

Application of energy storage technology in new energy power system

Zhang Meng

State Grid Shanxi Electric Power Research Institute, Taiyuan 030001, Shanxi Province, China

Abstract: With the rapid development in our country, the electric power industry faces new development requirement. Today, when reserves of fossil energy are decreasing and the environmental pollution problem is becoming more and more serious, people are paying more and more attention to the development and utilization of new energy sources. In order to meet the social demand for electricity in the new era, the relevant departments must strengthen the development of new energy power generation and the use of energy conversion to promote the power system to energy-saving and green development. Based on the specific types, application and future development prospects of energy storage technology, this paper mainly aims at promoting the in-depth development of new energy power generation industry and providing important technical support through rational analysis.

Key words: energy storage technology; New energy generation; Application strategy

In recent years, new energy is in a period of accelerated development, and the government has also given strong support to the development and utilization of new energy in policy, so more and more wind power generation systems and photovoltaic power generation systems have been incorporated into the grid. New energy is random and difficult to control, and its access to the power system will inevitably have a certain impact on the operation and regulation of the entire power system. The energy storage technology can solve this problem well. Therefore, it is of great significance to adopt energy storage technology in the field of new energy. This paper analyzes the rational application of energy storage technology in new energy power generation, and discusses the key to the further development of new energy storage technology.

1. The characteristics of new energy storage technology in power system

First, energy storage technology can improve the operating efficiency of the power system itself. In the new era, all kinds of science and technology continue to advance, and the power grid is more in line with the requirements of people's life and industrial production. Compared with conventional energy, the power quality of new energy will be affected by external factors, therefore, the power quality is not so stable, and the application of energy storage equipment will improve the efficiency of power use. While ensuring the bus voltage, power enterprises should control the frequency modulation, otherwise it is likely to be interfered by other factors. In the peak cutting and valley filling, because the output and consumption of new energy are carried out at the same time, it is necessary to pay attention to the off-peak period of electricity consumption in the development and upgrading of the power system. Energy storage technology can effectively solve this problem, it can in the low period of electricity consumption, timely retention of the remaining electric energy, in the peak of electricity consumption is very natural release of electric energy, so as to achieve an effective adjustment effect. In the short-term power supply of electrical engineering, the power grid suddenly disconnected, resulting in the power generation system quickly into the island state, it is difficult to control the whole network, and the use of energy storage devices can effectively control the power grid, adjust the voltage and frequency of change amplitude, to achieve the island and grid-connected two ways of free switching.

Large-scale power outage will have a serious impact on people's production and life, and the new energy is limited by the external environment, leading to unstable power supply, and will also have a certain impact on the power system. Faced with this situation, the power company can optimize the new energy power supply system by adding some energy storage devices.

China is a solar energy, wind energy (also a form of solar energy) are relatively rich in the country, and in the old, small, remote, remote poor areas, and the mains is very unreliable or no mains at all the actual situation, to solve these regional communication stations, especially unattended station power supply problems, should first consider new energy. In the use of new energy power supply system, how to choose the appropriate energy storage battery is a very important issue.

2. The important classification of energy storage technology

(1) Pumped storage power station

Among many power storage technologies, pumped storage power generation system is the most mature and widely used one. Pumped storage refers to the use of pumps to transport electricity from low levels to high levels when electricity consumption is low: at peak times, the power of the water in the reservoir is used to produce electricity. Although the pump reservoir has high energy density, large storage capacity and long storage period, it will also be limited by regional location and investment cost, and its construction will have an impact on the local ecological environment.

(2) Battery energy storage

Battery energy storage is a chemical energy storage method, which is mainly through the chemical reaction of the electrolyte in the battery, the electrical energy is converted into chemical energy and stored. Battery energy storage life is relatively short, maintenance procedures are more complicated, but it has the advantages of short response time, not subject to regional restrictions and high efficiency.

(3) Supercapacitor energy storage

As an emerging energy storage technology, supercapacitors are considered as an energy storage technology between conventional capacitors and lithium-ion batteries. The material has the commonalities of both materials: fast charge and discharge, long life, high power density, and high energy conversion rate. Therefore, in the need of short discharge time, high power occasions. The use of supercapacitors for energy storage can produce good results.

3. Research on storage technology in new energy power system

(1) Enhanced the reliability of the power supply system

Electricity load is dynamic change, the current electricity production and consumption are used on demand, which is likely to install a large number of units to cope with the peak, resulting in unnecessary waste. The application of energy storage device through the load is low when the excess power adsorption, the load is high when the surplus power will be discharged, in order to achieve the purpose of “peak cutting and valley filling”.

Because the load curve will be affected by day and night changes, seasonal changes and great changes, and the load is uncontrollable, so it is very difficult to work out an effective power generation planning and scheduling scheme. Energy storage technology is used to improve the power plant's ability to cope with load changes and ensure the stable operation of the power grid. When power consumption is at its peak, the remaining power in the power system is stored through energy storage devices. During the peak of power consumption, the energy storage device transmits the power to the power grid to respond to the change of load, so as to realize the load peaking and valley filling. In the case of a large area of power outage caused by an unexpected event, the energy storage device can be used as an uninterruptible power supply to the load, and can also be used as a “black start” plan to supply power to the power plant. Therefore, energy storage technology plays an important role in ensuring the safety, reliability and stability of the power system.

(2) Improve the power quality of the power system

The new energy generation enters the power system and needs to meet the demand of the power system for power quality. It uses the control of grid-connected inverters to adjust the active and reactive power transmitted by the microgrid to the power system, so as to improve the power quality. The isolated new energy power is significantly affected by meteorological factors and has significant volatility, while the storage equipment can effectively suppress the power fluctuations of the power system, maintain the stability of the node voltage, and effectively alleviate the power quality problems such as “voltage sag” in the power grid.

