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A REVIEW OF DESIGN AND IMPLEMENTATION OF AUTO STATE HYBRID POWER SYSTEM USING CUK CONVERTOR

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ABSTRACT

For dc-dc power conversion, a bidirectional DC-DC CONVERTER is used. One of the full bridge converters serves as an inverter, while the other serves as a rectifier. This dc–dc converter is ideal for use in electric vehicles. Soft switching implementation without additional devices, high efficiency, and a simple control are some of the system's advantages. ESS (Fuel Cell) and a DC load are the three components that make up the proposed system. As an energy buffer, the Fuel Cell can be charged or discharged to maintain the PV/battery hybrid power system's balance of power output. The integrated bidirectional buck/boost converter in the phase-shift full-bridge DC-DC converter between the PV and the load shares power switches. The AC source is converted to the DC source using a fuel cell. Medium and high power applications, such as in fuel cell vehicles and power generation, require converters that are lightweight, compact, and highly efficient. A converter is required. The PWM technique is being used to generate pulses.

Keywords: Fuel Cell, Photo Voltaic Cell, Inverter, Pic Micro Controller, Mosfet Devices

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1. INTRODUCTION

Natural resources like solar photovoltaic systems and wind turbines can be used to generate renewable and environmentally friendly energy. It's exciting to see it progress, but the difficulties of integrating a wind and photovoltaic system are apparent. Wind and photovoltaic (PV) systems are combined to meet the demand for energy. The PV array generates DC output voltage while the wind turbine generates AC output voltage to convert light energy into electrical energy. Energy systems powered by the sun and wind are commonplace. To generate electricity, use RES (renewable energy sources). In order to meet the energy needs, the wind and PV systems have been integrated. Power conditioners are used to regulate the output power of wind and photovoltaic systems. Batteries are used to store it. The grid takes advantage of the surplus power. When the wind turbine's load demand is high, the battery and even the grid are used to provide power. The PV and wind energy systems are interconnected with power electronic equipment, either to convert, control, or transfer power, or to monitor and control the power. When it comes to the entire power system, the most important factor is the quality of the power. the generation, transmission and distribution sectors must maintain power

quality to improve the system's overall efficiency, performance and lifespan. As a result, renewable energy systems such as wind and photovoltaic (PV) systems also require it. A power system's rated magnitude and frequency must be maintained at or near the system's rated current and voltage in order to achieve power quality. Energy resources are being consumed at an alarming rate in today's world. In light of the alarming state of global warming and rising emissions, a significant increase in the use of renewable energy sources in the existing micro grid is an absolute necessity. PV and wind energy systems are used in the project to generate hybrid power. The hybrid power generation is primarily intended to improve power quality. Inverters are used to convert the DC power generated into AC power, which is fed to an AC load. Energy that isn't used is exported to the grid. Multilevel inverter controllers are used to improve power quality. To limit the amount of current distortion in the utility, utilities in some countries enforce harmonic standards and guidelines. The simple diode rectifiers should not be used because of the serious consequences of conventional converters. In order to achieve rectification with low input current distortion and near-uniform power factor, there is a pressing need to do so. In recent years, environmental concerns have led to an increase in the demand for vehicles that are less harmful to the environment. The significant advancements in fuel cell technology and power electronics have made it possible for electric vehicles to be powered by fuel cells. There are numerous advantages to fuel cells, including high density current output, clean power generation, and high efficiency operation. The fuel cell, on the other hand, shares many characteristics with the traditional chemical-powered battery. When the fuel cell is first connected to a load, the output voltage drops quickly, but as the output current increases, the voltage decreases more slowly.In addition, the fuel cell lacks the ability to store energy.This means that auxiliary energy storage devices (i.e., lead-acid batteries) are always required in electric vehicle applications for cold starts and to absorb the energy generated by the electric machine. An additional DC–DC converter is also required to draw power from the auxiliary battery during vehicle starting.The battery's excess load will be released until the fuel cell voltage is high enough to support the high-voltage bus. The dc–dc converter can also be used to store the regenerated braking energy in the battery.One of the best options is a full-bridge isolated bidirectional dc–dc converter.

2. LITERATURE REVIEW

Shaorong Wang and Muhammad Tajamul Aziz have published "PV-Wind-Battery Based Standalone Microgrid System with MPPT for Green and Sustainable Future" in IEEE [01] in 2019. Modeling hybrid power generation using various power electronics devices in Simulink has been explained in this paper.

