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Hybrid Energy System Using Photo Voltaic Energy And Fuel Cell System With Three Level Inverter For Grid Connected Applications

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ABSTRACT

The performance, technical aspects and practical considerations of a grid connected photo voltaic-fuel cell (PVFC) hybrid system is solidly analyzed in this paper. The photo voltaic generation is the global, simplest and economical way to harvest energy, among the other renewable energy sources. As the photo-voltaic (PV) system is not that reliable with the daily atmospheric conditions, this makes the hydrogen fuel cell (FC) system which is reliable and consistent regardless of the surroundings, to co-operate with the former one. These two renewable energy sources posses the convenient energy conversion to DC electricity. An MPPT algorithm of perturb and observe (P&O) is applied to harvest maximum power by triggering a boost converter for PV system and a buck converter is controlled for FC system, then the both systems are regulated to a 400V DC bus. A sinusoidal inverter control is used for DC-AC conversion, and it is connected to the national grid using phase locked loop (PLL**).**

INTRODUCTION

The major problem that human race experienced in the last decades of last century and still experiencing is nothing other than the energy problem. As the conventional sources are running on its last reel we should travel through some other ways to lengthen the life of human kind as we living now. The renewable energy sources are the clean systems which never lose its quantity, quality and availability by the continue usage of any species. The photo-voltaic system is the economical and feasible source among the renewable energy systems. Because the sunlight is constantly available on the surface of our globe, earth during day time and can be tracked and converted into electricity without much difficulty and money, photo-voltaic system is the first choice comes into the mind of technocrats when it is the matter of energy harvesting. The photovoltaic/solar cells are the functional stage of conversion of light energy into electricity.

The series and parallel combinations of solar cells/panels make the required voltage and power rating of the systems. An optimum power harvesting method termed as maximum power point tracking, MPPT can be applied to the PV system to enhance the efficiency. The perturb and observe (P&O) algorithm with modified structure is widely used now in power tracking. The MPPT pulse drives the DC-DC converter at the PV system and the output is connected to the common DC bus where all other sources are fed their power. As the PV system is not that linear and trustworthy with every atmospheric condition, it should be in co-operate with some other energy sources which offers a consistent working

characteristics like a battery/cells to supply a continuous power to the load.

The hydrogen fuel cells are the best choice which offers a constant working characteristics and wide operating ranges. Because of good efficiency, rapid response to load and flexibility, Fuel cell system with PV has a wide area of applicability in recent days. The fuel cell system works on the principle of electro-chemical reaction of hydrogen with oxygen. Due to the reaction of hydrogen and oxygen it generates electricity, heat and byproduct as water. The voltage and power rating of the fuel cell system is defined by the flow of hydrogen and oxygen from the storage tank and the concentration of hydrogen molecules. The FC system also needs to have a DC-DC converter to convert the required DC level voltage which is fine with the constant DC bus. An inverter system which is used to convert the DC power into AC which most of the industrial and domestic loads consume.

For the proper conversion into AC with required voltage level, frequency and phase sequence, proper inverter control has to be made. A three phase locked loop drive PWM pulse generator efficiently do this purpose. A fuel cell is a device that can directly transfer chemical energy to electric and thermal energy. There are different types of fuel cells. Among this different fuel cell types a proton exchange membrane fuel cell (PEMFC) has been selected. Proton exchange membrane fuel cell can be operated at low temperature (about 80 °K) with high power density product and at same time without impact environment. Proton exchange membrane has high startup system and shadow system performance. These advantages have been attended amount of research in last year's, especially in stationary and mobile power generators and electric vehicles. Two factors have been controlled on Proliferation of trade of fuel cell technology. They are high performance and low cost.

Low cost covered economy fuel cell research. Fuel cell performance has been managed by more elements such as operating conditions, material properties and cell design. It is necessary understand parameters effect on fuel cell performance. The physical and mathematical is principle device in this work. Where, the mathematical model is important tool in simulation and modeling. The development of physical models allows dependable simulation process under practical conditions parameters, where it is necessary in fuel cell development and optimization

It generates electricity with the help of sunrays. It is pollution free process. Using this process type of power generation method is comparatively costly these days. The generation of power using PV cell depends on weather conditions. Power electronics device can extract suitably high power from the PV arrays to keep overall output power per unit cost as low as possible. In general, the output power of PV array that depends upon environment condition, sunrays falling on PV array, the output energy may change every time; and the current voltage characteristics of PV arrays is highly nonlinear.

Solar panel is the fundamental transducer; it is an energy conversion component of photovoltaic (PV) systems. It has used in various applications, such as aerospace industries, electric vehicles, power generation, communication equipments, etc. As the number of research, is going on to improve the utilization of solar energy because it is pollution free and has number of advantages. Practically, the power supplied by the panels depends on several extrinsic factors, such as temperature, insolation (incident solar radiation) level and load condition. Thus, its electrical power output generally increases linearly with the increase in irradiation where as decreases with ambient temperature.

However, by using maximum power point tracking (MPPT), the photovoltaic system's power transfer efficiency and reliability can be improved significantly, as it can continuously maintain the operating point of the solar panel at the peak point, pertaining to that irradiation and temperature. MPPT consists of two units DC –DC Converter and MPP algorithm. Normally DC-DC converter offers constant source of power for change in line or load condition but it can also be used to track unique point by MPPT algorithm.

EXISTING SYSTEM

The project uses energy from light and wind to generate electricity. In coastal areas, especially those countries where it is difficult to meet the increasing demand of electricity, the wind speed is sufficient most of the time for the generation of electricity. In addition, the availability of sunlight definitely is another option. In this project, the best source is chosen among the two whenever both of them are available. The prototype was successfully able to charge a 4.5V battery and run a load along with the charging process at the same time. A mobile phone was also connected for testing purpose, and was successfully charged.

PROPOSED SYSTEM

The photo voltaic generation is the global, simplest and economical way to harvest energy, among the other renewable energy sources. As the photo-voltaic (PV) system is not that reliable with the daily atmospheric conditions, this makes the hydrogen fuel cell (FC) system which is reliable and consistent regardless of the surroundings, to co-operate with the former one. These two renewable energy sources posses the convenient energy conversion to DC electricity. An MPPT algorithm of perturb and observe(P&O) is applied to harvest maximum power by triggering a boost converter for PV system and a buck converter is controlled for FC system, then the both systems are regulated to a 400V DC bus. A sinusoidal PWM inverter control is used for DC-AC conversion, and it is connected to the national grid using phase locked loop (PLL).

In the proposed system both the PV and FC systems are designed and simulated to provide a 6 kW power delivering capacity each. The PV system is comprise of a number of parallel and series connections of

PV panels in which each panel consist of numerous number of PV cells which are arranged to generate the required voltage and power rating.

CONCLUSION

A hybrid power system of the described system is too expensive and too labor intensive for the power industries and generation field. In this hybrid system with using fuel cell is more efficiency, long life and cheapest compare to hybrid system with using battery. The use of PVFC hybrid power generation is an especially vivid and relevant choice for as these are power sources of technological, political, and economic importance in their state. We can use any of the renewable energy sources for the hybrid system, but the described one shows the optimal control and power regulation.The key element concepts presented in this work are two renewable power sources connected to a power grid with complex electrical interactions.

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