

Brief Analysis of Smart Grid

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Abstract

Driven by the rapid development of economy, people's demand for electricity is increasing quickly. At the same time, considering the imbalance of resources in our country, in order to meet people's needs, we must vigorously develop the smart grid. The development of smart grid has brought a profound transformation to the power system. Based on these, this article mainly analyzes the definition and research background of smart grid, the development focus and the advanced technologies of smart grid, and the practice at home and abroad. Finally, the prospects for the development of smart grid are discussed, and summarized its strengths and suggestions for the construction of our country. The smart grid is based on advanced technology equipment and can achieve the goal of "safety, quality, economy, and environmental protection" of the grid. In the rapid development of science and technology, smart grid will show its strong vitality.

Keywords

Smart grid technology, Distributed generation, Intelligent scheduling, Future trends.

1. Introduction

At present, energy conservation, emission reduction and sustainable development have become international hot spots. The priority of human energy development is to gradually replace fossil energy with renewable energy. Build an innovative system for energy use and apply information technology to completely retrofit existing systems. Therefore, we expect to use a digital information network system to connect the production, transformation, transmission, distribution and use of electrical energy. Increase the utilization of energy and security of supply to new levels through intelligent controls, reducing pollution and greenhouse gas emissions to an environmentally acceptable range. This is the idea of smart grid.

Smart grid is the inevitable result of economic and technological development. Specifically, it refers to the use of advanced technologies to improve the performance of power systems in terms of energy conversion efficiency, power utilization, power supply quality and reliability. The basis of the smart grid is distributed data transmission, calculation and control technology, besides, efficient transmission technology of data and control commands among multiple power supply units.

For smart grid technology, the European and American regions have formed a strong research group. Content covers power generation, transmission, distribution and sales. Many electric power industries are also carrying out smart grid construction practices in full swing. Through the effective combination of technology and business, the smart grid can effectively play its role, and ultimately achieve the purpose of improving operational performance.

With the continuous deepening of China's power system reform, smart grid will also become a new direction for the development of power grid. At the macro-policy level, the power industry needs to meet the requirements of a resource-saving and environment-friendly society; at the level of market-oriented reforms, the power grid must be able to flexibly support various kinds of energy trading. In this article, we mainly analyze the definition and research background of smart grid, the development focus and the advanced technologies of smart grid, and the practice at home and abroad.

Finally, the prospects for the development of smart grid are discussed and summarized its strengths and suggestions for the construction of our country.

2. Definition and Background

2.1 The Concept of Smart Grid

The smart grid is the intelligence of the power grid (Smart Power), also known as the “Power Grid 2.0,” which is based on an integrated and high-speed two-way communications network. Through advanced sensing and measurement technologies, and advanced equipment technologies, advanced control methods and application of advanced decision support system technology to achieve the grid's goals of reliability, safety, economy, efficiency, environmental friendliness, and safety of use. Its main features include self-healing, motivating and including users, resisting attacks, providing Satisfy the 21st century user demand for power quality, allow access to various forms of power generation, start the power market, and optimize the efficient operation of assets.

The smart grid does not have a definitive concept. Experts in different fields interpret their connotations from different perspectives and refine them as research and practice deepen. In a word, smart grid connects various devices and assets through sensors to form a customer service bus. Therefore, the information is integrated and analyzed to reduce costs, increase efficiency, improve the reliability of the entire power grid, and optimize the operation management.

2.2 Research Background

Social development requirements

After the global financial crisis, the government introduced a series of measures to stimulate economic development. Industrialization and urbanization have entered a new stage. The scale of production benefits of various industries has gradually expanded. Driven by the rapid development of economy, people's demand for electricity is increasing quickly. It is estimated that by 2020, the electricity consumption in China will reach 7.7 trillion kWh. In order to meet the national economy's demand for electrical energy, China must pay attention to the construction of power grids to ensure the reliability of power transmission and distribution.

The transportation of clean energy

The development of clean energy such as wind energy, solar energy and geothermal energy in China is mostly concentrated in resource enrichment areas such as the north and west. Large-scale wind power generation bases are mostly located in Xinjiang, Mongolia, and Tibet; hydroelectric power generation areas are mostly concentrated on major rivers such as the Yangtze River and the Yellow River. However, there are few local users and the power demand is small. Electricity and electricity use areas do not match. Therefore, we need to solve the long-distance large-scale transportation problem of electric energy.

Practice in Other Countries

European countries combine their own regional characteristics and focus on different areas of smart grid construction. For example: Denmark focuses on the development of transmission and distribution of wind power; Germany focuses on the connection of offshore wind power. At the same time, EU countries cooperate to develop European power interconnection to achieve the optimal deployment of electricity and energy.

As for the United States, the government actively attracts major organizations to jointly promote the development of smart grid technologies and standards. The U.S. mainly focuses on upgrading and updating the power network infrastructure, while maximizing the use of information technology and replacing system intelligence with labor. The main implementation projects are the GridWise project led by the U.S. Department of Energy and Grid Intelligence Alliance and the Intelligrid project initiated by EPRI.

3. The Development Focus in China

In recent years, China's power grid investment has increased significantly, and power industry investment is gradually tilting toward grid investment. Accelerating the construction of a strong smart grid and building a modern, safe, high-quality, economical and environmentally friendly power grid system has become a top priority for China's power construction. In recent years, the policies issued by relevant departments in China have clearly defined the importance of the development of smart grids. Among them, advanced technology is the priority for the development of smart grids.

