

Research on Power Communication Application in the Smart Grid

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Abstract—Currently, the domestic social and economic development quickly, the grid size is also growing, prospects of power communications brighter. Power communication network is reflected in all aspects of the power of industrial production, power communication applications in the smart grid can effectively improve the efficiency of the power grid, in large part to ensure the safe use of electricity. In this paper, an overview of the current state of smart grid communications and electric power and communication point for the study, the analysis of the specific requirements of smart grid power communication, research and communications applications, power applications in the smart grid, and finally explained the power of communication in the field of smart grid application challenges, in order to provide a theoretical reference for the industry.

Keywords—*power communication; smart grid; application; research*

I. INTRODUCTION

The rapid development of today's rapidly changing world is inseparable from the rapid innovation of smart grid to some extent. In the generation, transmission, transformation and distribution of the whole process, you can see the smart grid with its unique and efficient low-carbon development was caused by a wave of intelligent network in the world. Smart Grid is automatic and widely distributed energy exchange network, it has the characteristics of power and two-way flow of information, but it is able to monitor all of the electrical components from the power plant to the user of the question[1-3]. It superiority of distributed computing and communications to provide real-time information for the grid and make it possible to maintain the level of immediate supply-demand balance device. The power of communication as the main content and key technologies of power grid construction, has been subject to extensive attention of relevant personnel, whether it is research institutions, power companies and telecommunications equipment manufacturers, all of the technological development in the field of great importance. In recent years, with the development of power grid construction, continuous advances in information and communication technology, and research to explore the power of communication technology are endless. For example, IP-based unified communications discussed the future direction of the communications grid enterprises, application, relationship broadband power line carrier communications and smart grid optical fiber communication in the modern grid automation.

The paper will explore the development of the grid that is built on, that the power of communication an important role in the overall process of the intelligent network. Accordingly, the effective implementation of the development of the power of communication technology, strengthen personnel training, is an important aspect of building an intelligent network, but also to strengthen the new demands of our nation-building.

II. SMART GRID AND POWER COMMUNICATION

A. Smart Grid

Smart grid refers to the power grid more reliable, more secure, more efficient, more energy efficient, more environmentally friendly, namely smart grid. Its own high-tech intelligence systems, including advanced transportation systems, advanced sensor measurement technology, advanced substation facilities, advanced control methods, based on an integrated, high-speed bi-directional communication network basis, in order to achieve security grid, efficient operation. China in 2009 for the first time released a smart grid development plan and program points from 2009 to 2010, 2011 to 2015, 2016 to 2020 three steps to achieve intelligent grid to achieve a strong intelligence network in the country[4]. Strong smart grid, not only can adapt to large amounts of clean energy to achieve energy savings, environmental protection purposes, and its built-in monitoring technology, can monitor the entire grid, identify obstacles, timely treatment can reduce losses[5]. The most important is that the smart grid can create a two-way interactive system, power suppliers can understand the user's electricity information, users can keep abreast of the price and other supply information.

Smart grid development goals is to protect national energy security, tackling climate change and promote renewable energy development, improve resource utilization efficiency, increase employment, improve the user value-added services; development focus lies in the development of smart grids and distributed renewable energy Power and network technology, two-way interactive technology for electric vehicles and grid technologies and grid operation coordinated with the user. Overall, the smart grid is a highly automated digital grid, each client and each node in the grid are up real-time monitoring, through integrated broadband communications, automatic control systems and a large number of distributed intelligence, real-time trading and market grid coordination and real-time

interaction of various departments. China to seize the smart grid is based on the country "rich in coal, oil, less gas, with the development of large-scale renewable energy conditions," the status of energy resources and the "east-west energy consumption demand a huge difference," the energy consumption characteristics proposed[6].

With the traditional power grid through a series of comparison, you can find the biggest highlight of the smart grid is intelligent, a higher degree of information. Advanced communications, information, control technology is the basis for the smart grid. Therefore, the establishment of a reliable, secure, real-time power grid communication network becomes realize intelligent primary problem. Reliable, high-speed, real-time power communication network will enable Smart Grid has become a dynamic, secure, sophisticated power switching systems and information exchange systems[7-8]. Such a system can be built to further improve reliability, improve resource utilization, enhanced user-side energy management and service levels, help increase the value of the power grid, and promote healthy development of national economy and lasting.

