HYBRID SOLAR STREET LIGHT AND WIND ENERGY SYSTEM

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Abstract- *Solar and wind energy are inexhaustible, clean, renewable and environmental friendly. As the global climate issues are increasingly serious and the energy crisis is continually growing, the use of solar and wind energy has become a current and future focus of study and application. Materials and Methods: This study provides a solution design of a hybrid street lights network power management, the way of making street light in network and sharing the rich energy of network street light with others through power line carrier communication, it designs a set of active-passive mode energy sharing method based on three-level electric quantity threshold value algorithm. Results: Under the premise of solar energy abundance in some street lamps, the project share the excess solar of the street lights to other lights. It also solves the problem of insufficient energy in node of part of street lights in the area caused by uneven illumination and temporary shelter. Conclusion: Experiments shows that it enhances regional solar/wind overall utilization of the greatest lighting needs and also extends the life of the battery.*

Keywords- *Electricity, hybrid, solar, power, wind*

I. INTRODUCTION

1.1 GENERAL

1.2 Electricity is very much needed in our day to day life. There are two ways of electricity generation either by conventional (old) energy resources or by renewable energy resources. Electricity demand is increasing day by day with developments and new technologies.

1.3

Majorly, electricity is generated by the conventional energy resources like coal, water, diesel, natural gases, nuclear energy etc. The main disadvantages of these sources is that they produce waste like ash in coal power plant, nuclear waste in nuclear power plant and taking care of this wastage is very costly and also it damages the nature. On the other side, the nuclear energy waste is very destructive to human being. The non-renewable energy resources are exhausting day by day. Soon it will be completely vanished from earth. We will have to find alternative ways to produce electricity. With the increase in global energy demand large industrial power requirements there has been a worldwide need for development in the field of renewable energy. The drastic consumption of oil, natural gas, fossil fuels and other exhaustible sources of energy at the current scenario, will lead to their depletion from earth. The concept of sustainable development has motivated us to search for alternative sources of energy which are freely and abundantly available to us.The non-conventional energy resources like solar, wind can be good alternative source. Solar energy has one disadvantage that it could not produce electrical energy in rainy and cloudy season so we need to overcome this drawback we can use two energy resources so that any one of source fails other source will keep generating the electricity. Due to seasonal and geographical restrictions of wind and solar and weather specific usage of solar panels,

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III. SYSTEM ARCHITECTURE

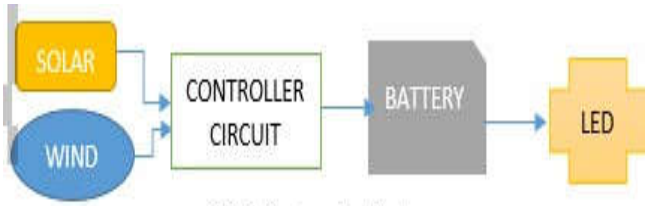

Fig.1: System Architecture

3.1.SOLAR POLY

Solar cell is a device which convert energy of light into electricity by photovoltaic effect. The physical of PV cell is very similar to that of the classical diode with a PN junction formed by semiconductor material. When the junction absorbs light, the energy of absorbed photon is transferred to the electron-proton system of the material, creating charge carriers that are separated at the junction. The charge carriers in the junction region create a potential gradient, get accelerated under the electric field, and circulate as current through an external circuit.

Operation depends upon 3 basic attributes:

1. Absorption of light
2. The seperation of charged carriers of opposite types
3. The seperation extraction of those carriers to an external circuit.

3.2 WIND TURBINE

Wind turbines convert the kinetic energy of the wind into mechanical power by rotating propeller-like blades around the rotor. The design on wind turbine is based upon Solar- Mill which was developed by **WindStream** technologies.

