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Research on Operation Safety of Power Transmission and Transformation Equipment in Wind Power Plant

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Abstract: *Wind power generation is clean renewable power without environmental pollution, so wind power plant has been paid more and more attention, and has been popularized in recent years. As an unstable energy, wind power has high requirements for the operation, management and protection of facilities to ensure the safe operation of the system. In order to improve the power efficiency, it is necessary to conduct in-depth research and Discussion on the operation management and guarantee countermeasures of the current wind power plant equipment. Based on this, this paper deeply discusses the key factors restricting the operation safety of the power transmission and transformation equipment of the wind power plant, and puts forward the safety technical means to enhance the operation safety of the power transmission and transformation equipment. It is expected to have a certain reference significance for the development of the power transmission and transformation equipment of the wind power plant, Thus, it has a positive reference for the management and guarantee measures of the current operation of power transmission and transformation equipment in wind power plants.*

Keywords: *Wind Power Plant, Operation of Power Transmission and Transformation Equipment, Safety Problem*

1. Introduction

Due to the continuous growth of national power consumption, the development of electric energy has become a major issue of widespread concern in the society. In recent years, the people's voice for energy conservation and emission reduction has become higher and higher. In order to make full use of resources, the state has gradually applied wind power to the power system. How to ensure the operation safety of power transmission and transformation devices of wind power plants has also attracted more and more attention, The operation management and protection of power devices should first ensure that all kinds of power devices can operate safely, and make full use of new technology to improve the daily maintenance and management of machinery and equipment, so as to enhance the protection awareness of employees and reduce the possibility of equipment failure.

2. Safe Operation Status of Power Transmission and Transformation Equipment in Wind Power Plant

Due to China's current economic and social development, wind energy is more and more widely used at home and abroad. It has a lot in common with the use and development of many renewable energy sources. Therefore, we must reflect its advantages and overcome its disadvantages at the same time. Based on this, the key is to carry out the safety management of wind power generation electrical equipment, so as to ensure the safety and stability of the system and make it develop in a reasonable way.

2.1. The Scale of Equipment Is Gradually Expanded

In the current gradual improvement of the technical level in various fields, in order to meet the development needs of new industries and make enterprises occupy a place in the market development, the equipment scale of many wind power plants is also increasing. With the increase of equipment scale, some wind power plants still adopt the original equipment operation and maintenance mode, which

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forms a certain one-sided problem and cannot fully control the equipment quality. In the process of obtaining equipment information, due to the backward technology and management means of some operators, the efficiency of obtaining information is not ideal, and even errors will occur. In addition, due to the limited number of management personnel of power transmission and transformation equipment in wind turbine power plant, centralized management must be carried out for facilities that cannot be handled and large-scale [1].

2.2. There is a Gap in Personnel Quality

In the process of construction and development, we must strengthen the work efficiency and professional quality of professionals, so as to comprehensively improve the production efficiency. In terms of the current implementation of operation management and maintenance management of wind power generation related equipment, many personnel are unable to fully deal with the problems arising from the operation of the equipment due to their lack of professional knowledge and ability, which seriously restricts the development of wind power generation. At the same time, some staff also failed to fully implement the internal supervision mechanism, resulting in a vacuum period in the management and maintenance of equipment, affecting the stability and safe operation of the equipment, and negatively affecting the routine management of wind turbines [2].

The professional team within the power plant is the core factor of power supply quality and safety. In order to ensure the stability of power generation and supply of the system, a team of professionals must be equipped to follow up the real-time management system. When there is no fault in the system, the condition of the whole system should be monitored. When the system has problems, it should put forward emergency solutions at the first time and take corresponding measures to reduce risks. To sum up, the key position of professional technical team in wind power generation system can not be ignored. At the same time, it is also a department with great demand for staff technology. Therefore, to ensure the stable power supply of the system, it is the primary task for the power plant to ensure the overall quality. Safety education is another key link, which is not only related to the operating efficiency of the company, but also related to the safety of relevant employees. Therefore, the company should put the team safety education on the agenda to improve the team management level, and use the safety education to overcome the problem of weak team awareness. And obtain the recognition of group members by ensuring safety education. However, considering this from the perspective of safety responsibility, it should also ensure that there are detailed records of each operation process of all members of the team, so as to lay the foundation for post accountability of major safety issues. In addition, internal safety management should also be actively carried out to ensure that team members can find hidden dangers in time and effectively prevent and eliminate major hidden dangers [3].