Yasser Abdel-Rady and Amr Ahmed A. Radwan IEEE Transactions on Sustainable Energy, 2019 [02]. Newtopologies for grid-connected wind and PV cogeneration systems are presented in this paper. They are simple and effective. Back-to-back (BtB) voltage-source converters are used to connect a full-scale wind turbine to the utility grid (VSCs).

Solar tracking and wind energy systems can be combined to generate hybrid power. The International Journal of Advance Research in Ideas and Innovations in Technology (IJAIIT) published an article on this topic in Volume 4, Issue 3, pp 2381-2384, 2018[03]. Using dual axis solar tracking and wind energy systems, as well as a microcontroller, the paper explains how to generate hybrid power.

Power Quality Issues in Grid Integrated Solar and Wind Hybrid System: A Review" by Pooja Patel, Dr. Vijay Bhuria, in International Journal of Engineering Development and Research, Volume 6, Issue 3, pp. 515–509. Using hybrid power generation with grid interconnection, this paper explains the various power quality issues and how to address them.

ICESAT 2017: "Hybrid ind Solar System for Efficient Power Generation" by Ravikumar S and Dr. H Vennila This paper proposes a new method for improving voltage stability and delivering high-quality power. DC DC converters, each independently controlled and connected to a common DC bus, are used to convert the voltage from the wind energy conversion system (WECS) and the photovoltaic panels. An adaptive Honey Bee Optimization (HBO) algorithm and a PI controller work together to provide voltage stability in the new controller. Using the Simulink platform, the proposed method is implemented.

International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS-2017), pp 3069-3073, 2017 IEEE [06]. MATLAB Implementation of Standalone Hybrid Wind-Solar Power Generation with and without Dump Power Control MATLAB simulink is used in this paper to develop a novel approach for developing a stand-alone hybrid power generation system. There is a demonstration of the use of an advanced control technique for a four-source power system that is typically not used in commercial power systems. This project was completed with a lot of effort put into controlling both active, reactive, and dump power.

Power Quality Improvement with a Grid Interconnection System Using a Hybrid Solar and Wind Power Generation, 1st IEEE International Conference on Power Electronics, Intelligent Control and Energy Systems, July 2016[07], Akshay B. Zade, Asha Gaikwad, Prachi M. Jeevane, and Ganesh Lohote. Various power quality issues, such as sag, swell, source voltage, source current, and THD percentage, are addressed in the paper through simulation and hardware analysis of a hybrid solar and wind energy system. A seven-level inverter can be used as a controller to improve power quality, according to the simulation results. By developing a prototype model for single-phase supply, the paper discusses the results.

International Journal of Advanced Engineering Technology, Vol. VII, Issue I, pp 121-124, Jan-March 2016[08]. In this study, a unified control strategy for power quality improvement is used in the simulation analysis of hybrid power generation. The nonlinear local load problems are addressed by the unified control strategy.

Grid Integration and Power Quality Issues of Wind and Solar Energy System: A Review, IEEE International Conference on Emerging Trends in Electrical, Electronic and Sustainable Energy Systems, p.71-80, 2016 IEEE [09]. Varun Kumar, A.S. Pandey, S.K. Sinha, Review of grid integration and power quality issues associated with renewable energy system integration into grid and the role of flexible AC transmission systems in relation to these issues are presented in this paper. In addition, recent developments in power electronics for the integration of wind and photovoltaic (PV) generators are also discussed. The magnetosphere of our planet, for example, can affect the performance and reliability of technologies on Earth and beyond. Particles and radiation are emitted by the Sun's coronal mass ejections (CMEs), solar flares, and the solar wind (CMEs). GICs are now used in modern technology to travel to other planets in the solar system, thanks to the Earth's magnetosphere and upper atmosphere. The sun's coronal holes, flares, and CMEs are linked to the sun's 11-year cycle. This cycle can be observed from a variety of locations on the Sun. For only a few months at a time, these magnetically complex and transient sunspot zones exist.

3. BUCK CONVERTER

Problems with power quality are common in the power system, and the current system is no exception On the other hand, integrating the wind and PV systems into the grid presents a number of issues. It's difficult to deal with issues like this. Voltage and frequency fluctuations and harmonics are two of the most common power quality problems. Uncontrollable invariability of renewable energy resources (ie) in both renewable energy side and power grid side disturbances, causing voltage and frequency fluctuations. Renewable energy generation produces harmonics due to the use of power electronic devices. Traditional methods for removing harmonics were to use passive filters tuned to the harmonic frequency that had to be removed. Voltage fluctuation includes flicker and rapid voltage changes. Reactive power compensation could be provided at the fundamental frequency by passive filters, which were simple, inexpensive, and highly efficient.

