RENEWABLE ENERGY MANAGEMENT SYSTEMS ON-GRID AND OFF-GRID WIND/PV AND BATTERY HYBRID SYSTEMS

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ABSTRACT

Renewable energy systems such as photovoltaic (PV) and wind energy systems are widely designed grid connected or autonomous. This is a problem especially in small powerful system due to the restriction on the inverter markets. Inverters which are utilized in these kinds of energy systems operate on grid or off grid. In this study, a novel power management strategy has been developed by designing a wind-PV hybrid system to operate both as an autonomous system and as a grid-connected system. The inverter used in this study has been designed to operate both on-grid and off-grid. Due to the continuous demand for energy, gel batteries are used in the hybrid system. The designed Power Management Unit performs measurement from various points in the system and in accordance with this measurement; it provides an effective energy transfer to batteries, loads and grid.

Keywords:- Renewable energy, Photovoltaic, Power Management

1.INTRODUCTION:

The use of renewable energy sources is rapidly increasing all over the world. New investments in renewable energy have reached 260 billion dollars world. Even though the world economic crisis has been affecting the world economy since 2008, significant investments in renewable energy have continued. When new investments are evaluated on a sartorial basis, it is seen that investments in the field of wind and solar systems have been in the forefront. Today, more than half of the world population has been living in urban areas. Due to the large population densities in urban areas, world energy sources are consumed in these densely populated areas as expected. Due to the population density in urban areas has been rapidly increasing, It is estimated that by the year 2050, 70% of overall population is going to be living in urban areas and as a result of this, the energy consumption rate is expected to be increased 80% more. Therefore, promoting the usage of small wind-solar system in urban areas has a significant importance. The main problem associated with low power wind solar systems is to shorten amortization period. When this is achieved, then wind solar systems could be more popular in urban areas.

2.LITERATURE SURVEY

Many grid connected PV installations consist of a single series string of PV modules and a single DCAC inverter. This efficiency of this topology can be enhanced with additional low power, low cost per panel converter modules. Most current flows directly in the series string which ensures high efficiency. However parallel Cuk or buck-boost DC-DC converters connected across each adjacent pair of modules now support any desired current difference between series connected PV modules. Each converter "shuffles" the desired difference in PV module currents between two modules and so on up the string. Spice simulations show that even with poor efficiency, these modules can make a significant improvement to the overall power which can be recovered from partially shaded PV strings. A grid-connected photovoltaic (PV) power system with high voltage gain is proposed, and the steady-state model analysis and the control strategy of the system are presented in this paper. For a typical PV array, the output voltage is relatively low, and a high voltage gain is obligatory to realize the grid-connected function. The proposed PV system employs a ZVT-interleaved boost converter with winding-coupled inductors and active-clamp circuits as the first power-processing stage, which can boost a low voltage of the PV array up to a high dc-bus voltage. Two compensation units are added to perform in the system control loops to achieve the low total harmonic distortion and fast dynamic response of the output current. Furthermore, a simple maximum-power-point-tracking method based on power balance is applied in the PV system to reduce the system complexity and cost with a high performance. At last, a 2-kW prototype has been built and tested to verify the theoretical analysis of the paper.The increased penetration of distributed generation (DG) units on the electrical grid systems, the renewable energy sources (RESs) including photovoltaic (PV) systems and wind energy systems have been widely used in the distributed power systems in the past decades. The DG units play an important role in reducing pollution, decreasing power transmission losses and improving local utilization of RESs, which becomes a strong support for the large-scale power grid. However, DG units may also bring challenges to the distribution network such as inverse power flow, voltage deviations and voltage fluctuations. When a number of DG units are clustered together, they can form a micro grid (MG) that solves the problems caused by high penetration of DG units success fully and makes the large-scale application of DG systems possible.

3.PROPOSED METHODOLOGY

The use of renewable energy sources is rapidly increasing all over the world. New investments in renewable energy have reached 260 billion dollars world. Even though the world economic crisis has been affecting the world economy since 2008, significant investments in renewable energy have continued. When new investments are evaluated on a sartorial basis, it is seen that investments in the field of wind and solar systems have been in the forefront.

