

A Survey on Effective Grid Connected Power Flows in Renewable Energy System

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Abstract: The demand for electricity is increasing day by day and canNot be satisfactorily met without Non-renewable energy sources. Renewable energy sources such as wind and sun are universal and environmentally friendly. These renewable energy sources are the best options for meeting global energy needs, but they are unpredictable due to natural conditions. Using solar and wind hybrid renewable energy systems is the best option to take advantage of these available resources. This article introduces wind energy conversion systems, solar energy conversion systems, and multistage inverters.

Keywords: solar system, wind, inverter, PV.

I. INTRODUCTION

Energy plays an important role in the development of a country. It is an integral part of the country's growth and economy. Our main source of energy is coal, oil and natural gas. As we all know, energy is needed for industrial, agricultural, commercial and domestic purposes. The global demand for energy is increasing day by day. There are many sources of energy from coal, fossil fuels, oil and other gases [1].

However, all of these sources are harmful to the environment, so the use of these sources is limited and limited. Due to global warming and pollution, we need a clean energy source. In today's world, the emphasis is on eco-energy that respects the environment, i.e. Generates energy without polluting the environment. In this case, we have the possibility of using renewable energy sources such as sun, wind, small hydroelectricity and biomass, biofuels, etc. Renewable energies have great potential to meet energy needs. However, the use of these energy sources also presents some difficulties. Much research is being done to improve the efficiency of renewable energy sources. The main objective is the conservation of natural resources, it is necessary to develop a system to avoid global warming and carbon emissions. The production of energy from renewable sources instead of coal or fossil fuels will bear fruit

for the country. If we use this renewable source to produce energy, it should reduce CO2 emissions [2]. As mentioned above, there are many renewable energy sources, but wind and solar energy are the most important. Because when it comes to renewable energy sources, the first thought is wind-solar, it is a well-known and widely used energy source. A single source of energy such as wind and photovoltaic is not completely reliable due to changes in the weather or the sun at night or during the rainy season and fluctuations in wind speed.

Wind and solar energy are normally used separately to generate electricity, but both have losses. As our environment changes every day, climate change affects these systems, solar radiation is not constant and the wind speed changes every time, which affects the system and its performance. Regardless of the cost of installing a single system, this combined hybrid system will be reduced to some extent. Instead of using just one system, the combination of these two elements helps us overcome losses. For example, when the solar system produces electricity during the solar period and the wind turbine gets its energy from the wind source. If the wind conditions are not strong enough to generate electricity at this point, there is a backup to meet the load demand generated by the solar system.

II. LITERATURE REVIEW

L. Wang et al. [3] This paper presents the stability improvement of a multi-machine power system connected to a large hybrid photovoltaic (PV) wind farm using super capacitor (SC) based energy storage. The operating characteristics of the hybrid PV wind farm are simulated by a 300 MW equivalent wind generator (WTG) based on a permanent magnet synchronous generator and a 75 MW equivalent PV generator field. The WTG and the PV generator are connected to a common intermediate circuit via a voltage source converter or a DC / DC boost converter. The energy of the common intermediate circuit is transferred to the

multi-machine power system via a Voltage source inverter, step-up transformers and a connecting line.

M.M.R. Singaravel et al. [4] in this generator, the sources are connected to the grid with a single step-up converter, followed by an inverter. Therefore, in comparison with the previous schemes, the proposed scheme contains fewer power converters. A model of the proposed scheme will be developed under the d-q axis. Furthermore, two low cost controls are proposed for the new hybrid scheme, with which the DC-DC converter and the inverter can be activated separately to monitor the maximum power of the two sources. The integrated functions of both controls, offered for different conditions, are demonstrated by simulations and experiments. The stationary performance of the system and the transient response of the controls are also presented to demonstrate the correct functioning of the new hybrid system. Comparisons between experimental and simulation results are provided to validate the simulation model.

B. Mangu et al. [5] this paper presents a control strategy for controlling the energy flow of a grid connected PV hybrid wind battery system with a two-way DC / DC converter coupled to a transformer with multiple inputs and multiple outputs. The proposed system aims to meet load demand, control the flow of electricity from various sources, supply the grid with excess electricity and recharge the grid battery when needed. An elevator converter coupled to a half-bridge transformer is used to draw energy from the wind, while a two-way elevator converter is used to draw photoVoltaic energy with battery charge / discharge control.

K. Basaran et al. [6] this is particularly a problem in the case of small high performance systems due to the limitation in the inverter markets. The inverters used in these energy systems operate on or off the grid. In this study, a new energy management strategy was developed in which a hybrid wind-photoVoltaic system was designed that can be used both as a stand-alone system and as a system connected to the grid. The inverter used in this study was developed for both grid and standalone operation. Due to the continuous demand for energy, gel batteries are used in the hybrid system. The designed power management unit performs measurements at various points in the system and in accordance with this measurement. Ensures efficient energy transfer to batteries, loads and mains.

