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To cite this article: Guang Zeng and Lijuan Yu 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **252** 032041

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Application and Prospect of Energy Storage Technology in the Electrical Engineering Field

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Abstract. In the process of rapid social and economic development, the power demand shows a trend of increasing year by year, and the continuous and stable supply of power is particularly important. By analyzing the traditional production processes of electric power, we can find out the disadvantages, what is, it is impossible to store electric energy internally. Relying on the energy storage technology developed by advanced science and technology, energy storage can be turned into reality and the quality of the power production can be effectively improved. It covers a number of process-based projects, such as production, transmission and utilization. As the operation process and foundation of the power grid cannot be changed, there is a lack of flexibility and difficulty in implementing safety control. In view of the current situation in China and the problems of electrical engineering in the future, the application and development of energy storage technology are discussed in detail.

1. Problems in power production and the function of energy storage technology

1.1. Obstacles exist in the safe operation of power system

In today's society, the increasing electricity demand, which makes the adjustment of power system, the internal environment is much more complex, not only presented the quantitative increase characteristics of power system capacity, but also power grid is expanding, and the stability of the power grid will be the relative decline.[1] It will be the efficient development of the electric power enterprise and it's also hard to get basic guarantee the safety of the running environment.[1] Therefore, it is necessary to start with the actual situation of power grid operation and carry out targeted work of strengthening. In this link, the strong coupling of each part should be enhanced and the system operating environment should also be adjusted appropriately. As a result of that, it is not difficult to find that the lack of stability of large power networks will not only adversely affect the security of power grid operation, but also hinder the efficient development of power industry.

1.2. Low efficiency of renewable energy

In today's society, the total amount of energy that can be consumed is constantly increasing, such as oil and other non-renewable resources. When developing and using such energy sources, the amount of energy is gradually reduced, and the phenomenon of depletion appears.[2] Therefore, the problem of energy application is getting more and more acute, so it is necessary to find alternative energy and realize the optimization and adjustment of energy structure. Wind energy, solar energy and other



resources are renewable resources. After the efficient use of such resources, the problem of energy application can be alleviated to some extent and the sustainable development of energy can be realized. In the field of electrical engineering, energy consumption is relatively high. In order to solve the current situation of energy utilization, it is necessary to apply renewable resources to replace applied energy. However, in practical application, energy efficiency is generally low and stability is difficult to guarantee, which makes the efficiency of resource utilization difficult to improve.

1.3. Existing problems of environmental pollution.

One of the most important aspects of environmental pollution is air pollution [2]. Especially with the development of transportation tools in modern society, more and more exhaust emissions are discharged into the atmosphere. Therefore, this issue has also attracted extensive attention. In the use of traditional vehicles, the main power source is the burning of fossil fuels, such as oil and diesel. However, in order to primarily solve the problems of modern exhaust and environmental pollution, the concept of "low-carbon, environment-friendly, and green travel" is also proposed [3]. Therefore, the driving system of transportation vehicles is gradually turned into electric power drive under this background. In this regard, how to improve the energy storage density of the battery and realize the rapid charging of the battery is a serious problem to be studied. In addition, according to the characteristics of energy system, the energy density of a heat engine is greater than that of a battery, but its power density is less than that of a conventional battery. In such a system, how to improve charging efficiency, prolong discharge time and improve specific power of energy storage devices are the key technical problems that must be solved by future transportation and propulsion systems.

2. Energy storage technology and its application

2.1. Pumping energy storage technology

The advantage of pumping energy storage technology is that it can be used to build any capacity of energy storage equipment, and the energy stored by pumping energy can be released for hours to days. Pumping storage is mainly used in energy management and efficiency control of electrical engineering and in providing spare capacity to electrical systems. As far as the present situation is concerned, there are more than 90GW of pumping energy storage equipment in use and operation, accounting for 3% of the total installed capacity in the world. Since the pumped storage technology is very high in energy storage, it plays a very important role in regulating the peak value of the power system and serving as the backup power source.

2.2. Battery energy storage technology

Battery energy storage technology has been upgraded and evolved in the UK, and has been widely used in power engineering around the world. The PSB, for example, is the battery storage technology being adopted in the UK, where a 15MW/120MW/h power station can be built with a net efficiency of up to 75%. The other kind of NaS battery is more efficient at 99%, which is superior to PSB battery and can output impulse power [4]. This unique feature enables NaS batteries to be used in the regulation of electrical energy quality and peak load regulation in electrical engineering, so as to improve the economic and practical performance of electrical equipment.

