Design and Development of Multi-Power Generation for Sustainable Energy Conservation

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Abstract **- Multi power generation is a project in which Combined the latest magnetic wind technologic with PV panels & hydroelectricity & manual pedal power generation all this together gives the best of both world for greater independence from costly grid electricity bills. From apartments to street lighting, hybrid systems are starting to bring consistent power to areas word wide, Wind turbines are an ideal solution to the traditional wind turbine, which need very high structures to allow room for their massive blades. Wind technology (so called due to the 'magnetic levitation' friction free drive) has been around for a while as we know from the Magnetic Levitation high speed trains. The electricity is generated using wind, hydro, solar and pedal energy. We used wind turbine, hydro turbine, solar panel and pedaling equipment to generate power. Our project is simple in design and cheap way to generate electricity. For power generation there isn't any fossil fuel used so it's does not harm environment.**

Keywords— Power Generation, Solar panel, Wind, Pedaling,Hydro Turbine.

1. INTRODUCTION

India is a large country and the rate of electrification has not kept pace with the expanding population, urbanization and industrialization and has resulted in the increasing deficit between demand and supply of electricity. This has not only resulted in under electrification but also put heavy pressure on the governments to keep pace with demand for electricity. People not served by the power grid have to rely on fossil fuels like kerosene and diesel for their energy needs and also incur heavy recurring expenditure for the poor people in rural areas. Wherever the rural areas have been brought under power grid the erratic and unreliable power supply has not helped the farmers and the need for an uninterrupted power supply especially during the critical farming period has been a major area of concern.

Solar Power:

India receives a solar energy equivalent of 5,000 trillion kWh/year with a daily average solar energy incidence of 4-7 kWh/m2.This is considerably more than the total energy consumption of the country. Further, most parts of the country, experience 250- 300 sunny days in a year, which makes solar energy a viable option in these areas. It could provide the solution to the rural energy problem, particularly in remote area where grid extension is not a viable proposition Solar energy, with its virtually infinite potential and free availability, represents a non-polluting and inexhaustible energy source which can be developed to meet the energy needs of mankind in a major way. The high cost, fast depleting fossil fuels and the public concern about the eco-friendly power generation of power have led toa surge of interest in the utilization of solar energy.

Wind Energy:

The development of wind power in India began in the 1990s, and has significantly increased in the last few years. Although a relative newcomer to the wind industry compared with Denmark or the United States, India has the fifth largest installed wind power capacity in the world. In 2009-10 India's growth rate was highest among the other top four countries. As of 31 Jan 2013 the installed capacity of wind power in India was 18634.9MW, mainly spread across Tamil Nadu, Gujarat, Rajasthan, Maharashtra and Karnataka. It is estimated that 6,000 MW of additional wind power capacity will be installed in India by 2012.Wind power accounts for 6% of India's total installed power capacity, and it generates 1.6% of the country's power.

Pedal Power:

In remote areas, hilly regions, strategic location, border areas (army deployment), Islands etc. generation of power is scanty if not nil. In these situations a Small Manual Battery Charging Unit would be of great help to provide power supply to battery chargers or battery operated gadgets like mobile phone, communication devices, radio, lamp, fan, TV etc. This product was conceived while studying various means to charge the batteries of an energy efficient lamp. The present design relates to very compact and easily portable power-generating unit, which besides being used as a power generator can also be used as cycle exerciser. The power-generating unit is pedal operated. It serves dual purpose of power generation and

helping the person to maintain physical fitness through exercise of muscles of legs and lower torso. The force applied to the pedals gets transmitted to the rotor unit of power generating device through chain-sprocket and gear train. The sizes of sprockets and gears are so chosen to achieve suitable rotating speed of the rotor for power generation.

Hydro Power:

Hydropower, or hydroelectric power, is a renewable source of energy that generates power by using a dam or diversion structure to alter the natural flow of a river or other body of water. Hydropower relies on the endless, constantly recharging system of the water cycle to produce electricity, using a fuel—water—that is not reduced or eliminated in the process. There are many types of hydropower facilities, though they are all powered by the kinetic energy of flowing water as it moves downstream. Hydropower utilizes turbines and generators to convert that kinetic energy into electricity, which is then fed into the electrical grid to power homes, businesses, and industries.

2. LITERATURE REVIEW

Aashay Tinaikar et al.,[2013] [1] has developed a model for Harvesting Energy from Rainfall to utilize energy stored in rain water to provide power to the buildings which are situated in the regions, affected by power cuts during summer and also highlights the advantages and the shortcomings of the design and feasibility.

Amirnaser Yazdani and Prajna Paramita et al.,[2009] [2] This paper proposes a control strategy for a single-stage, three- phase, photovoltaic (PV) system that is connected to a distribution network. The control is based on an inner current- control loop and an outer DC-link voltage regulator. Proper feed forward actions are proposed for the current-control loop to make its dynamics independent of those of the rest of the system. A modal/sensitivity analysis is also conducted on a linearized model of the overall system, to characterize dynamic properties of the system, to evaluate robustness of the controllers, and to identify the nature of interactions between the PV system and the network/loads. The results of the modal analysis confirm that under the proposed control strategy, dynamics of the PV system are decoupled from those of the distribution network and, therefore, the PV system does not destabilize the distribution network. It is also shown that the PV system dynamics are not influenced by those of the network.

Arjun et al., [2003] [3] has developed a Micro-Hybrid Power System using Solar & Wind that harnesses the renewable energies in Sun and Wind to generate electricity which resulted that the site is abundant in renewable energy and the hybrid nature increases the reliability and reduces the dependence on one single source.

