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Performance evaluation of hybrid wind and solar power

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Abstract:

A hybrid power system which consists of PV-arrays and wind turbines with energy storing devices (battery bank) and power electronic devices has been discussed in this paper to achieve an efficient and cost competitive system configuration so that hybrid power sources could improve the life of people especially in rural areas where electricity from the main grid has not reached yet

Key words: Renewable energy, PV panel, Battery, Hybrid system.

Introduction

Renewable energy sources such as solar energy and wind energy have been deemed clean, inexhaustible, unlimited, and environmental friendly [1]. Such Characteristics have attracted the energy sector to use renewable energy sources on a larger scale [2]. However, all renewable energy sources have drawbacks. The one that is common to wind and solar sources is their dependence on unpredictable factors such as weather and climatic conditions. Fortunately, due to both sources' Complementary nature, some of these problems can be addressed by overcoming the weaknesses of one with the strengths of the other [2]. This brings us to the hybrid solar-wind power plant concept. A system that brings together two sources of energy is called a hybrid system. The concept of having hybrid power stations is not new, but has gained popularity in recent years [1]. Hybrid energy stations have proven to be advantageous for decreasing the depletion rate of fossil fuels, as well as supplying energy to remote rural areas [3], without harming the environment.

The focus of this paper is to identify how to get the maximum power out of a solar panel to power a remote application The Maximum Power Point Converter is essentially a DC-to-DC converter, where the DC input voltage is a solar panel and wind turbine and the output voltage is 28 volts. The intent of the converter is to show how to take the solar panel and generate a voltage capable of recharging a 24-volt battery.

Solar Panel

Solar Panels are an array of solar cells. The characteristics of the solar panel are essentially the same as those of the solar cells, only scaled up in voltage or current based on the number of solar cells used and the arrangement of the array. Solar panels come in a variety of shapes, sizes and efficiencies, but all have similar characteristics.

Wind turbine

Wind turbines are used to convert the wind power into electric power. Electric generator inside the turbine converts the mechanical power into the electric power Wind turbines can be classified with respect to the physical features (dimensions, axes, number of blade), generated power and so on. For example, wind turbines with respect to axis structure: horizontal rotor plane located turbines, turbines with vertical or horizontal spinning directions with respect of the wind. Turbines with blade numbers: 3-blade, 2-blade and 1-blade turbines.

Design of hybrid energy systems

Hybrid systems are the ones that use more than one energy resources. Integration of systems (wind and solar) has more influence in terms of electric power production. Such systems are called as hybrid systems. Photovoltaic solar panels

and small wind turbines depend on climate and weather conditions. Therefore, neither solar nor wind power is sufficient alone. A number of

renewable energy expert claims to have a satisfactory hybrid energy resource if both wind and solar power are integrated within a unique body. Strong enough, wind velocity is relatively small. In the winter time, when sunny days are relatively shorter, wind velocity is high on the contrast. Efficiency of these renewable systems show also differences through the year. In other words, it is needed to support these two systems with each other in the summer time, when sun beams are to sustain the continuity of the energy production in the system. The kinetic energy of the wind is converted to the mechanical energy in the rotor. The rotor shaft speed, 1/18, is accelerated in the reduction gear and then transmitted to alternator. The electricity that comes from the alternator can be directly transmitted to dc receivers as well as it can be stored in the batteries. To get the solar panel to operate at its maximum power point, there are a few items needed. first, in order to know the output power of the solar panel, both the current and voltage of the solar panel have to be monitored. This will be accomplished by a high side current monitor and simple resistor divider on the solar panel's output voltage. There also needs to be a way to control the output power of the solar panel. This is done by manipulating the panel's output current. And lastly, a software algorithm is needed to know which way to manipulate the current (e.g., whether the current out of the solar panel should be Increased or decreased). Depending on the environmental conditions, required energy for the system can be supplied either separately from the wind or solar systems or using these two resources at the same time Control unit decides which source to use for charging the battery with respect to condition of the incoming energy.

