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Review of Hybrid Solar PV and Wind System

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Abstract - Hybrid energy system is the combination of renewable energy sources such as solar energy, windenergy, etc., which has equivocal nature and is an effective way to generate reliable power. Renewable energy sources are very commanding for the electric power production. Hybrid power system is very good solution for the rural areas. This article deals with the review of different technologies for the hybrid power system. The main aim of this article to introduce rudiments, characteristics, integration of hybrid power system for the production of reliable power according to literature reviews. Renewable energy systems in rural and non-electrified location in Jordan in specific and throughout the world in general has a major weakness that they are highly dependent on the renewable resources that cannot be controlled and are intermittent in nature and in some cases are difficult to be predicted such as solar irradiance and wind energy.

Key Words: Converter, Filter, Hybrid Power System, Synchronization.

I.INTRODUCTION:

Energy, a well known word which is the capability to perform work. Nowadays people cannot live without energy. A world without energy is like a debilitate world. Energy can be transmitted, distributed, supplied in the form of electrical energy. Therefore electrical energy is used universally as a vehicle for energy. As years are passing, the population of the world increases. Due to this increasing population of the world, energy requirement is also increases fastly. Due to lacuna of capacity, atmospheric conditions, 40% of villages in the country like India cannot get electricity[2]. It becomes necessary to provide electricity through renewable energy sources in the rural areas. Hybrid energy system are ecofriendly, available in enormous. Due to low cost it is suitable for rural areas. In order to get reliable power from hybrid energy system, design of this system must be excellent. There are many non conventional energy sources like solar PV, wind which are easily available in nature are being used. Primary energy consumption in the world is 1/10,000 of are available on the surface of sunny countries. In terms of rapidly growing energy technology in terms of percentage of yearly growth of installed capacity wind energy is rapidly growing energy technology.

According to the survey, by the end of 2001, worldwide wind operational total power capacity was 23,270MW. Out of this, in Europe 70.3%, in North America 19.1%, in Asia and the Pacific 9.3%, in the middle East and Africa 0.9% and in South and Central America 0.4% was installed[4]. This paper attempts to review of different methods of hybrid power system for getting reliable power operation.

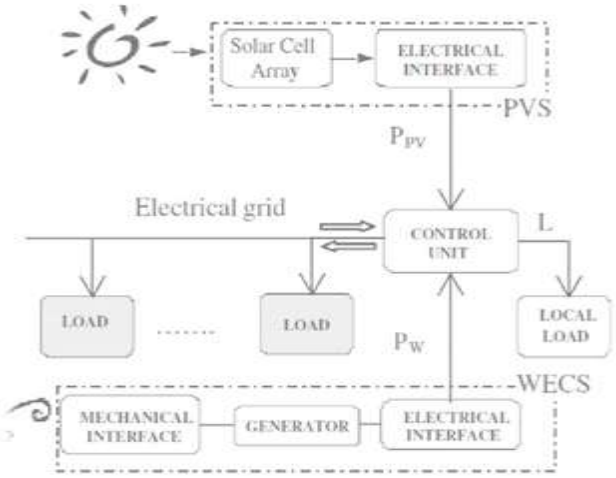

Fig.1 Hybrid wind and solar power system connected to a grid[1]

II. HYBRID POWER SYSTEM TECHNOLOGIES:

Convolution technique are used for grid linked and stand alone application of the hybrid wind and solar power system[1]. Fig.1, represents the hybrid wind and solar power system connected to grid which is bidirectional. Author approaches analytical and simulation method to compare the reliability indices condition to fulfill the load demand, in that case battery bank release energy to synchronize the load requirement. Fig.3 shows the block diagram of hybrid wind solar PV system. PV system model used are of three types- PV array power model, solar radiation on PV module surface and PV module temperature model. It is necessary to select excellent PV array model because it is highly influenced by weather conditions especially solar radiation. In this author approaches optimal sizing method to optimize the configuration of hybrid power system by connecting battery bank. This optimal sizes method uses genetic algorithm(GA) which has ability to attain global optimum simplicity. Fig.4 gives the flow chart of optimal sizing model by using genetic algorithm(GA). Due to this method the required loss of power supply probability(LPSP) with minimum annualized cost of system(ACS) can be achieved. According to this literature review the battery storage of this hybrid power system with 3 to 5 days are suitable for 1% and 2% LPSP. Hybrid energy system gives the fluctuating output power. In this article hybrid system consist of solar PV, wind turbine, fuel cell, dc-dc boost converter[4]. Probabilistic models are used for the improvement of long term evaluation, performance and optimal sizing of hybrid power system. According to review of this article for finding optimal combination of the energy components for minimizing the life cycle cost, a general model develops. Rural areas in Western Ghats(Kerala), India found that micro hydro wind system are the optimal combination for electrification[2].