2.3. Management Mode and Quota Standard Status

The construction of wind turbine power transmission and transformation equipment itself is to save energy. The management and maintenance of the equipment can also improve the overall efficiency of the safe operation of the equipment, so as to make the operation and development of power generation enterprises more stable and healthy. Well maintained equipment can also reduce equipment maintenance costs, manage service costs and reduce resource consumption. Equipment management plays a key role in the construction of wind turbine, and its performance and safety are directly related to the stable operation of the whole power station. The traditional method of managing electrical equipment is difficult to keep up with the pace of technological development of the current era in China. In the current stage of managing wind power plant equipment, a lot of information should be generated, and technicians must manage it before they can deal with the problems caused by the equipment in the work. Under the condition of congenital deficiency of equipment operation and maintenance measures, due to the increase of equipment application information, it is easy to form the problem of inconsistent equipment design quota standards, so that all information about electrical equipment installation can not be obtained in time. On this basis, technicians also have great difficulties in obtaining reliable data information. They often encounter obstacles in statistical data information, which not only causes safety hazards to a certain extent for the normal operation of power equipment, but also is unfavorable to the normal and stable operation of wind turbines [4].

3. Importance of Safe Operation of Power Transmission and Transformation Equipment

Wind power plants need huge equipment. At the same time, due to the relatively large and powerful

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equipment, the engineering design is more cumbersome, and the safe operation steps of control equipment are also very cumbersome. Therefore, power companies must strengthen the supervision and management of power generation equipment to ensure the quality of their power generation equipment and the safe operation of power stations [5].

3.1. Reduce Operation Accidents

At present, the most important factor in the formation of the operation safety problems of many power transmission and transformation equipment in China's power plants is due to the poor quality of the electrical equipment itself. In order to increase benefits and reduce construction costs, some wind turbines have major problems in the product quality of the electrical equipment itself, and then the operation safety problems of the power transmission and transformation mechanical equipment. There are problems in the formation of power transmission and transformation mechanical equipment. Generally, the main problems are formed in the following two links: first, in the selection of electrical equipment, the company may choose low-quality power transmission and transformation mechanical equipment in order to reduce the operating cost. After long-term use, the mechanical equipment will form various safety problems [6]. Second, in the process of power transmission and transformation equipment installation, the technical and professional knowledge reserves of construction workers are not enough, which is easy to form installation and operation problems, resulting in small changes in some parameters of power transmission and transformation devices, but the main problems such as grounding and short circuit will be formed in the process of practical application. Therefore, the safety inspection of power transmission and transformation equipment before installation can effectively avoid the above potential safe operation problems.

3.2. Reduce Labor Costs

Ensuring the daily safety work of power transmission and transformation mechanical equipment can effectively reduce the labor cost. However, because the stable work of power transmission and transformation mechanical equipment is inseparable from scientific and reasonable mechanical equipment maintenance and management, and the external and internal geophysical environmental conditions of power transmission and transformation mechanical equipment are relatively complex, there are considerable difficulties in the implementation of equipment maintenance and management, Therefore, the maintenance and management of mechanical equipment often must be in accordance with special specifications and technical standards, but in real life, many equipment maintenance and management personnel are constrained by technology, resulting in the failure of maintenance and management of mechanical equipment. Moreover, at present, the comprehensive quality of China's wind turbine equipment maintenance and management personnel still needs to be further improved, and there is a considerable lack of excellent technical professionals, which increases the labor cost of power transmission and transformation equipment maintenance of wind power plants to a certain extent. For example, in order to gradually reduce the occupation of urban power supply resources by transmission transformer facilities, many wind turbine plants have introduced intelligent transformers and underground substations. However, due to the lack of reference experience in the maintenance process, it puts forward higher requirements for the professional knowledge reserve and technology of maintenance technicians, and also increases the difficulty of maintenance and management of transmission transformer facilities, Therefore, safe operation of power transmission and transformation equipment can effectively reduce relevant labor costs [7].

