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OPTIMALLYSIZING THE COMBINATION OF PV ARRAY-WIND SYSTEM INTO THE BATTERY BANK

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Abstract: In this research paper we have evaluated the potential of hybrid system to produce electricity for a community and other states. The different types of renewable sources are specifically evaluated in the economic performance of the overall equipment. The presented methodology is applied to evaluate the potential of photovoltaic-wind hybrid system. Using hybrid system has reduced the pollution and decrease the global warming. In this we have analyzed the data of solar and wind power and calculated the average energy which operates the designed load. By using hybrid system we have fulfill the energy demand into the future. The intensive consumption of fossil combustibles is the main cause for the negative impact on our atmosphere. Hence switching to renewable energy resources will eliminate this problem.

Index term: Average energy, hybrid system, renewable energy, solar power, wind power

INTRODUCTION

In this hybrid system we have designed a model to generate electricity which operate the load with multiple renewable energy sources PV array and wind turbine, and operate with solar system software for remote power monitoring and control.This paper focus on two renewable sources: wind power and solar photovoltaic (PV). Both these energetic sources are clean and worldwide available. The comparative advantages of these energetic sources in relation to other renewable energies are demonstrated by the intense expansion of both wind and photovoltaic (PV) production plants, mainly in the industrialized world. An ideal system has to supply, at any given time of the month, an instantaneous energy ES that equals the consumed energy by all system loads EL.

$$E_s = E_l \quad (1)$$

COMPONENTS USED

- l293d motor driver IC-

It is a motor driver IC which allow dc motor to drive on either direction. It is a 16 pin IC which can control a set of two dc motor simultaneously. It works on the concept of H-bridge that is allows the voltage to be flown in either direction.

Left input pins will regulate the rotation of motor connected across left side and right input pins will regulate the rotation of motor connected across right side.

- Pin 2=logic 1 and pin 7=logic 0| Clockwise Direction
- Pin 2=logic 0 and pin 7=logic 1| Anticlockwise Direction
- Pin 2=logic 0 and pin 7=logic 0| No Rotation/ High Impedance State
- Pin 2=logic 1 and pin 7=logic 1| No Rotation

- **max232 interface-**

The MAX232 is an IC, first created in 1987 by Maxim Integrated Products, that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals.The drivers provide RS-232 voltage level outputs (approx. ± 7.5 V) from a single + 5 V supply via on-chip charge pumpsand external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to + 5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case.

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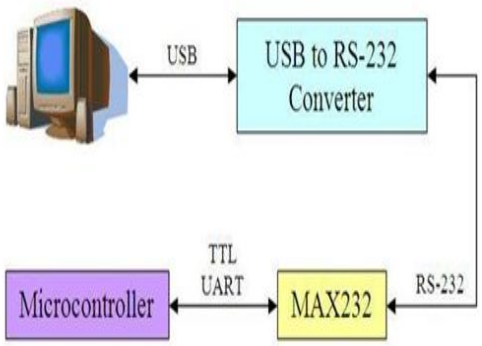
The receivers reduce RS-232 inputs (which may be as high as ± 25 V), to standard 5 V TTL levels. These receivers have a typical threshold of 1.3 V, and a typical hysteresis of 0.5 V.It uses smaller external capacitors – 0.1 µF in place of the 1.0 µFcapacitors used with the original device.The newer MAX3232 is also backwards compatible, but operates at a broader voltage range, from 3 to 5.5 V.



- **AT89S52 controller**

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.All four ports in the AT89C51 and AT89C52 are bidirectional .Each consists of a latch (Special Function Registers P0 through P3), an output driver, and an input buffer. Most of the ports of the 89S52 have 'dual function' meaning that they can be used for two different functions .The first one is to perform input/output operations and the second one is used to implement special features of the microcontroller like counting external pulses, interrupting the execution of the program according to external events, performing serial data transfer or connecting the chip to a computer to update the software. Each port has 8 pins, and will be treated from the software point of view as an 8-bit variable called 'register', each bit being connected to a different Input/Output pin.

- **0809 adc-**

The ADC0808, ADC0809 data acquisition component is a monolithic CMOS device with an 8-bit analog-to-digital converter, 8-channel multiplexer and Analog Span Adjusted Voltage Reference microprocessor compatible control logic. The 8-bit A/D converter uses successive approximation as the conversion technique. The converter features a high impedance chopper stabilized comparator, a 256R voltage divider with analog switch tree and a successive approximation register. The 8-channel multiplexer can directly access any of 8-single-ended analog signals. The device eliminates the need for external zero and key specifications full-scale adjustments. Easy interfacing to microprocessors is provided by the latched and decoded multiplexer address inputs and latched ttl tri-state outputs. The design of the ADC0808, ADC0809 has been optimized by incorporating the most desirable aspects of several A/D conversion techniques. The ADC0808, ADC0809 offers high speed, high accuracy, minimal temperature dependence, excellent long-term accuracy and repeatability, and consumes minimal power. These features make this device ideally suited to applications from process and machine control to consumer and automotive applications.