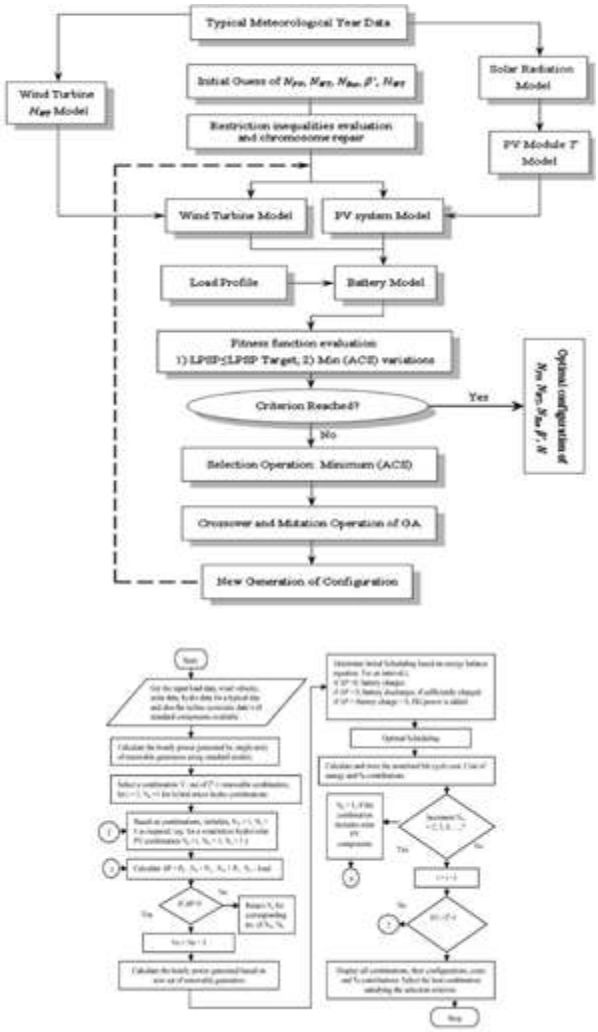

Fig.2 Flow chart for finding optimal hybrid power system[2]

The optimal operation of selected hybrid power system with 100% renewable energy which cost Rs. 6.5/kwh eliminates the need of conventional diesel generator. Fig.2 represents the flow chart for finding an optimal hybrid power system. For minimizing total life cycle cost, non linear constraine optimization techniques are used. Hybrid power system for the generation of power is the combination of wind, solar PV array, battery, inverter, controller. To satisfy the load demand PV array and wind turbine work together and that time battery is in state of charging mode[3].

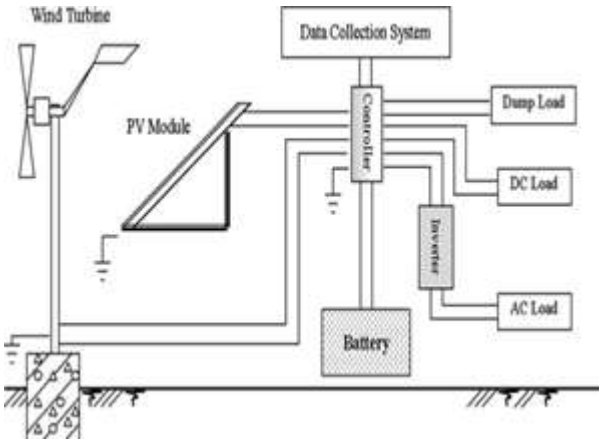

Fig.3 block diagram of HW&PV system[3]

In case one of the component, wind turbine or PV array not in the Continuous power flow for the stand alone loads cannot be guaranteed due to worst weather condition. At this stage fuel cell fulfill the load requirement for solar PV and wind turbine which gives the continuous power supply to the load. Power getting from solar PV and wind turbine fluctuates, to eliminate power fluctuation efficient energy device fuel cell is used. Author approaches PSIM software to simulate the proposed hybridsystem model. Author develops the integration of photovoltaic(PV), fuel cell and ultra capacitor(UC) system for continuous power supply[5]. Whenever PV system cannot fulfill the load requirement at that time fuel cell comes into action. If the load demand increases above the limit of fuel cell in that case ultra capacitor bank fulfill the load requirement. In this fuel cell uses long term and short term storage batteries and this model simulate by using MATLAB software.
Maximum electricity comes from wind which clears that wind is superior than solar at the site. But both are alone cannot fulfill load requirement. According to review of this article optimized solar PV-battery-wind hybrid system is more cost effective than wind alone, solar PV alone system[6].

III.CONCLUSION:

This paper provides review of the different hybrid power system techniques. This methods are very useful for the next generation students and researcher who are interested to make study in the hybrid power system analysis using different simulation softwares. Hybrid power system that exclusively pivot on the intermittent renewable energy sources will generate a swing output voltage that leads to damage the machines that operate on stable supply. Hybrid power system are most advantageous power system which required for continuous reliability of power supply.

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