B. Power Communication

As a key component of the overall power system, the power of communication to protect the entire power system developed security and stability. On the other hand, the power system has laid the foundation for modern management mode follow the grid, and promote the development process of network automation scheduling. And with the process of economic development of our country, we can also find the power of communication technology already gradually integrated into the development process of the smart grid. Power system communication network belongs to a private communications network, with strong privacy and security and reliability to ensure safe and stable operation of electric power communication network platform features a variety of features, which can be implemented standardized communication network architecture, it can be realized exchange of information transmitted between communication devices, smart grid construction plays a very important role as the domestic economy continues to grow with the increasing social progress of science and technology, the power of communication to get a better space for development as an important part of the development of the power industry smart grid and infrastructure development, power communication must fully play its role in supporting the specific requirements of smart grid power communication. The purpose of the composition of its system by transmission systems, switching systems and terminal equipment consisting of interconnected, power communication is implemented in order to ensure the security and stability of the power system operation. Power system security and stability in large part to rely on the support of power communication network, power communication network is an important infrastructure of the power system. With the rapid development of China's power grid, power communication will also be applied into the future intelligent power system, complete the construction of the system, a fully functional power communication network. At present, the power of communication technology is more mature special fiber optic cable technology, while packet switching, DDN,

ATM networks and other communication services has also been a great development. With the continuous development of the power system, power communications business has gradually diversified, complex, intelligent direction. Information and communication systems in the smart grid, including a variety of information needs to be passed in the generation, transmission, substation, distribution, electricity and scheduling six links in the. They can be divided into three categories: business class grid operation control, power production and management business and enterprise management business.

Power Communication has experienced five stages: First, from the initial development of open wire and coaxial cable to fiber optic transmission phase; the second is from a crossbar switch to telephone switching stage; the third is from the main hardware-oriented software technology for the stage ; four are from fixed to mobile communications communication stage; five are from analog to digital network communications network stage. The pace of development of electric power communication network quickly, has been widely applied to various fields. Currently, electric power communication network will also be applied to the development of smart grid into the future, and in information technology which has become increasingly fierce competition, power communication network has gradually infiltrated the cross-industry technology, which led to cross-permeable competition in the electricity market. Power communication has become an important infrastructure of the power system, power communication leading the development of new technology in the field of electricity, and equipment installed capacity, power generation and grid-scale power generation in the country has entered the forefront of the world, the power of communication in the modern electricity production and management has a very important role. First of all, the power of communication in the country's electric power communication network gradually integrated services use open, and has a high level of technical equipment; secondly, the power of communication has developed to a certain size, the technology has also been a high professional, with a more perfect the management standards and technical specifications.

III. SMART GRID COMMUNICATION REQUIREMENTS OF THE SPECIFIC POWER

1) comprehensive coverage of the communications network. According to research data, said that although the country is already at this stage will be the backbone network transmission medium to conduct a comprehensive type of optical fiber technology, but in the part of the grid extension, especially in power distribution, power transmission and electrical energy in all aspects of the communication network The overall coverage is not optimistic. For example, the current domestic electricity sectors Some cities have started pilot operation of broadband access, in order to capture the power of information by this method, although not yet a larger scale, but is now taking shape. But with the popularity of smart grid in the near future, management will also generate electricity, substation, electricity and other aspects of real-time data, demanding higher accuracy, but will also play power communication will not be ignored important role.

2) diversification and reliable means of communication. As we all know, our current grid development or to the main content of the main optical fiber communications, satellite, microwave, etc. Although in recent years have made some progress, but still complementary components. But in this case we have seen in many parts of the communication capacity is not optimistic, and even live because of saturation and overloading. So we hope that the power of smart grid communications, like neural networks of the brain, can fully diversify period, the flexibility to fully and effectively on the basis of data collection grid, implement reasonable control box protection, and to some expand the communication capacity extent.

3) communication system manageability requirements. Overall, the management system at all levels of the grid at this stage is not perfect, and the development of the smart grid is also high hopes to solve this problem. Specifically, in the layout of the smart grid, power communication is often placed in relatively open structure of the Internet, and the network structure also means that the communication will be set higher and the operation of the same standard, which not only make the entire grid real-time operation is under control, more able to effectively improve their equipment operability. On the other hand, manageability, often also means safety factors provide a higher demand. Although the electric power communication network operation process will be synchronized to the network, but it also must protect the confidentiality of data and reliable operation of the process, and thus be able to resist illegal attacks from the network.

IV. APPLICATIONS OF POWER COMMUNICATION IN THE SMART GRID

A. *Analysis of power communication applications in the smart grid business*

In the smart grid business, through the power of communication technology to achieve automatic meter reading, billing, and other measurement and electrical energy, and real-time collection of grid operation, the device status and other aspects of customer metering data, and then according to their importance and practicality its automatic classification, and then transmitted to the server interface to transfer these operations can interfere with effective control of redundant data to facilitate the calculation of electricity and tariff aspects, but also on energy-related information in the user's grasp.