1. Vertical axis turbine mounted on single base.

Savonius wind mill accept wind from both direction

2. Silent operation
3. Cut- in speed – 5m/s

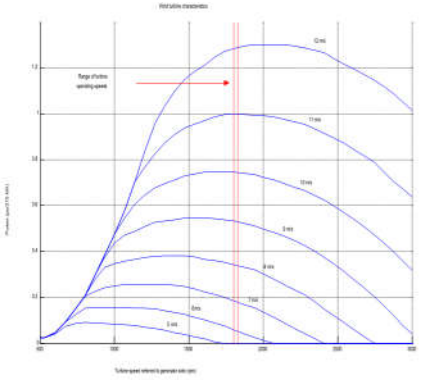

Fig.3: Wind Turbine Characteristics

Design required for Hybrid system:
A. Solar System
1. Annual duration of Sunshine hours 2. Solar Radiation (KWH/m2/day)
B. Wind System:
1. Mean Annual Hourly Wind Speed (m/sec)

The site selected is Nagpur, which has latitude of 21'14' North and Longitude is 79'08' East. Solar radiation data for tilted panel and average wind speed data above 50 m above the surface of Earth is taken from Nasa website.

- Average wind speed: 3.34 m/s
- Average solar radiations: 5.53 kw-hr/m2/day

IV CALCULATIONS AND RESULTS

The total power generated by this system may be given as the addition of the power generated by the solar PV panel and power generated by the wind turbine.

Mathematically,it can be represented as

$P_{total} = N * P_{wind} + N_{solar} * P_{solar}$
Where,
P_{total}= Total Power Generated
P_{wind}= Power Generated by wind
N= No. of wind turbine
P_{solar}= Power Generated by Solar
N_{solar}= No. of Solar Panel
A. Calculations for wind energy
The power generated by wind energy is given by,
Power = (density of air * swept area * velocity cubed)/2

PW = ½. ρ (AW) (V) 3

Where, P is power in watts (W)
ρ is the air density in kilograms per cubic meter (kg/m³) AW is the swept area by air in square meters (m²) V is the wind speed in meters per second (m/s).

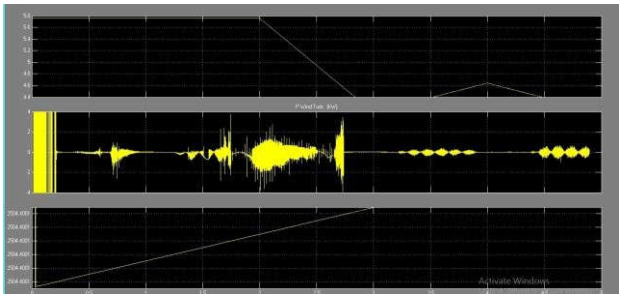

Fig.4: Matlab Wind Results

The above figure shows the total power developed by inconsistent wind and its output in DC voltage and current.

B. Calculations for solar energy

To determine the size of PV modules, the required energy consumption must be estimated. Therefore, the power is

calculated as

PSolar = Ins (t) * ASolar*Effe(pv)

Where,

Ins (t)= isolation at time t (kw/ m2) ASolar = area of single PV panel (m2) Effepv= Overall efficiency of the PV panels.

Overall efficiency is given by,

Eff(pv)= H * PR

Where,

H = Annual average solar radiation on tilted panel. PR = Performance ratio

CONCLUSION

Solar-wind hybrid energy systems needs only initial investment. It will compete well in generation with the conventional energy sources. When accounted for a lifetime of reduced or avoided utility costs. The cost of the system depends on the system chosen, wind resource on the site, electric costs in the area, and the battery bank required. Cost of the Wind-Solar Hybrid system is to be minimized. For minimize the cost of the system we need to increase the use of RE energy sources.

Wind-Solar hybrid streetlight will have three main advantages:

1) Social benefit: Wind-Solar hybrid streetlight is a high-tech environmentally friendly product. Installing the wind-solar hybrid streetlight is done, it gives conformity with the government's environmental protection idea.

2) Economic benefit: It uses and produces power by itself. After the construction of a one-time investment, we can get a long-lasting benefit. Changing the traditional streetlight system laid on the underground cable power supply way saves a lot of manpower and monetary investments.

3) Environmental benefit: Each traditional streetlight spends 1825 kWh power in 10 years. According to the standard thermal coal consumption (400g / kWh) to calculating, the standard coal consumption will be 7.3 tons. So a city center will consume 876,000 tons of standard coal just in 10 years, It will let out 3 million tons of carbon dioxide, 17,500 tons of sulfur dioxide, 13,000 tons of nitrogen dioxide, and so much 10powder and impurity. But when using the wind-solar hybrid streetlights, the pollution will be avoided.

FUTURE SCOPE

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