The new energy power generation system must go through the process of rectification and inverter when transmitting electric energy to the power grid, so the system contains many power electronic components. This leads to the appearance of harmonics, and the output of the whole system is fluctuating, making the output voltage of the power system change, which has a great impact on the quality of power. However, the energy storage device can improve the power quality, through the energy storage device to the power system in the reactive power and active power compensation, harmonic compensation in the power grid. The power quality regulation device based on the supercapacitor energy storage technology can not only store the excess power in the photovoltaic system, but also respond quickly when the need to discharge, which can solve a variety of power quality problems in the power grid, proving that the energy storage technology is feasible to improve the power quality of the power system.

(3) Increase the availability rate of new energy

The power system has simultaneity, that is, the generating power and the load power are consistent. However, due to the uncontrollable and random characteristics of the new energy itself, the power distribution in the power grid is very uneven, resulting in a large number of abandoned wind, abandoned light, abandoned water and other phenomena. Energy storage technology has a very key impact on improving the absorption capacity of new energy power generation. In order to maximize the use of energy, energy storage equipment stores the output of new energy, and can also act as a buffer, so as to solve the imbalance in the generation time of new energy generation technology, optimize the performance of the grid, and improve the controllability of the system output. With the continuous access of new energy power generation system to the national grid system, the characteristics of energy distribution and diversification are more prominent, the response adjustment of the power grid side, the capacity of energy storage equipment, so that new energy, power system, storage equipment cooperate with each other, can better promote the development and application of new energy.

(4) Short-time power supply

In the current environment of increasingly serious energy problems, ensuring electricity has become an important matter related to the national economy and people's livelihood. Large-scale power outage will have an extremely adverse impact on people's production and life. After the new energy power supply is connected to the power system, once there is a failure, it will leave the power network and enter the island state, and there are usually some power supply defects between them, and the two-way power supply transformation of the energy storage system can make up for this loss, and make the smooth conversion of the power network from access to the island state is possible. In addition, the generation of new energy is seriously affected by meteorological factors, therefore, in harsh weather conditions, energy storage devices can provide power for new energy to ensure the stable operation of the load.

4. The development trend of storage technology in new energy power system

With the large use of new energy, China's energy storage technology is also developing rapidly. Although China already has a relatively perfect energy storage system, but because of the difference in use occasions and demand and other reasons, at present, energy storage

technology has not been promoted in China. In the future, the development direction of China's energy storage technology will have the following directions: In energy storage technology, how to improve the conversion efficiency of energy storage equipment, and extend its service life, will become the focus of future energy storage technology research; In the application of energy storage, the application function of energy storage technology will appear diversified development, and a variety of energy storage technology for compound energy storage will also become a major development direction.

(1) The power system must explore the integration of energy storage technology. Energy storage technology depends on the grid to exist, and new energy generation systems must rely on energy storage technology. The wide application of high-power energy storage technology not only improves the stability of the power grid, but also replaces the traditional backup power supply, and realizes the peak regulation and frequency modulation of the power grid. The introduction of large-scale energy storage equipment will have an important impact on the design, control, scheduling and planning of the power grid, so it is necessary to master the dynamic characteristics of the system and conduct in-depth research on it.

(2) Ideological adjustment. Promote the coordinated development of new energy and energy storage technology, energy storage and power generation are two completely different development fields, however, with the strong support of the state, new energy power generation has been rapid development, and gradually integrated into the traditional power system, wind power and solar power generation has been far behind.

(3) Adopt multiple means to promote the development of energy storage technology. First, the government should strengthen policy support. The government should conduct scientific pricing on the power market and introduce corresponding policies. A strict distinction has been made between waste energy and electricity, and the value and price of electricity have been evaluated. He believes that with the implementation of this policy, the investment in the energy industry will be more and more large, and the development of the energy industry will be faster and faster. Second, financial security. For energy storage technology, such as compressed air and electrochemical energy storage technology, to give special funding. Increase funding for scientific research and expand research platforms. Third, industry technology to strengthen independent research and development, promote the promotion of energy storage technology. Fourth, promote the development of new energy storage technology. In new energy power stations, new energy storage technology should be actively applied to reduce the occurrence of wind and light abandonment.

Conclusion

Faced with the gradual exhaustion of energy in China, there is an urgent need to achieve the goal of sustainable development and provide the power system with new energy for power supply development needs. Besides, the use of new energy power supply system and the appropriate energy storage battery are also very important issues. For this reason, this paper summarizes several commonly used energy storage technologies, analyzes the important role of energy storage technology in new energy generation, and the accelerated energy transformation in our country. With the construction of energy Internet and smart grid, energy storage technology will play a more and more important role, and has a great strategic significance for speeding up the development of electric power system of our country.

References:

- [1] Jiayuan Wang, Yang Li, Yuan Li, Min Yang, Xiaosan Wang. Analysis of Influence of New Energy Power Generation Cost on Grid-connection [J]. Applications of Integrated Circuits, 2023, 40(2):204-205.
- [2] Yan Guo. Research on ways and measures of new energy power generation Equipment to help "double carbon" [J]. Electric Apparatus Industry, 2023(02:22-23).
- [3] Jun Zhang, Shenxin Jin, Shiming Wang, Yongguo Li, Yu Cao. Virtual Simulation experiment of Marine new energy power generation [J]. Experimental Science and Technology, 2023, 21 (01):59-65.
- [4] Weihong Liu. Power Grid dispatching and improvement Countermeasures in coordination with new energy development [J]. Public Standardization, 2023(02):119-121.