



Renewable Hybrid Power Generation System for General Purpose



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ABSTRACT

In this proposed system, we discuss the universal issues about energy management for renewable resource, Wind / Photovoltaic (PV) hybrid power system in order to improve energy efficiency with LED's as the light source and placing the wind turbine in addition to solar. The LED's are energy saving, high luminous efficiency and high useful life to the proposed system. And in the same way the position of the turbine plays a major role, we had overcome that design for effective power production. By placing the short armed two turbine in the horizontal path due to the too and fro motion of the vehicles air pressure is developed on the blades of the turbine. The pressure is developed from both the directions keeps the turbine in continuous motion of all the vehicles such as Trucks, Lorries and Buses, etc., Due to this, an uninterrupted power generation by solar at day time and whenever the vehicles crosses the path both at day and night the turbine rotates and energy is generated. This would put down the electricity bill and reduce the pollution rate to a certain limit.

KEYWORDS: Renewable resource, turbine design, Power LED's, Street light, Energy management, Dual converter, Electrical generator, DC Battery source.

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I. INTRODUCTION

Solar and wind energy is more effective and conventional form of renewable energy available at most it does not depends on any factor, solar energy begins when the day begin and wind is available with a too and fro motion of the vehicle at streets. Much research's are on going to overcome power crisis. The demand in country is hiking each and every day. But, the available power does not meet the requirement. Renewable energy resources must be utilized as much as possible to cut down the demand rate and it's non-polluting. At present, the issue is how to utilize and manage these resources. This paper is proposed to overcome and enhance the power management as said [2], at highways, by acquiring the available energy sources at highways. The proposed system has some advantages such as the energy generated can be utilized not only by

street lights but also in traffic signal, and direction and distance indicators.

The sun has produced energy for billions of years. Solar energy is the sun's rays (solar radiation) that reach the earth. On a bright, sunny day, the sun shines approximately 1,000 watts of energy per square meter of the planet's surface, and if we could collect all of that energy we could easily power our homes and offices for free.

Solar energy can be converted into other forms of energy, such as heat and electricity. In the 1830s, the British astronomer John Herschel used a solar thermal collector box (a device that absorbs sunlight to collect heat) to cook food during an expedition to Africa. Today, people use the sun's energy for lots of things.

Solar energy can be converted to **thermal (or heat) energy** and used to:

- Heat water – for use in homes, buildings, or swimming pools.

- Heat spaces – inside greenhouses, homes, and other buildings.

Solar energy can be converted to electricity in two ways:

Photovoltaic (PV devices) or “solar cells” – change sunlight directly into electricity. The photovoltaic cell was discovered in 1954 by Bell Telephone researchers examining the sensitivity of a properly prepared silicon wafer to sunlight. Beginning in the late 1950s, photovoltaic cells were used to power U.S. space satellites. The success of PV in space generated commercial applications for this technology. The simplest photovoltaic systems power many of the small calculators and wrist watches used everyday. More complicated systems provide electricity to pump water, power communications equipment, and even provide electricity to our homes.

- **Solar Power Plants** - indirectly generate electricity when the heat from solar thermal collectors is used to heat a fluid which produces steam that is used to power generator. Out of the 15 known solar electric generating units operating in the United States at the end of 2006, 10 of these are in California, and 5 in Arizona. No statistics are being collected on solar plants that produce less than 1 megawatt of electricity, so there may be smaller solar plants in a number of other states.



Fig 1: Solar Panels Absorb Energy To Produce Hydrogen At Sunline Transit Agency.

