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Application of Electronic and Electrical Industry in the Field of New Energy

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ABSTRACT

This paper focuses on the application of the electronic and electrical industry in the field of new energy, and comprehensively analyzes its key role in the development of the new energy industry. By describing the current development status of the new energy industry, this paper introduces in detail the application of the electronic and electrical industry in new energy power generation systems such as solar energy, wind energy, and hydropower, as well as battery energy storage, power transmission and distribution. This paper analyzes the technological innovation and efficiency improvement brought by electronic and electrical technology to the field of new energy. It aims to reveal the important significance of the deep integration of the electronic and electrical industry with the field of new energy, provide theoretical reference and practical guidance for the development of related industries, and promote the development of the new energy industry in an efficient and sustainable direction.

KEYWORDS

Electronic and Electrical Industry; New Energy Field; Solar Energy; Wind Energy; Energy Storage.

1. INTRODUCTION

As the world's attention to environmental protection and sustainable energy development continues to increase, the new energy industry has flourished and become an important force in promoting the transformation of the future energy landscape. New energy covers a variety of clean energy forms such as solar energy, wind energy, hydropower, biomass energy, geothermal energy, etc. Its development and utilization are of key significance for alleviating the pressure of traditional fossil energy depletion, reducing environmental pollution, and responding to climate change [1] . In the development of the new energy industry, the electrical and electronic industry plays an indispensable supporting role. With its unique advantages in power conversion, control, monitoring, etc., electrical and electronic technology is deeply integrated into all aspects of new energy from power generation to power consumption, greatly promoting the progress of new energy technology and the development of the industry. In-depth research on the application of the electrical and electronic industry in the field of new energy is of great practical significance for optimizing the structure of the new energy industry, improving energy utilization efficiency, and promoting the sustainable development of the new energy industry.

2. CURRENT STATUS OF NEW ENERGY INDUSTRY DEVELOPMENT

At present, the new energy industry is showing a trend of rapid development. Globally, the installed capacity of solar photovoltaic power generation continues to rise, and many countries and regions have vigorously built large-scale photovoltaic power stations. At the same time, distributed photovoltaic power generation is widely used in residential and industrial and commercial fields. Wind power generation is also developing rapidly. Onshore wind power technology continues to mature, and offshore wind power has also grown rapidly with its rich resource advantages. As a relatively mature new energy, hydropower continues to play an important role in areas rich in hydropower resources, and new hydropower projects are constantly being developed and constructed. In addition, new energy forms such as bioenergy and geothermal energy are also gradually being explored and developed and applied in specific areas. However, the new energy industry also faces some challenges in the process of development, such as energy intermittency problems, such as solar energy is affected by day and night and weather, and wind energy is affected by unstable wind power, resulting in large fluctuations in power generation output; as well as the compatibility of new energy power generation with traditional power grids, it is necessary to further optimize the dispatching and control of the power system.

3. APPLICATION OF ELECTRONIC AND ELECTRICAL INDUSTRY IN NEW ENERGY POWER GENERATION SYSTEM

3.1. Solar Power Generation System

In solar photovoltaic power generation systems, electronic and electrical technology runs through the entire process. As the core equipment, photovoltaic inverters undertake the key task of converting the direct current generated by photovoltaic cells into alternating current. Advanced inverters use intelligent control algorithms, which can adjust working parameters in real time according to environmental factors such as light intensity and temperature, realize maximum power point tracking (MPPT), and effectively improve photovoltaic power generation efficiency. For example, a certain brand of photovoltaic inverter can improve photovoltaic power generation efficiency by 5% - 10% through optimized MPPT algorithm. At the same time, the photovoltaic monitoring system provided by the electronic and electrical industry uses sensors to collect power generation data, equipment operation status and other information of photovoltaic power stations in real time, and transmits this information to the monitoring center through the data transmission network. The staff can analyze the data through monitoring software, and can promptly discover and handle equipment failures to ensure the stable operation of photovoltaic power stations. In addition, in the photovoltaic cell manufacturing process, electronic and electrical technology is used to accurately control parameters such as temperature and pressure in the production process to improve the production quality and conversion efficiency of photovoltaic cells [2] .

3.2. Wind Power Generation System

In wind power generation systems, electronic and electrical technologies also play an important role. The control system of a wind turbine uses electronic sensors to monitor parameters such as wind speed, wind direction, and blade angle in real time. Through variable pitch control and variable speed constant frequency control technology, the wind turbine is always kept in the best operating state, improving the efficiency of wind energy capture. For example, when the wind speed changes, the control system automatically adjusts the blade angle to ensure that the wind turbine can generate electricity stably at different wind speeds. At the same time, power electronic converters are used to achieve frequency conversion and control of the output power of wind turbines to meet the requirements of grid access. In terms of centralized monitoring of wind farms, the monitoring network

built by the electronic and electrical industry can remotely monitor and manage multiple wind turbines, predict wind turbine failures through data analysis, arrange maintenance in advance, and reduce operation and maintenance costs. In addition, electronic and electrical technologies are also used in the manufacturing process of wind turbines to improve the reliability and performance of wind turbines.