2.3. Flywheel energy storage technology

A cylindrical rotating mass block and a mechanism using magnetic bearing control are the main components of the flywheel energy storage unit in the process of utilization. The magnetic levitation bearings used here are designed to reduce or eliminate friction losses in the operation of the unit, thereby extending the service life of the flywheel energy storage unit. In order to ensure the high efficiency of the flywheel energy storage unit, the flywheel unit is best operated in a vacuum environment, so as to reduce the loss of wind resistance to the flywheel unit. The flywheel unit can be connected with a generator or some engines to adjust the speed of the flywheel operation, so as to

achieve the flywheel unit energy storage device and therefore, the purpose of energy storage device of flywheel unit and power exchange in electrical engineering is realized

2.4. Supercapacitor energy storage technology

Supercapacitors can also be called supercapacitors, which is why they are described as supercapacitors because they have higher dielectric constant, larger surface area and higher pressure resistance than ordinary capacitors. At present, the supercapacitors are mainly used in power engineering, and are widely used in low capacity. Supercapacitors can increase the level of power supply in a power system when the voltage in the system suddenly drops or is subject to instantaneous interference.

2.5. Compressed air energy storage.

Compressed air energy storage is often used in peak-load regulating gas turbine power plants. For the same power output, CAES units consume 40% less gas than conventional gas turbines [5]. This is because conventional gas turbines use about two-thirds of the input fuel for air compression when generating power, and CAES can use cheap electricity from the low load on the grid to pre-compress the air and then add some gas to generate power as needed. Compressed air is often stored in suitable underground mines or caves beneath molten rock.

3. Prospect of energy storage technology

3.1. Develop efficient and low-cost energy storage technologies

In the current application process of energy storage technology, the main factor limiting the application of energy storage technology is that the application cost of energy storage technology is too high, so reducing the development and use cost of energy storage technology is a hot issue in the field of electrical engineering. In addition, improving the working efficiency of energy storage technology is conducive to improving the performance of power system stability. Therefore, improving the working efficiency of energy storage equipment is also an urgent problem to be solved by the research circle of energy storage technology.

3.2. Development of power electronics technology

In the development process of electric power industry, whether various energy forms can be truly transformed and developed effectively will directly affect the energy storage technology in China. Therefore, it is very important to solve the problem of energy conversion with large capacity and low cost. On this basis, we develop the power storage technology in electricity, which will enable the power industry to achieve more effective progress and improvement.

3.3. Increase the application of energy storage technology in power transmission

Power transmission and distribution work are the main purpose of power engineering, so strengthening the application of energy storage technology in power transmission and distribution has become the focus of electrical engineering work. The main methods are about reasonable planning of energy storage power supply, connection between energy storage units and electrical engineering power grid, improvement of control and regulation technology, etc.

3.4. Strengthen the management of energy storage technology

The development of energy storage technology also exists in the real market. Therefore, while the market is constantly changing and developing, the management of energy storage technology must be improved correspondingly. [3]Power engineering can effectively use energy storage technology under the effect of market regulation to realize efficient energy management.

3.5. Energy storage technology in the field of electrical engineering can solve the problems of national defense development process of China's high-performance weapon equipment

As the modern equipment of weapon needs the support of the electric power system, the flexible use of high density to make the power system run smoothly [4]. Compared with a larger system of power, the system with strong independence will be restricted due to the influence of weight and space elements, and the amount of power capacity is limited. Therefore, the utilization and distribution of capacity should be considered under the premise that the independent system of power is limited by space. In addition, new type of high-energy density weapon equipment, such as electromagnetic, electric heat gun, laser weapon and other high-power microwave weapons, has make light and miniature become a reality, enabling the system to supply consistent power in a short time, effectively improving the power supply quality of the power supply system. In the process of allocating weapons with higher energy density, good results can be obtained by using energy storage technology.

3.6. Search for new application areas

In the process of development, in the process of improving and developing energy storage technology, new energy storage technology should be properly developed and studied to ensure the continuous improvement and progress of technology.[5] When improving the existing technology and application fields, the existing problems should be improved on time to avoid limitations. At the same time, in order to make energy storage technology develop in a more comprehensive direction in the application process, industries and fields of the new application should be constantly developed in the process of service, so as to make better progress and application of energy storage technology in the future development process

4. Conclusion

To sum up, electricity plays an important role in China's social development, which not only influences the improvement of people's living standards, but also exerts a subtle influence on social development. By analyzing the development of energy storage technology in the electric industry, we can have a profound understanding of the importance of energy storage method in engineering construction, and provide reasonable Suggestions for the future development of China's electric power, so that China's electric power industry can be in a leading position in the world in the future development, thus promoting the modernization development of Chinese society.

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