II. WORKING OF WIND ENERGY

Wind farms are erected based on the availability of atmospheric pressure of wind in a specific region. There are certain criteria's and design procedure to erect wind mills as discussed in [7]. At Highways there is availability of wind by the motion of moving vehicles. When a free moving air particle is disturbed by forceful object succeeding in its

path a pressure is developed at the body of the object and it is delivered to the surrounding near objects. By this phenomenon wind turbine is placed on the top of street light. The wind turbines are not placed in vertical path, but horizontally

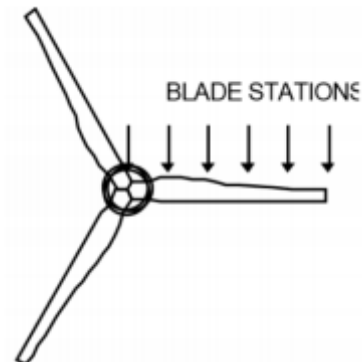


Fig.2: Top View of Wind Generating System

As, show above in fig.1, this design will keep the blades in rotational motion since the vehicle are directed towards left and right direction and hence a forceful wind can be obtained when two vehicles crosses the blade evenly. The blades are connected to synchronous generator to maintain the rotational RPM (Rotation per minute) as constant and its performance characteristics discussed in [12].

a) Design of wind energy generator

In the case of designing or choosing the blade, the diameter of the larger wind-rotor is around 8 feet [2.4 m]. The smaller machine has 4' diameter [1.2 m]. Mostly The blades are, made of unsaturated polyester, fiber-reinforced epoxy composite material. The energy produced by wind turbines depends on the swept area of the blades. The shapes of the blades are important near the tip but much less so near to the root (the larger, inner end of the blade). The can convert only up to 25 -35% of the wind pressure to make a mechanical movement with blades The power (watts) in the wind blowing through the rotor is given by this formula:
 Power (watts) = $1/2 \times \text{air-density} \times \text{swept-area} \times (\text{wind speed})^3$ (When the air density is 1.2 kg/m³)

The diameter is one of the main criteria when the diameter of the blade increases automatically the power may be doubled The speed of the blade is decided by the amount of load is put on to it by air, Rotor blades are

designed with speed in mind, relative to the wind. This is said to be the tip speed ratio (tsr). Tip speed ratio is the speed the blade tips travel divided by the wind speed at that time. It can be determined by,

$$\text{Rpm} = \text{wind speed} \times \text{tsr} \times 60 / \text{circumference}$$

The number of blades also plays a vital role in the speed developed by the rotor, multi-blade has low tip ratio it creates a high torque but power does not increase. The speed should be more than the torque to generate electricity

b) Connection

A two-pole on-off switch rated for 20A at 12 volts DC is suitable for a 12 volt system. From the switch, lead the wiring on to the rectifier and connect any AC wire to any AC terminal. We have used two bridge rectifiers to provide enough AC terminals. Both the negative terminals are connected together from the bridge rectifiers to battery negative and connect the positives to battery positive via a suitable fuse.

III. OPERATION AND FUNCTIONING

In this proposed hybrid system solar and wind energy is made hybrid the power obtained from the sources are converted to a DC and stored in a battery both the outputs are uneven the rotation of the wind turbine may vary; it depends on the speed of the vehicle crossing the area at a particular instance. The blades of the turbine are made up of polymer or fiber as said in [1]. The wind energy generation system is placed at the corners edges of the streets or near the traffic signal where we can find a steady flow of vehicle. Use of Light weight blades can produce rotational motion at low wind. The solar output also depends on the intensity of the light. The lights are replaced by power led's for an effective output and low power consumptions. A switching circuit is made when there are voltage generation from solar the street lights gets TURNED OFF. In the absence of solar power the lights are TURNED ON. This power can also be synthesized by traffic signals, direction and distance indicator. Due to this power the above said can be reduced.