3.3. Application of the Electronic and Electrical Industry in the Field of New Energy Storage

Battery energy storage is an important means to solve the intermittent problem of new energy, and the electrical and electronic industry plays a key role in this field. In the battery management system (BMS), electrical and electronic technology is used to monitor the voltage, current, temperature and other parameters of the battery, and control the battery charging and discharging through precise algorithms to prevent overcharging and overdischarging of the battery and extend the battery life. For example, in the lithium battery management system of electric vehicles, BMS can reasonably adjust the charging strategy according to the battery status to ensure the safe and efficient operation of the battery. At the same time, the power electronic converter plays the role of energy conversion and control between the energy storage system and the power grid, realizing the rapid response and bidirectional power flow of the energy storage system. For example, in the application scenario of the combination of distributed photovoltaic power generation and energy storage system, when photovoltaic power generation is in excess, the power electronic converter stores the excess electric energy in the battery; when photovoltaic power generation is insufficient or the power demand is large, the electric energy in the battery is inverted into AC power by the converter for use by the load or transmitted to the power grid. In addition, the electrical and electronic industry is also developing new energy storage technologies, such as supercapacitors, to provide more options for new energy storage.

3.4. Application of the Electrical and Electronic Industry in the Field of New Energy Power Transmission and Distribution

In the transmission and distribution of new energy power, the electrical and electronic industry uses advanced technical means to improve the stability and reliability of the power system. As a product of the deep integration of electrical and electronic technology and the power system, smart grid technology uses communication technology, sensor technology and automation control technology to achieve real-time monitoring and intelligent dispatching of the power system. For example, by installing intelligent monitoring equipment on the transmission line, the operating status of the line can be monitored in real time, and hidden dangers of line faults can be discovered in time. In terms of power distribution, the distribution network automation system uses electrical and electronic technology to achieve remote monitoring and fault isolation of the distribution network, thereby improving power supply reliability. For example, when a distribution network fails, the automation system can quickly locate the fault point, automatically isolate the fault area, and restore power supply to the non-fault area. In addition, the Flexible AC Transmission Technology (FACTS) uses power electronic devices to flexibly control the voltage, phase, impedance and other parameters of the transmission system, improve the transmission capacity and stability of the transmission line, and better meet the needs of large-scale access to the power grid for new energy power.

4. CHALLENGES FACED BY THE ELECTRONIC AND ELECTRICAL INDUSTRY IN THE APPLICATION OF NEW ENERGY

4.1. Technical Cost Issues

Although the application of electronic and electrical technology in the field of new energy has made significant progress, the cost of some advanced technologies is still high. For example, high-performance photovoltaic inverters, battery management systems and other equipment have high manufacturing costs due to the use of advanced chips, complex circuit designs and high-end manufacturing processes. This has increased the investment cost of new energy projects to a certain extent and affected the large-scale promotion and application of the new energy industry. Reducing technology costs requires the electronic and electrical industry to increase R&D investment, optimize production processes, improve production efficiency, and reduce unit costs through large-scale production.

4.2. Compatibility Issues

There are many different types of electronic and electrical equipment in new energy systems. Due to the differences in the manufacturers and technical standards of each device, compatibility issues between devices are more prominent. For example, in some new energy microgrid projects, photovoltaic inverters, energy storage devices and grid access devices of different brands may have problems such as poor communication and uncoordinated control, which will affect the overall performance and stability of the system. Solving compatibility issues requires the establishment of unified technical standards and specifications, strengthening communication and cooperation between equipment manufacturers, and promoting the interconnection and coordinated operation of equipment [3] .

5. CONCLUSION

The application of the electrical and electronic industry in the field of new energy runs through all aspects such as new energy power generation, energy storage, power transmission and distribution, providing strong technical support for the development of the new energy industry and promoting the innovation of new energy technology and industrial upgrading. Although the current application process faces challenges such as technical costs, compatibility, and talent shortages, these problems will be gradually resolved with the continuous advancement of technology, the deepening of industrial integration, and the strengthening of international cooperation. In the future, the deep integration of the electrical and electronic industry and the field of new energy will make greater contributions to global energy transformation and sustainable development, and create a cleaner, more efficient, and more reliable energy future.

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