3.1 Network topology technology

The basis of the development of smart grids is a structural framework with strong anti-interference ability, flexibility and stability. The development of network topology technology can realize long-distance large-scale transmission and realize optimal allocation of resources. Utilizing UHV can not only increase the transmission capacity, but also increase the utilization efficiency and reduce the waste of resources.

3.2 Communication System Technology

Smart grids rely on open, standard, and integrated communication systems to monitor and analyze power grid systems in real time. Analyze and predict based on early symptoms of failure. Analyze the existing failures and propose solutions. The continuous integration of the grid system provides the necessary communication information for the planning, construction and management of the grid.

3.3 Smart metering technology

In order to realize intelligence, smart grids need to measure the user's electricity consumption rules through smart metering technology to balance supply and demand. Utilize demand-side management technology to manage the power grid and achieve detection.

3.4 Intelligent scheduling and protection technology

Intelligent scheduling technology is an extension of the existing dispatch center. Establish a synchronous network information protection and control system on the basis of the original to ensure the coordination and unification of the power system, and to protect and control the regional system to achieve intelligent regulation and protection.

4. Development Prospects and Application

The development of smart grid in our country has led to the reform of energy in our country, providing an opportunity for the development of new energy. The existing new energy sources in China include solar energy, wind energy, and hydropower. This allows us to continue to intelligent the power station and its related equipment. The superiority of smart grid has been recognized by many countries.

As one of the key technologies of the smart grid, the digital substation technology will be a long-term process. The maturity of the technology needs to be combined with the engineering application. The digital substation technology is based on integrated automatic substation technology, which can achieve stable development of applications and breakthroughs in key technologies.

Popularize electric vehicle charging stations. China's electric cars started late but developed rapidly. In order to meet the charging needs of electric vehicles, all provinces are vigorously promoting the construction of electric vehicle charging stations and charging piles. Accumulation and recharging of electric vehicles may cause stress in local areas; charging behavior during charging time and load peak times will increase the burden on the distribution network. The popularity of fast charging devices for electric vehicles will also become the focus of the smart grid.

Smart home equipment. Smart Home provides users with a home-based platform that utilizes advanced computer technology to integrate various subsystems related to home life organically. It can provide a full range of information exchange to help families and the outside maintain information exchange and optimize people's lifestyle. The smart home can realize the automatic

control of the home appliances, the information exchange between the electrical devices and realize the remote control. The development of smart homes is inseparable from the smart grid. The development of smart grids solves the problem of power supply reliability that smart homes face.

5. Strengths and Suggestions

5.1 Strengths

Smart grids have clear advantages. It can adapt to the access of large-scale clean energy and renewable energy, and adding digital sensors, remote control devices, etc. to existing power systems will make the power grid more intelligent, greener and more efficient. Smart grids make life more convenient, low-carbon and economical. The home smart grid system can not only realize remote control of household appliances, but also can automatically read meters, pay bills, and can access small household wind power generation and rooftop photovoltaic power generation devices, thereby increasing the proportion of clean energy consumption, reducing urban pollution, and It can also save money for a family.

The development of smart grid not only promoted China's economic development, but also changed China's energy structure. At the same time, it has achieved low-carbon environmental protection, improved people's quality of life and reduced the pressure on the environment.

The smart grid is the trend of the development of the world power grid, and all countries are accelerating the "intelligence" of the power grid. The grid has become "smarter" and citizens are more "wisdom" in using electricity. The smart grid will make our lives more colorful.

5.2 Suggestions

In the future development of smart grids, not only national development but also comprehensive benefits, sustainable development and environmental protection should be considered. The grid, users, power supply, business links, and data information systems are built into an effective system. In the future development of the smart grid, it should focus on the stability of the grid structure. Connect large and medium-sized power grids and establish a network sharing platform to realize real-time interaction and sharing of power grid information. In addition, there are also strengthening management and giving full play to the advantages of an integrated management model. Build a smart grid with Chinese characteristics. Build a smart grid with Chinese characteristics. To promote the construction and management of smart grids in an orderly manner, formulate reasonable planning plans, and promote the development and progress of smart grids.

6. Conclusion

The development of smart grid is a new technological breakthrough. At this stage, the development of smart grids is still not perfect. This requires constant measures to promote the development and improvement of smart grids based on their own national conditions and appropriate reference to other countries' advanced technological experience. The development of smart grid not only promoted China's economic development, but also changed China's energy structure. At the same time, it has achieved low-carbon environmental protection, improved people's quality of life and reduced the pressure on the environment.

China is different from developed countries such as Europe and the United States. Research on smart grids in foreign countries is more concerned with the distribution sector, and our top priority is to meet the growing demand for electricity. We need to pay more attention to the smart transmission grid. It is necessary to combine the construction and development of UHV power grids, enhance the ability to control the safe operation of large power grids, and ensure the safe, reliable, and stable operation of the power grids. We should gradually co-ordinate the development of transmission grids and the construction of distribution network information, put forward the definition and planning of China's smart grid, and gradually build a smart grid with Chinese characteristics.

The development of a smart grid is a long-term, systematic project that requires the close coordination of policies and regulations. With the continuous development of the smart grid and the

rapid advancement in the top high-tech fields, various technologies will have more and more broad prospects in the smart grid. We expect that the relevant national scientific research departments will be able to discuss and expand the specific technologies involved in the smart grid in the future. As a result, the smart grid creates greater economic benefits for the socialist market economic system.

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