III. MULTI-LEVEL INVERTERS

Multilevel inverters gradually convert power to multilevel Voltage in order to achieve better power quality, lower switching losses, better electromagnetic compatibility and higher Voltage capability [7]. In view of these advantages, multi-tier inverters

have gained popularity in recent years. In the recent past, multistage inverters have generated immense interest in high Voltage and high power applications.

When looking for multilevel inverters, the corresponding control strategies are an important research area. One of the most important problems in controlling a multistage Voltage source inverter is how to use simple control techniques to obtain a sinusoidal output of varying amplitude and frequency [8]. In inverters, Non-fundamental current harmonics cause power loss, electromagnetic interference, and pulse pairs in variable speed AC drives. Harmonic reduction can therefore be closely related to the performance of an inverter for each switching strategy. Multistage inverters can increase performance by connecting power semiconductor components in series and parallel by a factor (m1) compared to two-stage inverters. Multi-stage inverters have the advantage over two-stage inverter systems with the same power that the problem of electromagnetic interference from low resistance components in the output Voltages can be greatly reduced. Due to these advantages, many studies have been performed on multistage inverters at the simulation level and very few with hardware implementations.

IV. WIND ENERGY CONVERSION SYSTEM

The physical (kinetic) energy of the wind is first captured by a specially designed turbine blade to rotate it. The mechanical energy of the rotating blades is transferred to the generator rotor via the shaft. The generator then converts this mechanical energy into electrical energy. This electrical energy is sent to an independent load or network via a transformer. A complete and efficient conversion of kNnowledge into wind energy from the fields of aerodynamics, mechanics, and electricity and control systems is an essential prerequisite. A general diagram of the WECS with various components and systems is shown in Fig. 1.

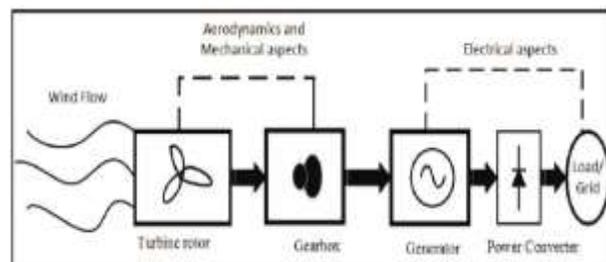


Fig. 1 General layout of wind energy conversion system

Electric Generator although different types of generators are used in the WECS [9], the Dual Power Induction Generator (DFIG) and Permanent Magnet SynchroNous Generator (PMSG) receive more attention every day. Thanks to their ability

to be more reliable to capture wind energy efficiently. Wind power plants with synchroNous generators are often referred to as gearless or direct drive wind systems. Nowadays, PMSG [10], supported by a fully electronic conversion system (Fig. 2), is receiving a lot of attention for power generation from gearless wind turbines. The magnetic field in PMSG is generated by a permanent magnet so that No direct current source is needed for excitation. He received a lot of attention due to his ability to wake up. Due to the brushless design, good dynamic behavior, ease of use and lower price, the induction generator is often used as a wind turbine [11]. To function, the induction generator needs reactive power to generate the magnetic field. The induction generator draws reactive power from the grid. In a stand-alone application, however, the need for reactive power is met by external sources such as power electronics converters or capacitor banks. When a capacitor is connected to an induction generator, this arrangement is called a self-excited induction generator (SEIG). The Dual Power Induction Generator (DFIG) is a widely used wind generator Nowadays. The DFIG rotor circuit is connected to an external variable Voltage via slip rings and can be controlled by an external device to achieve variable speed operation [12]. The DFIG stator is connected to the mains via a transformer, while the rotor is connected to the mains via a harmonic filter. The DFIG can operate approximately 30% above and below the synchroNous speed, which is sufficient for Normal speed fluctuations. This unique feature allows DFIG to gain significant market share as a wind turbine. In the future, one of the main reasons will be to design the generator to be lightweight and low maintenance, where failures can occur. Furthermore, reducing the cost of the generator system will remain a major problem in the future. Therefore, the focus shouldn't just be on frequently used wind turbines. PMSG, DFIG or SEIG, but also on the invention of other new types of generators with reduced weight and resistance close to zero. Superconductor-based power devices are Now the subject of intense research. The dimensions and weight of the high temperature direct drive superconducting generator (HTS) are significantly reduced [13].

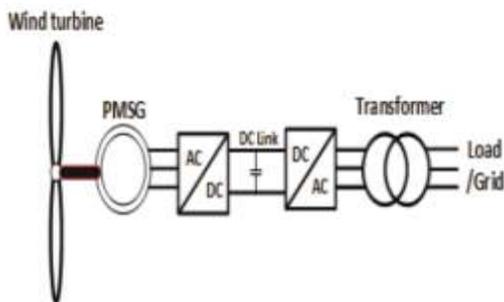


Fig. 2. Variable speed of PMSG with power converter.