B. *Application of intelligent power communication network in the field of new energy*

In the smart grid construction, new demands for energy, that is, to achieve the renewable energy replace non-renewable energy and sustainable development objectives, therefore, smart grid companies want to access and control of the new approach to energy research, so that new and renewable energy can successfully be applied in smart grid construction and after the connection of new renewable energy person, and to ensure that the power communication system can power voltage, power quality and other aspects of the automatic adjustment in the use of new energy generation When, to make power communication systems for power generation equipment can

start, stop, and power control and other aspects of effective management, to form the new energy management system.

C. *Application of electric power communication network in the intelligent distribution of*

In the electricity network, the distribution network is a very important part, which has a flexible, efficient and reliable grid characteristics and power communication network with high security and reliability, used in power distribution network, you can achieve fault automated discovery and processing to meet the power and energy storage element of high permeability network access requirements can largely improve the quality of electricity supply in addition, electric power communication network and smart distribution grid technologies conducive to the effective integration of the distribution system compatible, interactive, integrated, self-healing, and other aspects of function optimization.

D. *Application of electric power communication network in intelligent substation in*

Intelligent substation construction as its physical basis, in the process of smart grid construction plays a very important role in today's power industry has been developing rapidly, smart substation building efforts must be increased to be on the advanced sensor technology, information technology, control technology and intelligent technology to fully utilize and then normalized based information platform, intelligent devices and network layer Layer 2 device, panoramic real-time monitoring of the substation, automatic control operation of the substation, substation and smart regulation etc. for substation automation to provide safe, reliable and guaranteed.

E. *Application of electric power communication network in the transmission of intelligence*

In the smart grid construction, the main transmission lines and transmission capacity of mining state monitoring both the technical requirements which include monitoring basic condition monitoring information, environmental information, operation and management of information and disaster warning information and other aspects, including intelligent transmission line system through the appropriate information and communication ways to achieve different agencies, units and equipment and other aspects of flexible access real-time monitoring information, thereby facilitating the integration and unification of data, in order to meet the relevant requirements of intelligent power communication network construction.

F. *Analysis of electric power communication applications in the field of intelligent network security*

With the smart grid construction progress continues to accelerate, power flow, information flow and business flow direction is toward the integration of development in the grid, the information security of their impact on the safe operation of more and more, and even affect the stable development of the smart grid Therefore, the power communication network information security as the underlying transport platform, the data must focus on smart devices, Second District, and three areas of business application integration, security, power and user-way interactive network and so on.

V. CHALLENGES OF POWER COMMUNICATION APPLICATIONS IN THE FIELD OF SMART GRID

In the smart grid communications platform in its possession more than just a communication channel, or compose an important part of the smart grid indispensable. So, smart grid communications platform and related services needed for effective smart grid cooperate in order to achieve a unified plan in the smart grid. The smart grid communications platform power actually belongs to a relatively open network architecture, you need to use common communication standards. Between smart grid devices can communicate with each other information, and interoperability, power communication network will not only be able to diverge to the relevant power generation, power transmission and transformation as well as terminals and other terminal equipment, it is also possible for the smart grid data acquisition play, protection, control role in providing scientific and rational support for smart grid network data services. The main problem currently exist in the field of intelligent networks is the lack of two-way, high-capacity, real-time access to the network for smart grid implementation supports.

Power lies in the following two aspects of communication in the field of smart grid application challenges faced: first, there is a phenomenon of forest for the trees, you can not stick to the fundamentals of smart electricity grid and communication development. Under current conditions, the energy saving is simply smart grid development is fundamental to ensure the production of electric power communication development. The fundamental innovation lies in national development, throughout the history of economic development, progress depends on every technological innovation, the smart grid is an important subject of new technological innovation; second, the lack of human resources, making the smart grid construction process, the emergence of the field of communications professionals in shortage, nearly five years of related resources and communications equipment has been an unprecedented development, the number of devices more than quadrupled, but related communications professionals in the

field but did not increase, led to the current smart grid communications access network construction lack of talent.

VI. CONCLUSION

In the process of building a smart grid, the power of communication plays a very important role, therefore, to build high-quality and efficient smart grid system, we must increase the power and communication construction work to promote the development of power industry, the full use of advanced power communication technology to improve its value in the smart grid construction, promote the power to communicate with the smart grid common sustainable development.

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