4. Safety Management Measures for Wind Power Transmission and Transformation Equipment

4.1. Improve Safety Management System

In view of the latest situation of wind power generation, the new technology development information is combined with the actual situation, and further integrated into a more updated, comprehensive and perfect management system on the basis of the traditional power management system of wind power plant. In addition, when designing a reasonable management system, we should not ignore the actual working efficiency of the equipment. When developing an effective management system, it is necessary to describe and emphasize the functions of the management system in detail, so as to set norms for the actual work of managers. When establishing the safety management system, more detailed specifications are given according to the actual working conditions of the current

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equipment, and the personnel are required to fully implement the rules and regulations during management, so as to be well documented. In the whole process of improving the management system, managers must be strict with their words and deeds, take the system as the benchmark, and carry out the inspection and management of power equipment according to detailed special methods, so that every staff can carry out effective management and avoid problems in the process of practical work. In the management system, the metal shell grounding of the equipment must be specified according to the characteristics of the wind turbine equipment, and the perfect safety protector must be taken as the benchmark. In addition, lightning protection device must be equipped. When electrical failure occurs, appropriate maintenance must be carried out to avoid power failure in the power generation range [8].

4.2. Optimize Management Process

When improving the equipment safety management of wind power plant, the management must take the scientific management process as the cornerstone to ensure that each management work is carried out in an orderly manner, so as to comprehensively improve the order of equipment safety management. The wind power plant should also be subject to routine management according to the current actual development trend, in the way of centralized management and comprehensive control, so as to ensure that the safety management can achieve the expected objectives. When carrying out relevant management work within the enterprise, it is necessary to make the management clear of the provisions on the safety management of wind power plant equipment, so as to implement the relevant management policies and make the wind power equipment more in line with the actual development situation in the process of normal operation. Managers should enhance their safety management awareness and strength, strictly implement relevant management mechanisms, focus on standardized management process, and adopt scientific and reasonable dynamic integration to optimize management effect, so that wind power generation equipment can focus on systematic process management mechanism and improve the effectiveness of quality and safety management [9].

4.3. Application of Enhanced Intelligence in Security Management

With the rapid development of the network era, digital power grid and Smart Substation also began to be born. The power transmission and conversion device is managed by computer, which greatly improves the working efficiency and provides a comprehensive guarantee for the safe work of the device. The factory should focus on improving the computerized management level of the transportation system and transmission device safety management system, and improve the working stability of the device through big data analysis and information processing technology. We can start from two key areas to build a substation transmission and safety system that is highly sensitive to signals. First of all, for wind turbines, we should focus on the research of computerized substation system, data transmission and monitoring system and its manual monitoring mode. In many cases, power plants need to invest huge manpower and materials, and the effectiveness of monitoring depends on the subjective human factors of the enterprise, and also has a considerable impact on the operating efficiency. The intelligent monitoring system saves time and labor, and also improves the monitoring quality. Based on this, intelligent robots can operate intelligently in power plants to monitor, operate and protect power transmission systems and converters. Secondly, the wind power plant should actively improve the information in the power transmission and transformation system. Through the comprehensive analysis of the data in the network, the digital information technology center has formed a scientific and reasonable information distribution protocol with the network, and gradually completed the automatic control of the network and transmission facilities to increase work efficiency.

4.4. Safety Technical Means of Insulator Antifouling

Insulator plays a key role in giving full play to the role of power transmission and transformation devices such as wind power plant. It is an indispensable and important component in the whole power transmission and transformation device, and the functional problem of insulator will directly cause the failure of the whole power transmission and transformation device. Because of its specific use function, insulators are often placed directly outdoors and in direct contact with the external environment, which makes insulators very vulnerable to the harm of foreign dust and harmful gases. If the maintenance personnel do not remove the dirt, dust and other pollutants on the surface of insulators in time, the impurities will be quickly transformed into ionic medium in case of water, resulting in leakage, and the insulation function is also endangered, Therefore, the anti pollution technology and maintenance management of insulators have become particularly critical. The anti pollution protection of insulators shall be carried out from the following two aspects: first, the wind power plant shall actively increase

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the monitoring capacity of insulators, monitor the insulation performance of insulators on site, and deeply deal with the dirt and dirt on the surface of insulators. When the leakage problem of insulators occurs, the monitoring organization shall be able to find it in time and put forward reasonable solutions. Secondly, the power plant has also taken corresponding safety measures for the insulator surface, such as spraying isolation substances such as silicone oil and ground wax on the insulator surface to avoid harmful air or dust and other pollutants from directly contacting the insulator surface, so as to prevent the insulator surface from forming too much conductivity and effectively prevent the formation of leakage.