Hybrid controller

To get the solar panel and wind turbine to operate at its maximum power point, there are a few items needed. First, in order to know the output power of the solar panel, both the current and voltage of the solar panel have to be monitored.This will be accomplished by a high side current monitor and simple resistor divider on the solar panel's output voltage. There also needs to be a way to control the output power of the solar panel. This is done by manipulating the panel's output current. And lastly, a software algorithm is needed to know which way to manipulate the current .After the comparator is enabled, the positive input will be greater than the negative input, which causes the output of the comparator to immediately change to an output high. The positive input of the comparator equals

VHH

$$V_{HH} = V_{OSC\_REF} + (V_{DD} - V_{OSC\_REF}) * R_{SOURCE}/(R_{SOURCE} + R_{HYSTERESIS})$$

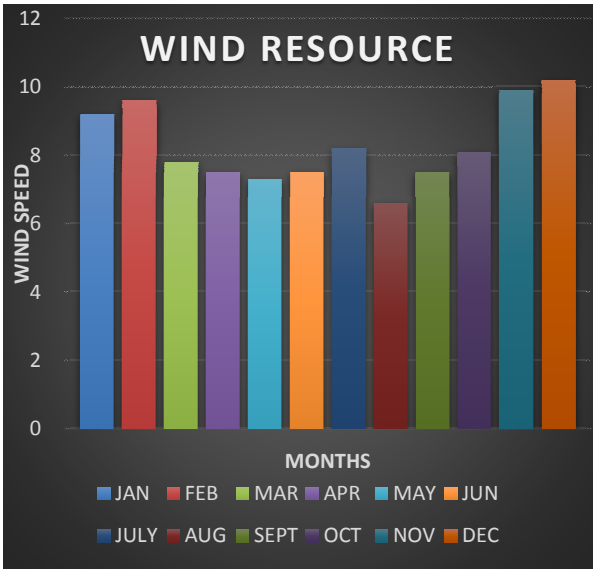
The rate the current in the inductor changes, or the slope of the inductor current, is inversely proportional to the inductance. The larger the inductor is, the slower the current in the inductor changes.

The combination of the amount of hysteresis and the size of theboostinductor inductor will dictate the frequency of oscillation.

$$T_{B-A} = (I_{HH} - I_{HL})L/V_{IN}$$

$$T_{C-B} = (I_{HH} - I_{HL})L/(V_{OUT} - V_{IN})$$

MONTHS	WIND SPEED
JAN	9.2
FEB	9.6
MARCH	7.8
APRIL	7.5
M,AY	7.3
JUNE	7.5
JULY	8.2
AUGUST	6.6
SEPTEMBER	7.5
OCTOBER	8.1
NOVEMBER	9.9
DECEMBER	10.2



Conclusion

This practical investigations are performed to examine the effect of source impedance on a small hybrid wind and PV power system. Because of voltage drop in power sources, both energy sources cannot charge a battery simultaneously after initial charging. There is only slight solar energy loss when wind power is in operation. To increase energy efficiency by gaining both wind and solar energy, a microprocessor-based hybrid charging system is proposed.

References

1.Borowy, B. S. and Salameh, Z. M., "Optimum photovoltaic array size for a hybrid wind/PV system," *IEEE Trans. On Energy Conversion*, vol.9, no.3, pp 482-488, Sep. 1994.

2.Chedid, R. and Rahman, S., "Unit sizing and control of hybrid wind-solar power sys- tems," *IEEE Trans. On Energy Conversion*, vol.2, no.1, pp 79-85, Mar. 1997.

3.m.h nehrir ,C.Wang, and V,Gerez,"Impact of wind power distributed generation on Distribution systems",proceedings,17th International conference on Electricity Distribution(CIRED),may 2003,Barcelona,spain.

4. Kyu-ho Kim,Yu-Jeong lee,Sang-Bong Rhee, Sang-Kuen lee and Seok-Kuyou,"Dispersed Generator placement using FUZZY-GA in Distribution systems",proceeding,2002 IEEE Power Engineering Society Summer Meeting, VOL,pp.1148-1153,july 2002,Chicago,IL.

5. Ekren,O.,EKren, B.Y and Ozerdem,B. "Break- even Analysis and size optimization of a PV/Wind hybrid energy conversion system with Battery storage – A case study", Applied Energy , Vol.86.No.7-8,Pp.1043-54,2009.

6. Ahmed , N.A.,Miyatake,M., and Al-Othman, A.K."Power Fluctuations Suppression of Stand – Alone Hybrid Generation combining Solar Photovoltaic/Wind Turbine and Fuel Cell systems,energy conversion and management Vol.49,pp.2711,2008.

7 .Yang,H.x,Lu,L. and Zhou , W."A Novel Optimization Sizing model for hybrid Solar-Wind power generation system:,Solar energy, Vol.81,No.1,pp.76-84,2007.

8.Ankur Bhattacharjee,"design and comparative Study of three photovoltaic battery charge Control algorithms in MAT LAB/SIMULINK Environment",vol-2 No.3,ISSN,pp,2012.

9. Pamos Hernanz et.al,"Modelling of Photovoltaic module",International Conference on renewable energies And power quality ICREPQ'10) Granada(spain),23th to25th march,2010.