Among the drawbacks are the interactions with the utility and other nearby loads. Its performance also suffers when the line's load fluctuates and switching transients occur. Parallel resonance with network impedance, overcompensation for reactive power, and a lack of dynamic compensation flexibility are some of the other issues that can arise. Specified Design

Wind energy is proposed as a direct connection to the grid in the project. Multi-level inverter connects the solar energy to the grid. When using solar power, a multi-level inverter is necessary because the output of solar power is dc. The multilevel inverter is connected to the solar energy to convert the dc to ac before connecting to the grid. THD (Total Harmonic Distortion) at Point of Common Coupling (PCC) can be reduced by using a multilevel inverter. Reduced total harmonic distortion (THD) can be achieved by using multi-level inverters. Waveform efficiency is increased by reducing the number of switches in a multilevel inverter. We've got RL hooked up to the grid now. The proposed project does not use the MPPT technique because a boost converter is used to increase the power received from the solar panel.

4. OBJECTIVES

The primary objectives of this study can be summarized as follows:

1) To study the hybrid power generation as per geographical conditions.
2) To study and analyze the MPPT Required for synchronization
3) To study the multilevel inverter as a controller.

4) To Study The stability improvement which comes under PQ in hybrid wind-Photovoltaic (PV) system is achieved by using energy storage based on Super capacitor
5) To Equate the power quality by smoothening the power fluctuation that were caused due to variation in the speed of wind and solar irradiance
6) To study the simulation model.

5. BLOCK DIAGRAM

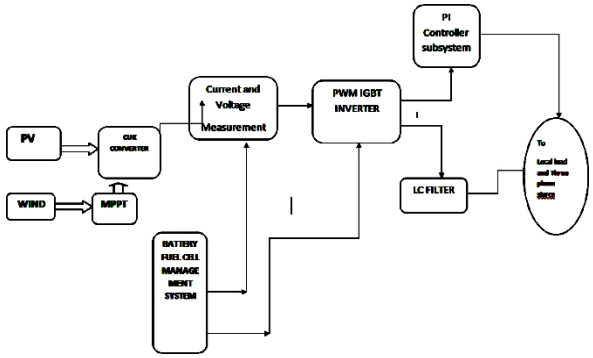

Fig 1. Block Diagram of Overall system

When it comes to the world's power systems, they must be extremely flexible, reliable and expandable.Renewable and dispersed energy assets are increasing in percentage, so existing grids need to be updated. For a system to work, it must be connected to a power electronic inverter, which is the most crucial part of that system.New ideas for inverter layout are needed to meet the increasing demands of smart grids. The modular inverter layout is a new modern concept for future-oriented strength structures. Power from both AC and DC renewable sources can be fed into a modern inverter, which is modular in design.An inductor in the circuit provides the additional benefit of reducing harmonics, which is a key feature of the Cuk-converter. The Inverter aids in changing the system configuration regardless of the battery fuel cell's fluctuating current and voltage.

In order for the system to function, each of the Renewable sources must be present at all times. It has been successfully tested in a variety of supply and ca conditions. The final product of the method described here is a highly effective inverter that can be configured in any way, be it in terms of size, components, configuration, or mode of operation.

6. CONCLUSION

There is a lot of concern about solar storms that produce coronal mass ejections because of the damage they do to high voltage power grids. If the grid is exposed to geomagnetically-induced currents, they can result in numerous detrimental effects. As transmission lines have become more interconnected and longer, the bulk electric power systems have become more vulnerable in recent decades to such events. Electricity flows of both real and reactive power unwelcome relay operations and higher-order harmonic currents are all examples of erratic behaviour.Damage to assets and asset failure are possible consequences of a large-scale disaster.a change in the geomagnetic field Massive power outages could result from a 100-year solar storm.Damage that could be catastrophic if proper monitoring and mitigation were not in place for high voltage power grids.There are no techniques employed here.The geomagnetic disturbances and how they affect the Earth's magnetic field are covered extensively in this thesis.the grid's electrical supply.

CONFLICT OF INTERESTS

None.

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