B. Roberts et al.,[2009] [4] Making electricity grids "smarter" and modernizing them so that they can accept large amounts of renewable energy resources are fairly universally accepted as steps necessary to achieve a clean and secure electric power industry. The best way to achieve this goal is a topic of debate among power system designers. Although energy storage in utility grids has existed for many decades, the impact of storage in future grids is receiving more attention than ever from system designers, grid operations and regulators. The amount of storage in a grid and its value is also a subject of debate. Understanding the leading storage technologies and how they can affect grid operations is an important first step in this assessment.

3. PROBLEM IDENTIFICATION

As energy consumption is increasing day by day and conventional resources are depleting vastly, there is need to find new energy sources to supply to the demand. The problem with non-conventional energy sources is that they cannot be generated when it is not available so it we cannot completely depend on them. Like solar energy cannot be generated when there is no sunlight. Similarly Wind Energy cannot be generated when wind is not available to rotate the turbines. Suppose no conventional resources is available there will be a need to find a different source of power generation. Various Army units go to camps and carry large battery which adds up to the unnecessary load of batteries, so there's a need to develop a product which recharges the battery using the available resources at that place.

4. PROBLEM RECTIFICATION

A multi-power generator that utilizes wind, solar, turbine, and pedal power would be a hybrid renewable energy system that can provide electricity in various ways. To rectify the different types of electrical energy generated by the wind turbine, PV panels, turbine, and pedal-powered generator, a rectifier circuit would be needed. The rectifier circuit would convert the AC (alternating current) power generated by the wind turbine, turbine, and pedal-powered generator into DC (direct current) power, which is what the PV panels generate. After rectification, the DC power could be stored in batteries for later use or converted into AC power using an inverter, which can provide a consistent voltage and frequency of electrical energy. This would enable the multi-power generator to provide electricity even when the wind is not blowing, the sun is not shining, or there is no flowing water to turn the turbine.

5. LIST OF COMPONENTS USED

S.no	Name of the Component	QUANTITY
1	Dynamo	1
2	Solar panel	1
3	Chain	1 Packet
4	Turbine	1
5	Bearings	2
6	Battery	1
7	Electrical switch	1
8	Sprocket	1
9	Water pump	1
10	Nut and Bolt	15 pieces each
11	Pedal	1 pair

6. FABRICATION

Fig: Working Model

7. CALCULATIONS

Charging Time:
The charging time differs on how many sources are generating the energy.
If the battery is charging at 2 amps then it will take 3.5 hours to charge the battery fully.
7000mah/2000mah = 3.5 hours

Discharging Time:
Battery AH X Battery Volt / Applied load.
Say, 7 AH X 12V/ 10 Watts = 8.4 hrs (with 40% loss at the max = 8.4 x 40 /100 = 3.36 hrs)
For sure, the backup will lasts up to 3.36 hrs

240V AC sockets are provided for various applications so depending upon the appliance the discharging time will vary.

8. WORKING PRINCIPLE

Windmill arrangement is the mechanical arrangements which are easily rotated by wind. The rotating speed depends upon the wind strength. The fan arrangement is coupled with the dynamo. So whenever the fan is rotated due to wind, the dynamo also rotated. The electric power is generated in the dynamo. And the another setup is rain water power generation, here the funnel is fixed in the vertical side to collecting the rain water and it's passed through the turbine arrangement at great force. In the turbine arrangement dynamo is fixed to generate the power from it, so whenever the rain water is collected through the funnel the turbine will rotates because of the flow of rain water and its generate the electric power through it. And another setup is manual pedaling which rotates the dynamo. When the dynamo rotates the output DC voltage is stored in the battery. An inverter is connected to the battery to convert DC to AC. From the inverter a CFL is made to glow. Solar power generation is the one of the effective method to generate the power. Here the solar panel consists of number of silicon cells. When sunlight falls on these cells, it generate voltage pulse and gathered together then given to charging circuit. For demo purpose here we are connecting the CFL to the inverter for the light to glow.

APPLICATION

1) Various monitoring systems.
2) Powering up for communication system.
3) As per requirement of electrical energy the system can be either designed or updated for higher energy requirement.
4) The system is used for domestic purpose. Street lighting,Traffic signals.
5) When ac mains supply is not available, the proposed system can be used as emergency system with only few changes.

9. CONCLUSION

Obviously, a complete hybrid power system of this nature may be too expensive and too labor intensive for many Industrial Technology Departments. Wind, Solar PV, Biomass and Rain water power generations are viable options for future power. Hybrid combinations of wind power, solar power, geothermal power, hydroelectric power, tidal power, biomass generated power, power from incineration of solid wastes, and many other technologies could be considered depending on local interests and resources. Besides being pollution free, they are free for remote areas, not accessible by the grid supply. Hybrid systems can address limitations in terms of – Fuel Flexibility, Efficiency, Reliability, Emissions and Economics. The hybrid system of solar/wind is environmental friendly. Efficient way of supplying electricity. As wind speed and sun shine is different in efficiency measures with the use of renewable energies will not only reduce electricity consumption and peak demand,

different parts of the world, a combination of energy thereby increasing the electricity service, but also reduce the production of conventional energy and greenhouse emissions from the combustion of fossil fuels. Therefore, energy storage systems will be required for each of these systems in order to satisfy the power demands. Usually storage system is expensive and the size has to be reduced to a minimum possible for the renewable energy system to be cost effective. Hybrid power systems can also be used to reduce energy storage requirements. By integrating and optimizing the solar photovoltaic and wind systems, the reliability of the systems can be improved and the unit cost of power can be minimized.

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