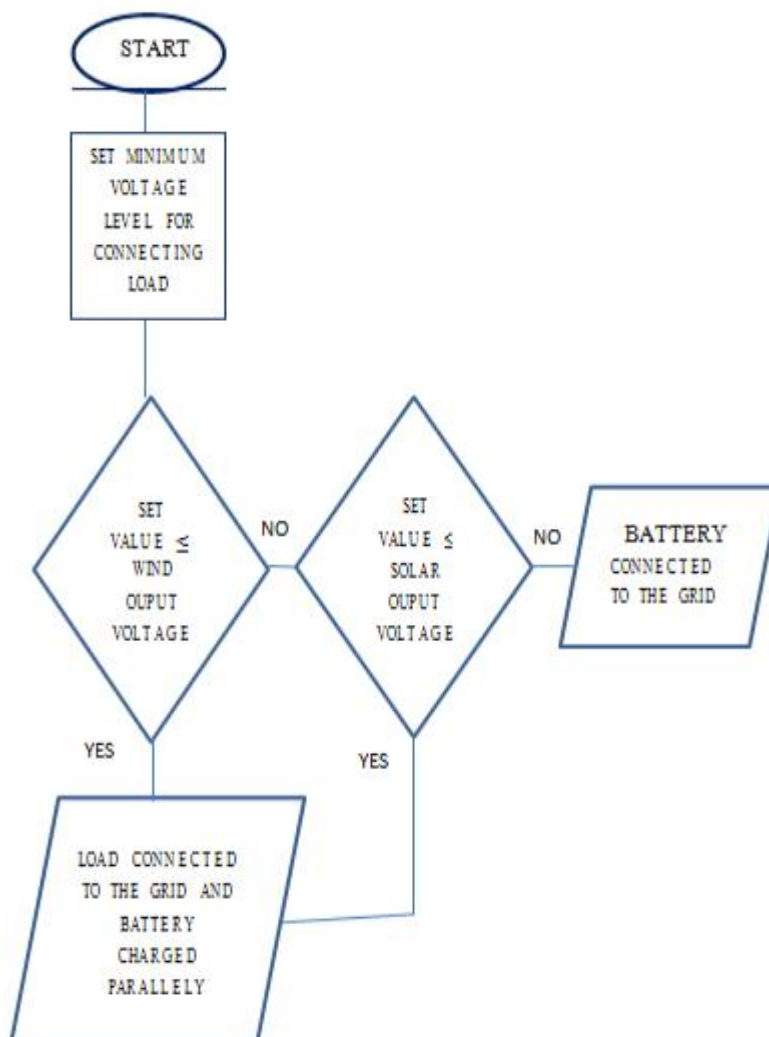
equalized by use the solar energy. Solar energy is a non-conventional energy.

Specification of PV panel used:-

Max Power : 10 Watts, Optimum Operating Voltage :
17.2 V, Optimum Operating Current : 0.58 A Open Circuit Voltage : 21.6 V.

Boost converter :- Boost converter converts the fixed DC to variable DC by using combination of thyristors, filters and switching transistors. It is a type of switch mode power supply. The TTL logic is used to switching operation of the thyristors. Its circuit similar to buck converter, but its working function have slight difference. This circuits are used in were the variable power requirement such that power amplifiers in electronic devices.

Working flow chart:



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Relay :- A relay is a simple electromechanical switch made up of an electromagnet and a set of contacts. Relays are found hidden in all sorts of devices. In fact, some of the first computers ever built used relays to implement. In this paper SPST relay is used.

Battery :- In the power system, batteries are a common. The battery is a device contains group of electrochemical cells. The batteries are converting the power from chemical energy to electrical energy. Battery delivers electrical power from the its positive and negative terminals and it is technically called anode and cathode. The load is connected to a battery, the electrolytes move the ions between electrodes.

Specification of battery used:-

Type : Regulated Lead-Acid Battery, Voltage :12

Volts Capacity loading :4.5 Ah

Wind Mill :- Wind is freely available in nature, by using the wind power to convert wind energy to mechanical energy. In modern world there are different types of wind turbines available. Commonly used horizontal axis turbine and vertical axis wind turbines. The blade is play main function of energy conversion.

Specification of wind generator used:-

Type : DC shunt generator, Output voltage: 6 V DC,

Max Power :10 Watts, Optimum Operating Current 1.6Amps.

PIC Microcontroller :- The basic building block of PIC 16F877A is based on Harvard architecture and also supports RISC (Reduced Instruction Set Computer). The PIC microcontroller architecture comprises of CPU, I/O ports, memory organization, A/D converter, timers/counters, interrupts, serial communication, and oscillator and CCP module

Result:- The Optimal utilization of renewable energy resources done by using the direct loading and the additional powers will be stored in the Lead acid battery by the way of switching operations.

The experimental explanation of this paper is the renewable resources solar and wind is connected to the DC Micro grid through relays. The battery also connected in the DC micro grid in two paths, one is charging in single way by using diode. Another one is connected to grid via relay.

The set value of output voltage is initially fixed; the operation mode which generation is connected to the load is given below cases. The parameters monitored by using in system display and also we can access via IOT devices.

Case 1: The solar panel output voltage increased higher than the set value, then the solar output relay is connected to the DC grid. Now battery source kept off condition.

Condition: When the wind source voltage is too low compared with set voltage then the Solar mode activated and supply to the load.

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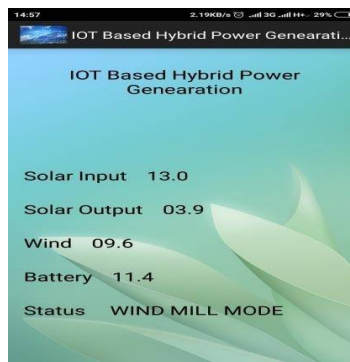
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Solar Mode

Case 2: The wind mill output voltage increased higher than the set value, and then the wind output relay is connected to the DC grid. Now battery source kept off condition.

Condition: When the solar source voltage is too low compared with set voltage then the wind mode activated and supply to the load.



Wind Mode

Case 3: When the solar and wind sources fails to producing output voltage less than set value, then the battery source is connected to the grid and solar, wind relays is disconnected from the grid.



Battery Mode



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