V. EVOLUTION OF POWER ELECTRONICS

The contribution of power electronics to the wind energy conversion system is based on the motive of increasing reliability and energy efficiency and improving the performance of the WECS by reducing mechanical stress. This allows the entire wind system to behave as a controllable generation unit, which means that wind energy can be better integrated into the grid [14]. Power electronics play an important role in variable speed wind turbines. Referring to Figure 7, the role of the electronic power converter for variable speed operation is clearly shown. The Thyristor can also function as a soft starter in the case of fixed speed wind turbines where the turbines are directly connected to the grid. Although power electronics can increase the cost of the system, this cost can be tolerated because power electronics converters help reduce mechanical complexity, absorb mechanical loads and minimize the effects of gusts of wind. In many cases, a gearbox is Not necessary, which is the main reason for losses and failures in wind turbines. In order to meet the extremely growing demands of the wind energy conversion system, it is expected that advanced electronic power technologies will be developed to develop electronic power converters which enable energy conversion at levels of higher Voltage. The research work for the development of a complete converter is based on a cascaded BTB-H bridge converter structure with galvanic ally isolated DC / DC converters as the interface [15]. This could be one of the promising solutions for the future WECS. In the DC-DC converter, a transformer is used that operates in the medium frequency range of several kilohertz. This greatly reduces the size of the transformer.

VI. ENERGY STORAGE TECHNOLOGY

Wind flow is inherently inconsistent. Due to this type of wind, electricity production is inconsistent. Irregular wind power can cause serious problems in the operation, stability and planning of the power grid. So there is an Energy Storage System (ESS) for reliable electricity generation from wind energy. The ESS stores excess electricity and delivers it to the load in the event of a power failure. Different types of energy storage technologies include the energy storage technology commonly used in WECS, which stores energy in the form of electrochemical energy [16].

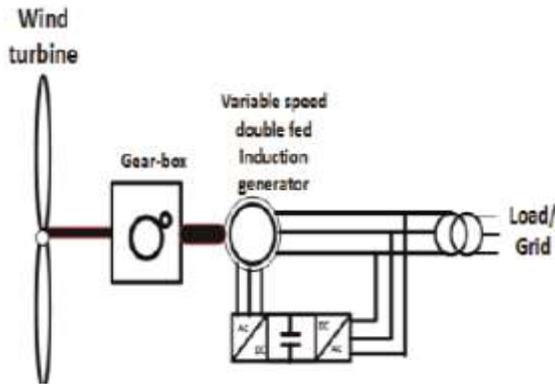


Fig. 7. Variable speed of DFIG

VII. SOLAR ENERGY CONVERSION SYSTEM

When sunlight hits the semiconductor surface of a solar cell, an electron rises and is attracted to the N-type semiconductor material. This leads to a plus negative for the N type and a plus positive for the semiconductors. -conductors. -P conductors that generate a higher current flow. This is called the photoVoltaic effect. The amount of electricity produced by a PV cell depends on its efficiency (type of PV cell), the size (area) and the intensity of sunlight hitting the surface. A single solar cell can produce very little electricity. To achieve a better effect, the solar cells are connected in series or in parallel. The solar system or photoVoltaic module consists of many solar cells connected in series or in parallel. The cross section of a photoVoltaic cell is shown in Fig. 1.

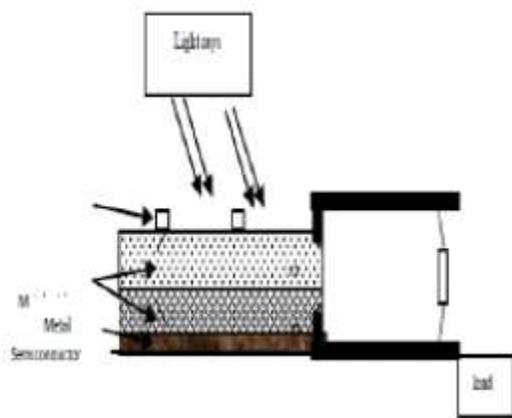


Fig. 3. Physical structure of a PV cell

The solar or physical energy conversion system of the photoVoltaic cell is very similar to that of the conventional diode with a PN junction formed from a semiconductor material. As the junction absorbs light, the energy of the absorbed photon is transferred to the electron-proton system of the material, creating separate charge carriers at the junction. The charge carriers in the

transition zone create a potential gradient, are accelerated under the electric field and flow as a current through an external circuit. The solar cell is the basic building of photoVoltaic, which directly converts solar energy into electricity.

VIII. CONCLUSION

The use of solar wind hybrid systems for renewable energy is increasing day by day and has shown an incredible development for the generation of electricity around the world in the past decades. Taking advantage of this development of new techNologies and research in the field of hybrid wind systems for renewable energies, a new difficulty arises which can be solved much more easily with new techniques. This article introduces wind energy conversion systems, solar energy conversion systems and multistage inverters in energy storage techNology.

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