- **lm339 battery level indicator**

This battery level indicator offers (5) LEDs that light up progressively as the voltage increases:

- Red: Power Connected (0%)
- Yellow: Greater than 10.5V (25%)
- Green 1: Greater than 11.5V (50%)
- Green 2: Greater than 12.5V (75%)
- Green 3: Greater than 13.5V (100%)

You may select your own colors.D1 is the voltage reference zener. Tied to this is a string of divider resistors (R2-6) that set the various fixed voltage levels. R7 & 8 form a voltage divider to that reduces the battery voltage by a factor of 3. U1 is an LM339 quad comparator that

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compares the various voltages from the two dividers. The comparator sections have open collector outputs that simply function as switches to operate the LEDs. D7 protects against reverse battery connection.The LEDs are biased to operate at about 4mA which is quite bright if modern LEDs are used. This current can be adjusted simply by varying the series resistors (R9 through R13). The overall current drain as shown is about 25mA which tends to be wasteful for continuous operation. For energy conservation, connect to battery via a pushbutton (Push to Test).

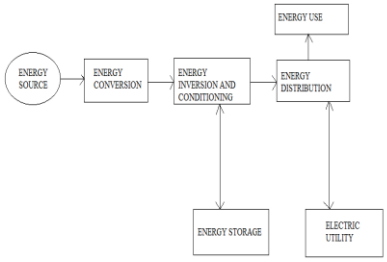
- **7805 regulator**

The **78xx** (sometimes **L78xx**, **LM78xx**, **MC78xx**...) is a family of self-contained fixed linear voltage regulator integrated circuits. The 78xx family is commonly used in electronic circuits requiring a regulated power supply due to their ease-of-use and low cost. For ICs within the family, the *xx* is replaced with two digits, indicating the output voltage (for example, the 7805 has a 5 volt output, while the 7812 produces 12 volts).78xx ICs have three terminals and are commonly found in the TO220 form factor, although smaller surface-mount and largerTO3 packages are available. These devices support an input voltage anywhere from a few volts over the intended output voltage, up to a maximum of 35 to 40 volts depending on the make, and typically provide 1 or 1.5 amperes of current (though smaller or larger packages may have a lower or higher current rating).

- 78xx series ICs do not require additional components to provide a constant, regulated source of power, making them easy to use, as well as economical and efficient uses of space. Other voltage regulators may require additional components to set the output voltage level, or to assist in the regulation process. Some other designs (such as a switched-mode power supply) may need substantial engineering expertise to implement.
- 78xx series ICs have built-in protection against a circuit drawing too much current. They have protection against overheating and short-circuits, making them quite robust in most applications. In some cases, the current-limiting features of the 78xx devices can provide protection not only for the 78xx itself, but also for other parts of the circuit.
- The input voltage must always be higher than the output voltage by some minimum amount (typically 2.5 volts). This can make these devices unsuitable for powering some devices from certain types of power sources (for example, powering a circuit that requires 5 volts using 6-volt batteries will not work using a 7805).
- As they are based on a linear regulator design, the input current required is always the same as the output current. As the input voltage must always be higher than the output voltage, this means that the total power (voltage multiplied by current) going into the 78xx will be more than the output power provided. The difference is dissipated as heat. This means both that for some applications an adequate heat sink must be provided, and also that a (often substantial) portion of the input power is wasted during the process, rendering them less efficient than some other types of power supplies. When the input voltage is significantly higher than the regulated output voltage (for example, powering a 7805 using a 24 volt power source), this inefficiency can be a significant issue.

SOLAR PHOTO VOLTAIC SYSTEM

A system used to transform solar radiation directly into electricity. At the heart of solar power plant also known as photovoltaic cell, is the solar cells which are interconnected to form solar module and solar array. The size and type of system depends upon its intended task. Modules and array are use to charge battery, run motor and to power any number of electrical loads. With the appropriate conversion equipment solar system can produce alternating current compatible with any conventional appliances and can operate in parallel with and in interconnection with various loads.
Solar power system consists of PV array, inverter, battery and various loads.



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Balanced system

The I– V characteristic of the PV module are:

I = IL - I0 (e^q(V +IRS)/nkT _ 1)

Where IL = photo current

I0 = diode saturation current

RS = series resistance

q = charge of electron

k = constant

T = temperature

N = number of PV module

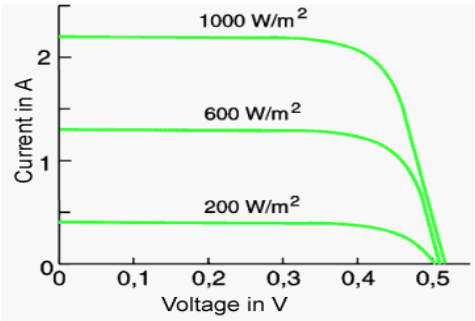
Power output from the PV array can be obtained by using the equation:

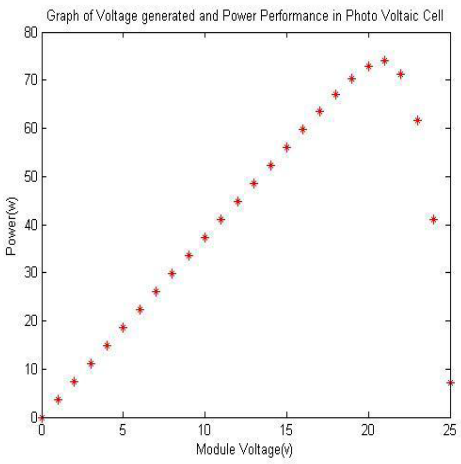
Ppv (t) = Ins (t) * A*Eff(pv)

Ins (t) = insolation data at time t (kw/ m2)

A = area of single PV panel (m2)

Effpv = overall efficiency of the PV panels and dc/dc converters.





WIND ENERGY SYSTEM

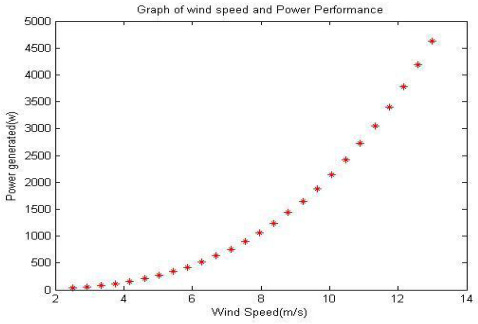
Wind power systems convert the kinetic energy of the wind into other forms of energy such as electricity. Althoughwind energy conversion is relatively simple in concept, turbine design can be quite complex. Most commerciallyavailable wind turbine uses a horizontal – axis configuration with two or three blades, a drive train including agearbox and a generator and a tower to support the rotor.An important factor in how much power your wind turbine will produce is the height of its tower.

The power available in the wind is proportional to the cube of its speed. This means that if wind speed doubles, thepower available to the wind generator increases by a factor of 8 (2 x 2 x 2 = 8).The fundamental equation governing the mechanical power capture of the wind turbine rotor blades, which drivesthe electrical generator, is given byPwin (t) = 1/2 *ℓ*A*V (t) 3* Cp*Effad

Where ℓ = air density (kg/m3)

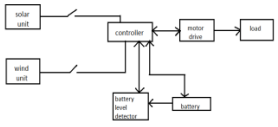
A = area swept of rotor (m2)

V = wind speed (m/s) and Effad = efficiency of the AC/DC Converter



HYBRID SYSTEM

If we produce energy by only PV module which is very expensive, we require a large surface and in winter period the radiation may be decrease, an energy production also decrease which cannot fulfill the consumer demand so to complete this demand we can use other storage device which is very expensive. So by using the hybrid we can reduce the price of power which is economical compared to the single PV module. In this hybrid system we can use the wind generator which cut at low speed. The energy produced by hybrid system stored by batteries which is supplied to consumer through an inverter at constant voltage and frequency type inverted used for the low production and island use for more production. It is compatible with a local network and has connection port for directly switch the wind or diesel generator in the system.



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METHODOLOGY

1) Collect the output voltages from solar unit and wind unit.
2) Take the average of maximum per minute values of the two units.
3) Determine the mean of the two average quantities obtained in step 2.
4) If the load is inoperative then the obtained voltage should charge the battery.
5) If the value obtained in step 3 is sufficient to operate the load then it should surpass the battery and operate the load.
6) If battery level detector indicates full battery and load is also inoperative then the supply should be cutoff using switch.

CONCLUSION

This paper concludes that hybrid model of solar and wind energy can fulfill the load demand. Wind energy support the solar energy to fulfill load demand. So through this system we can supply energy to rural areaswhere sufficient energy cannot be produced. Analysing the methodological data we can obtain a favorite solution for the applicability of the green energy sources in this proposed application. We can use small optimal storage capacity which reduces the cost. We can decrease the unit rate of energy and reduce the pollution level by proper utilization of the natural resources.By providing load with energy directly obtained from solar and wind. This will reduce the dependency of system on battery, thereby reducing the size and cost of battery and increasing the efficiency and performance of system.

WORK IN FUTURE

We can produce the large amount of energy from the renewable resources in future by using the proper locations. Many locations are available in India where large potential of solar and wind energy in future can be installed, the small plant into rural area where solar and wind is available by using this energy. In future by using We have used the small storage capacity.

In future we can install large solar and wind plant which are cheaper compared to small plants.proposed application. We can use small optimal storagecapacitywhich reduces the cost. We can decrease the unit rate of energy and reduce the pollution level by proper utilization of the natural resources. By providing load with energy directly

obtained from solar and wind. This will reduce the dependency of system on battery, thereby reducing the size and cost of battery and increasing the efficiency and performance of system.

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