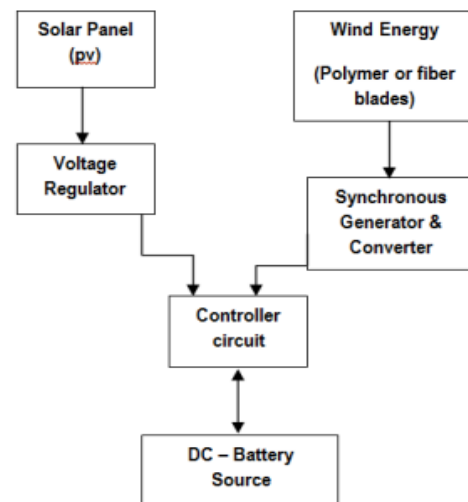


Fig.3: Flow chart of working of Hybrid power system in Street lights

As shown in Fig.3, all the switching process are carried out in the controller unit alternate charging and discharging processes is carried out with the available resources guidelines of using the using the street lights gives idea about the betterment operation and management of the street light as said in [4].

IV. EXPERIMENTAL RESULTS

The performance of the wind-solar hybrid system is shown in Fig.10, with balanced linear load at wind speed of 11 m/s. The corresponding rotor speed set point is at 99.6 rad/s, and its stator frequency is 47.08 Hz. Since the power generated by the system is more than the required active power for the electrical loads, the battery is absorbing the surplus power to maintain the frequency of the load voltage constant. The required battery capacity is determined by the energy needed to keep the circuit working during the peak load time. To determine whether the circuit will operate from the mains or from the battery, it's indicated by small led (green –on main, red – on battery, Blue – battery at minimum level) by using control circuit. Further, the reactive power required by the load is supplied by the load-side converter to maintain the magnitude of the load voltage constant. Thus, under these conditions, both the magnitude and the frequency of the load voltage are maintained constant.

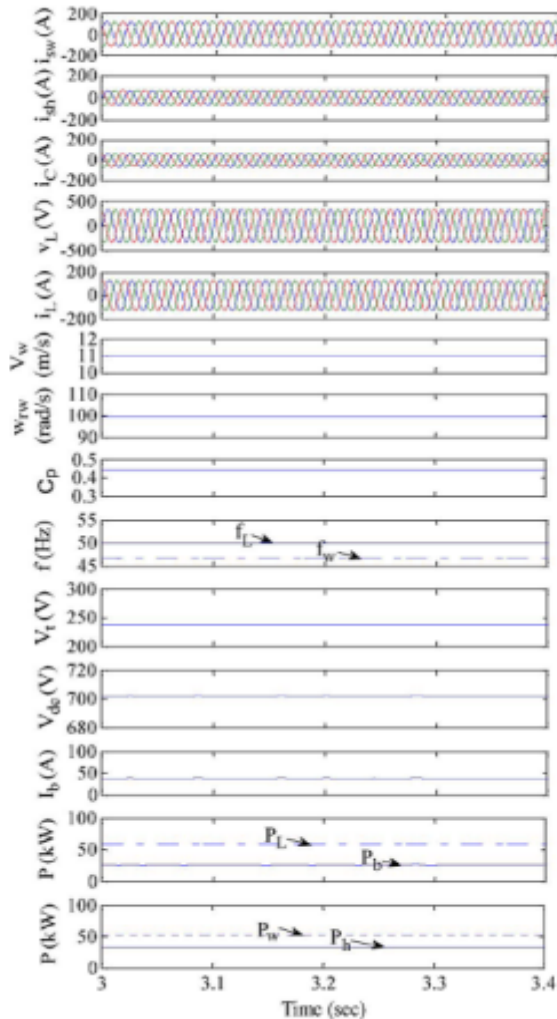


Fig.4, Performance of hybrid system with balanced linear load at wind speed of 11 m/s

IV. CONCLUSION AND FUTURE WORK

In this paper, the renewable energy's, wind and solar have ability to complement each other. The solar panels are placed in between two street lights and interconnected for two loads in this scheme the power converters which interact with the controller is used to control set of operations(Based on presence and absence of vehicles the brightness or the supply can be cut down). By interconnecting all the sources to be made common and load sharing can be made. The power to the loads can be equally shared. Thus the unequal and power can be regularized. Using this method, the initial investment is saved and the total energy loss in the conversion to be reduced. This can be also erected in the path on rail roads where high pressure of wind is developed by the motion of the train.

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