Today, more than half of the world population has been living in urban areas. Due to the large population densities in urban areas, world energy sources are consumed in these densely populated areas as expected. By the reason of 60–80% of world energy has been consumed in urban areas, 75% of CO2 emission occurs through these areas. Due to the population density in urban areas has been rapidly increasing, It is estimated that by the year 2050, 70% of overall population is going to be living in urban areas and as a result of this, the energy consumption rate is expected to be increased 80% more. Therefore, promoting the usage of small wind-solar system in urban areas has a significant importance. The main problem associated with low power wind solar systems is to shorten amortization period. When this is achieved, then wind solar systems could be more popular in urban areas.

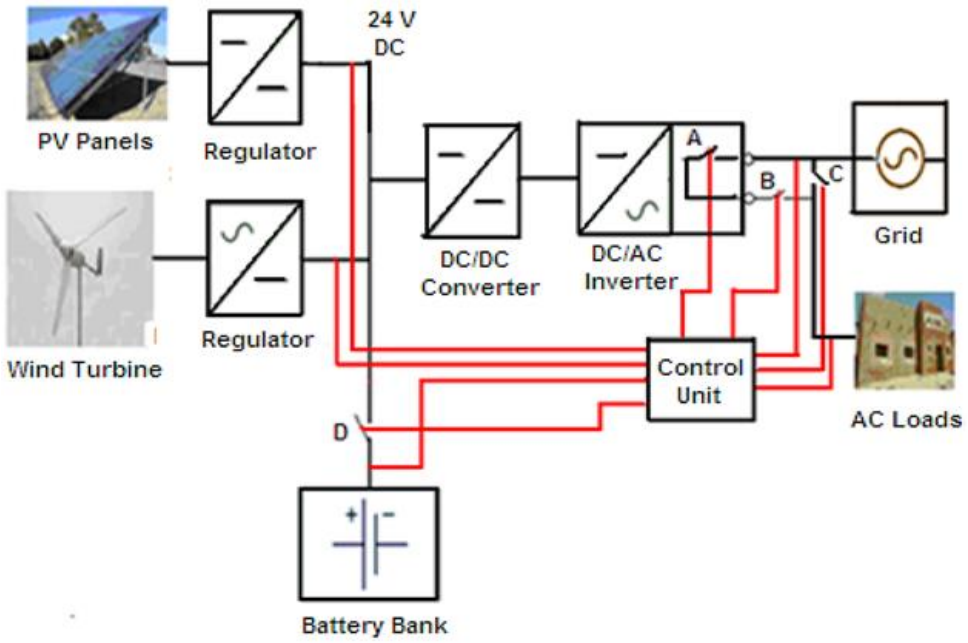

Fig 3Block Diagram:

The term solar panel is best applied to a flat solar thermal collector, such as a solar hot water or air panel used to heat water, air, or otherwise collect solar thermal energy. But 'solar panel' may also refer to a photovoltaic module which is an assembly of solar cells used to generate electricity. In all cases, the panels are typically flat, and are available in various heights and widths.