4.5. Strictly Implement the Maintenance and Inspection Work

Electrical equipment is the core element to ensure the normal operation of the whole electrical system, as is the case for wind turbines. Therefore, in order to ensure the safe and stable operation of the system, we must first ensure the smooth operation of power equipment and continue the normal working life of power equipment. Therefore, it is necessary to ensure that the working conditions of electrical equipment can be monitored to provide the basis for system management for relevant departments. At the same time, it is also necessary to ensure that hidden dangers in the work of electrical equipment can be timely and effectively maintained and managed, and the development of hidden dangers can not be allowed to endanger the stability of power. Relevant departments should ensure that the testing of the equipment is carried out in strict accordance with the relevant specifications of national laws and industrial standards. Since the equipment must always input energy to the power grid, if there is a power failure, it will be very harmful. Therefore, it is necessary to continuously collect all kinds of data formed in the working process of electrical equipment through the installation of Internet of things sensing equipment for real-time monitoring system operating parameters, and upload them to the control end at the first time, For relevant regulatory authorities to make timely assessment, so as to eliminate hidden dangers in time before major problems occur in system operation. Moreover, the test status, maintenance information, working environment, load status and equipment configuration of instruments and equipment should be fully recorded, and whether the current equipment should be repaired or system maintenance should be judged according to the test results of technical parameters given by the testing instruments and equipment. Using the advantages of information resources, we can ensure that the system test results are more accurate [10].

4.6. Increase Staff Training Opportunities and Establish a Reward and Punishment Mechanism

The comprehensive quality of scientific and technological personnel is very important for the safety of transmission equipment and conversion devices in wind farms. Therefore, wind power plants should focus on improving the training conditions for responsible construction personnel. In terms of training objectives, the training process will be carried out according to the personal wishes and qualifications of technicians. The first is to actively change the views of relevant personnel to understand the significance of computer application to equipment safety, so as to enhance the understanding of computer application. Second, we should strive to cultivate the ability of computer researchers in technical training. In China, since the application of electronic computers to ensure the operation safety of power transmission system and wind power substation is still in its infancy, the computer application technology of engineers is less popular. Therefore, corresponding experts can be required to provide computer guidance for on-site personnel and make use of the lecture experience to improve the theoretical knowledge reserve of electronic computers.

The key thing in the wind power plant is to strictly implement the safety rules and regulations and safety management norms to ensure the safety of the team. Because the team is a huge department with many people. Therefore, it is very important to improve the safety training level of the whole team. Safety technical training should be carried out selectively. Training can also be classified according to the category and nature of personnel responsibilities. The safety training content of the training course is also very useful. For example, production line managers who use electronic equipment need to carry out extensive training in equipment use, routine inspection and basic maintenance. When it comes to error handling, managers should pay more attention to improving error control ability. In other words, it is necessary to diversify the forms and contents of safety education, carry out target safety education, and pay attention to cultivating the safety awareness of team members. A more reasonable reward and punishment and deterrence system can be formed to promote team management. Therefore, the company can publish the test results and make evaluation in the hardware testing stage every year. The certification results can also be directly related to the salary of staff. The use team must pay attention to

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safety management, and only when there are bonuses and penalties can we really do a good job in team safety management.

5. Conclusion

Wind power generation is a type of power generation that has attracted much attention at present. Taking wind energy as clean energy and hydropower generation is in line with the national concept of environmental protection and energy conservation. In the modern society with serious shortage of resources, it is obvious that it needs enough attention. At the same time, the power plant has brought changes in the quality of life of residents in remote areas of China through the effective use of power transmission and transformation equipment. For example, the power transmission and transformation project of Xinjiang Manas thermal power plant has expanded the power supply capacity and provided power output guarantee for power users in northern and southern Xinjiang. In order to improve the stability of the system operation of the wind power plant and prolong the working life of the system, the above report discusses the safety operation management and maintenance requirements of the power transmission and transformation devices of the power plant, so as to realize the advantages of wind power generation.

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