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Design and Development of Portable Power Generation Case

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ABSTRACT: Environmentally friendly solutions are becoming more prominent than ever as a result of concern regarding the state of our deteriorating planet. This paper presents a new system configuration of the front-end rectifier stage for a hybrid wind/photovoltaic energy system and also we have incorporated a pedal powered generator so when the solar or wind power can't be generated efficiently then power can be generated using mechanical means i.e. by a pedal power generator. This configuration allows the two sources to supply the load separately or simultaneously depending on the availability of the energy sources. When a source is insufficient in meeting the load demands, the other energy source can compensate for the difference. The areas or location like in remote areas and hilly region where conventional energy source are not available this portable power generation case will come in handy to get the enough energy to charge battery operated gadgets like mobile phones, communication devices, radio, lamp, fan, TV, etc. Several hybrid wind/PV power systems with, usage of rectifiers and inverters is also discussed.

KEYWORDS: Portable hybrid Wind/Solar energy system and pedal powered generator by mechanical means, Portable Power Generation Case

I. INTRODUCTION

Energy is playing an important role in human and economic development. One of the driving forces for social and economic development and a basic demand of nation is energy. Most of the energy production methods are one-way, which requires change of form for the energy. In parallel to developing technology, demand for more energy makes us seek new energy sources. Researches for renewable energies have been initiated first for wind power and then for solar power. Efficiency of solar power conversion systems is ca. 18%, whilst that of wind power is ca. 55%. These efficiencies could be increased by 50% with beam tracking, beam focusing and wind direction adaptive motion methods. Therefore we have developed a portable power generation case which can generate and save energy and doesn't completely depend on one energy source.

II. LITERATURE REVIEW

With increasing concern of global warming and the depletion of fossil fuel reserves, many are looking at sustainable energy solutions to preserve the earth for the future generations. Other than hydro power, wind and photovoltaic energy holds the most potential to meet our energy demands. Alone, wind energy is capable of supplying large amounts of power but its presence is highly unpredictable as it can be here one moment and gone in another. Solar energy is present throughout the day but the solar irradiation levels vary due to sun intensity and unpredictable shadows cast by clouds, birds, trees, etc. The common inherent drawback of wind and photovoltaic systems are their intermittent natures

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that make them unreliable. However, by combining these two intermittent sources and by incorporating maximum power point tracking (MPPT) algorithms, the system's power transfer efficiency and reliability can be improved significantly. When a source is unavailable or insufficient in meeting the load demands, the other energy source can compensate for the difference. Several hybrid wind/PV power systems with MPPT control have been proposed and discussed in works. Most of the systems in literature use a separate DC/DC boost converter connected in parallel in the rectifier. [1]

Hybrid models have been an effective means of producing generating electricity throughout the world. Lots of research work has been done and continuing the new advances in this system. This paper reports the probabilistic performance assessment of a wind, Solar Photo Voltaic (SPV) Hybrid Energy System. In addition to this solar/wind system with backup storage batteries were designed, integrated and optimized to predict the behaviour of generating system. This paper proposes a hybrid energy system combining solar photovoltaic and wind turbine as a small scale alternative source of electrical energy where conventional generation is not practical. Simulation of the hybrid system under investigation was carried out by using PSIM software. A simple and cost effective maximum tracking technique is proposed for the photovoltaic and wind turbines. This paper provides a core of a CAD/CAA tool that can help designers determine the optimal design of a hybrid solar power system for either autonomous or grid link applications. This technique uses linear programming principles to reduce the cost of electricity while meeting the load requirement. [2]

In this paper panel contribution, the modelling of wind turbines in power systems dynamics simulations is discussed. First the three most important actual wind turbine concepts are described. Then, various classes of wind turbine models are introduced and it will be discussed which model type can be integrated in power system dynamics simulation software. To conclude, it will be argued that it is possible to model various kinds of variable speed wind turbines with only one model in power system dynamics simulations. In this investigation, wind turbine generators, photovoltaic panels, and storage batteries are used to build a grid linked generation system which is optimal in terms of multiple criteria including cost, reliability, and emissions. Multidisciplinary design facilitates the decision maker to make more rational evaluations. A set of trade-off solutions can be obtained using the multidisciplinary approach, which offers many design alternatives to the decision maker. A grid linked hybrid power system is designed based on the proposed approach. [3]

In this paper we studied manually power generation system. When the solar or wind power can't be generated efficiently then power can be generated using mechanical means i.e. by a pedal powered generator. 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. The shape and size of rotor is chosen to act as a flywheel and impart suitable moment of inertia. The electrical power so produced can be fed to a rectifier unit and plurality of electrical connectors in the rectifier unit provides electrical power to various electrical devices. [4]

III. OBJECTIVE

1. To develop a product, which can be used to generate energy by not completely depending on one energy source.
2. To fulfil by the demand of power by non-conventional energy sources
3. To reduce the weight of carrying batteries
4. Storage of generated power
5. To save Conventional Fuel
6. To make use of most of the available energy at a particular place.

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IV. PROBLEM DEFINATION

1. 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.
2. 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.
3. Similarly Wind Energy cannot be generated when wind is not available to rotate the turbines.
4. Suppose no conventional resources is available there will be a need to find a different source of power generation.
5. 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.

V. METHODOLOGY

Sr. No.	Components	Specification	Quantity
1	Dynamo	12V 20Watt	2
2	Solar Panel	12V 20Watt	1
3	Battery	12V 7A	1
4	DC Charge Controller	10-14V 60Watt	1
5	Inverter	12V DC to 240V AC	1
6	Tripod	8ft 3 leg	1
7	USB Charger	5V 1A	1

Table No 1:Components List and Specification

1. Collecting info of power generation from non-conventional energy resources like wind, solar, human power.
2. We are intended to make aneco-power generator of 230VAC 50 to 60 watt o/p.
3. We are using battery of 12vdc 7 A. and a DC charge controller to charge the battery.
4. For all rotary power generator (wind,human power) we are using 12VDC 20 watt dynamo which can generate this power at 200 RPM.
5. Solar panel will be a pair of 12V 20 watt.
6. Wind generator will be mounted on tripod and human power generator will be an indoor unit.
7. Solar Panel will be fitted outside the case with screws.
8. All this units are attach parallel to dc charge controller which control the input charge which can be vary from 0 to 20 VDC to 14VDC constant to charge battery.
9. The battery will be connected inverter which will give the o/p of 230VAC 60 watt.

VI. 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.
 $7000\text{mah}/2000\text{mah} = 3.5$ hours

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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 = $8.4 \times 40 / 100 = 3.36$ 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. As the Solar Panel is fitted the outside the case it keeps the charging the battery when it's getting sunlight.

VII. IMAGES



Figure No 1: Portable Power Generation Case



Figure No 2: Windmill Setup

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Figure no 3: Inside Setup

Figure No 4: Battery & Charge Controller

VIII. CONCLUSION

Figure no 1 shows the actual case we have made. Figure No 2 shows how the windmill looks like when its assembled from the case. How the case will look like with all the components assembled in it is shown in Figure no 3 providing with the battery and charge controller shown in Figure no 4. From the testing we can say that these kind of hybrid energy sources can be used in future with more developments in the system. It will be pollution free, as it uses non-conventional energy. Furthermore R&D can be done to reduce its weight. It will be useful for trekkers and travellers. More efficient batteries will be added in future. It will be able to make use of solar, wind and human power.

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