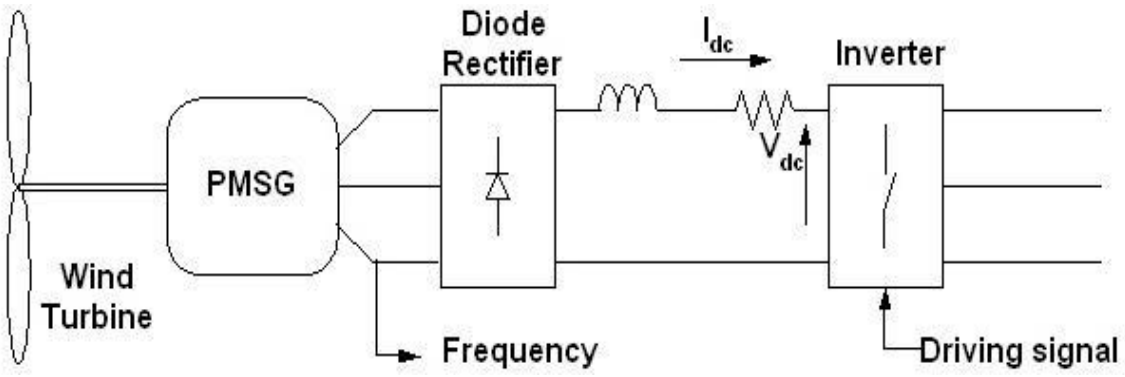

Fig.3.1. Wind Energy Conversion System

This paper has the main focus in the first energy conversion stage the AC-DC converter, which is responsible by an injection of a high harmonic current content into the PMSG. The circulation of harmonic currents into the generator will produce significant additional power losses. Normally, the useful life of an electrical machine is specified based on the assumption of operation under rated load. When considering the proper rating for a machine the voltages and load currents are usually assumed to be sinusoidal. Therefore, the additional increase in the stead-state temperature caused by the harmonics can lead to premature ageing of the insulation and breakdown. Also the mechanical stress due to harmonics can reduce the useful life of the machine [2]. This work applies three well-known approaches to harmonic mitigation in three-phase AC-DC energy conversion systems: a) harmonic trap filters, b) single-switch three-phase boost rectifier and c) three-phase boost type PWM rectifier [3, 4, and 5]. Using these approaches is possible to minimize or to eliminate the current harmonic content. A software simulation model developed in [1] using PSIM® software, which allows easy performance evaluations is used to estimate the behaviour of these three different schemes associated with the PMSG WECS. Simulation results showed the possibility of achieving maximum power tracking, output voltage regulation and harmonic mitigation simultaneously. A windmill is a machine which converts the energy of wind into rotational motion by means of adjustable vanes called sails. The main use is for a grinding mill powered by the wind, reducing a solid or coarse substance into pulp or minute grains, by crushing, grinding, or pressing.[1][2] Windmills have also provided energy to sawmills, paper mills, hammermills, and windpumps for obtaining fresh water from underground or for drainage (especially of land below sea level).

4.SIMULATION RESULT:

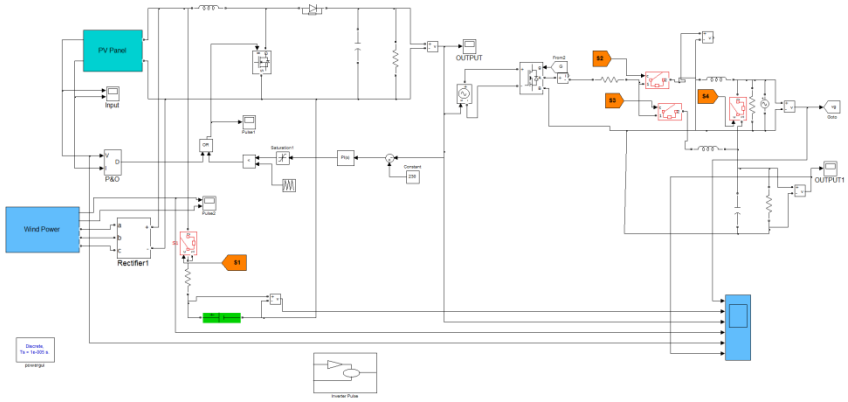

Fig 4.1 Wind Voltage And Current:

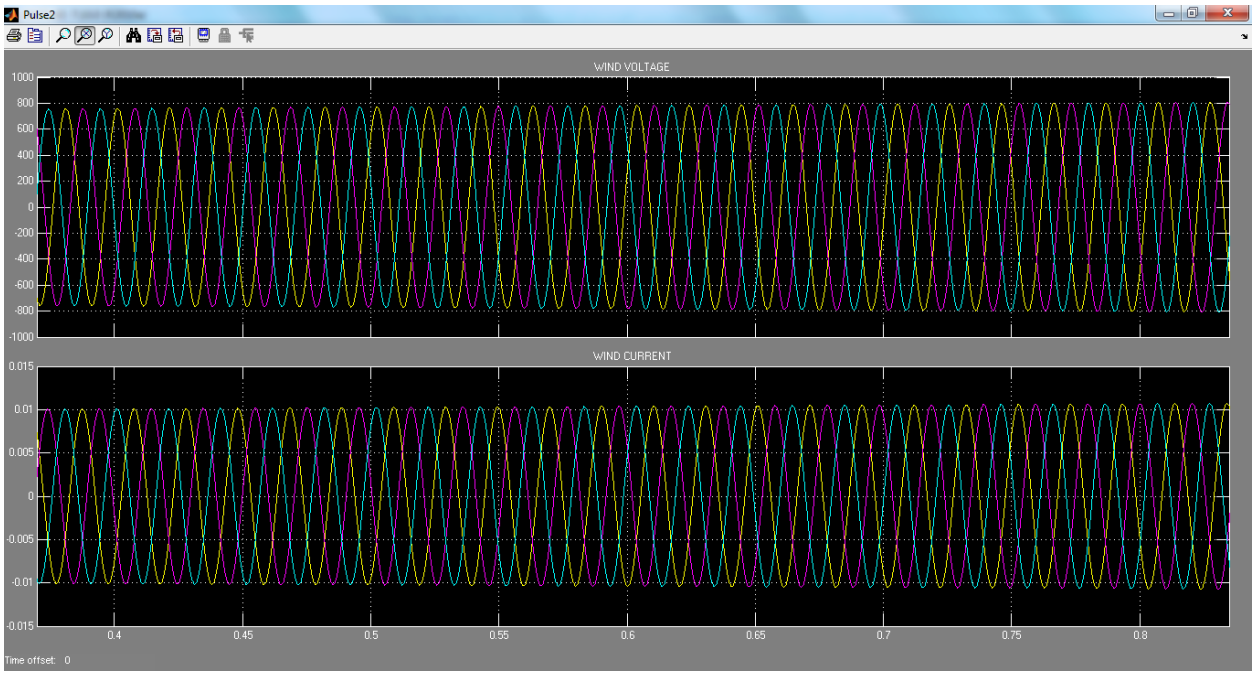

Fig 4.2 Solar voltage and current:

RESULT AND DISCUSSION:

Mode 1: In mode 1 of operation, normal power supply to load occurs (i.e.) from grid power to load. During this operation of mode, power supply is not obtained from hybrid sources. So during this mode the voltage from the solar and wind sources is stored in the battery. According to the simulation, this mode is in operation from 0 sec to 0.5 sec. Mode 2: In mode 2 of operation, power supply for load is obtained from solar and wind sources (i.e.) from renewable sources to load. During this operation of mode, power supply is not obtained from grid sources and also voltage from the renewable sources is not stored in the battery. According to the simulation, this mode is in operation from 0.5sec to 1sec. C. Mode 3 In mode 3 of operation, power supply for load and grid is obtained from hybrid sources (i.e.) from renewable sources plus battery to load and grid. During this operation of mode, stable power supply to load and grid is obtained from hybrid sources to overcome fluctuations if any. The voltage from the solar and wind sources is stored in the battery as well to maintain the battery voltage. According to the simulation, this mode is in operation after 1sec.

CONCLUSION:

The annually energy amount obtained from the resultant hybrid system is measured averagely 2500 kWh/year. Within the context of developed control unit application, when the developer control unit is used, the power transferred to grid, batteries and/or autonomous loads are averagely more than 10% according the control unit is not used. According to this, it is determined that the system cannot provide averagely 250 kWh power earnings per year comparing to conventional system. Moreover, in accordance with the incentive of renewable energy sources in Turkey issued under the laws and regulations, by transferring the power which is generated more than the needs of autonomic load at system.

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