Analysis of Key Technologies in the Construction of Ubiquitous Power Internet of Things

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Abstract: The Internet of Things (Internet of Things) first appeared in Bill Gates'1995 "The Road to the Future", in which Bill Gates has mentioned the concept of the Internet of Things. The Internet of Things is considered to be another major milestone in the information industry after the computer, Internet and mobile communication networks. The Internet of Things (IOT) has aroused great concern in the United States, the European Union, Japan and other countries for promoting the emergence of new strategic industries and accelerating the economic revitalization and social development transformation of various countries.

1. Introduction

Smart grid technology allows us to better manage, save, monitor and use energy, giving consumers the power to decide when, where and how to use energy. Predictable benefits include electricity savings, intelligent management, greater reliability and efficiency, increased use of renewable energy, support for hybrid vehicle access, and intelligent home appliances.

The smart grid using the Internet of Things technology improves the reliability of the power grid. When there are large disturbances and faults in the power grid, the smart grid can still maintain the power supply capacity to users without large-scale blackouts; it can still ensure the safe operation of the power grid under natural disasters and extreme weather conditions or human-induced external damage; it has the ability to ensure information security and prevent computers. The ability of virus to destroy. Smart grid technology can better identify and respond to man-made or natural damage. Real-time information can allow grid operators to isolate damaged links and allow power to bypass damaged areas and re-supply power.

Smart grid makes the electric energy generated by various ways more compatible. Domestic wind farm development areas are generally concentrated in remote areas, which is precisely where the power grid is relatively weak and the affordability is limited. Moreover, the relatively small load in remote areas makes it difficult to absorb the electricity generated locally. The low density, instability and discontinuity of wind power make the power generation rise and fall suddenly, which impacts the weak power grid in our country. The grid is unwilling to access, which makes the utilization hours of wind farms too low to form the scale effect, resulting in the return on internal investment of wind power projects less than 8% of the average level of society and lack of investment attraction. At present, the lagging development of domestic power grid has become the bottleneck of new energy development, and the smart grid will solve the problem of new energy generation grid has become the consensus of all countries. Smart grid emphasizes on achieving the goal of clean, efficient and interactive on the basis of power supply security, reliability and quality. When the grid is built, it will be able to deliver renewable energy, such as wind power and solar energy, as well as traditional coal power. The main reason why our country put forward vigorously building smart grid is to support wind power, solar energy and other new energy access, and support demand side management.

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2. Power Internet of Things

There are three stages of online exhibition: one is information gathering stage, the other is collaborative perception stage, and the third is ubiquitous aggregation stage. We have deployed all aspects of the Internet of Things, such as dedicated chips, application system development, standard system, information security, wireless broadband communication, software platform, testing technology and experimental technology, and strived to achieve breakthroughs in the application of Internet of Things technology in power systems in the next three years, and to form a number of innovative scientific research achievements with important impact.

The core of the development of power industry lies in the construction of an intelligent network system with the ability of intelligent judgment and adaptive regulation for unified multi-energy access and distributed management, which can monitor and collect the information of power consumption of power grid and users in real time, and use the most economical and safe transmission and distribution mode to transmit power to the end users, so as to realize the optimal allocation and utilization of power and improve power consumption. Reliability of network operation and energy efficiency. The essence of smart grid is energy substitution and compatible utilization. It needs to integrate the data in the system and optimize the operation and management of power grid on the basis of open system and shared information model. Open whole network system will completely change the structure of today's power grid, realize the whole process control from energy access, transmission and distribution dispatch, safety monitoring and relay protection, user power information collection, metering and billing to user power side, that is to say, the existence of Internet of Things technology can be reflected everywhere in the future smart grid.

In terms of energy access, smart grid can make new types of power, such as renewable energy generation, more convenient and faster, such as distributed generation. With so many independent and relatively unpredictable power supply, distribution network is required to evolve from passive one-way network to active current management system in many directions. Through the application of Internet of Things technology in smart grid, the influence of weather change on the output of distributed power generation can be analyzed in real time through information sharing, and the power change of distributed power generation can be predicted in time, so that the output of distributed power generation can be controlled within the scope, which not only eliminates the disturbance brought by distributed power supply to the power grid, but also meets the needs of intelligent dispatching system. And peak shaving. It can be seen that the application of Internet of Things technology can completely eliminate the adverse impact of distributed power access.

In the aspect of power transmission and distribution dispatching, through the application of the Internet of Things technology, the sensors throughout the power grid can sense the internal operation of the power grid in time, feed back the energy loss of the dispatching system to the overall system, and can assist dispatchers to optimize the operation of the network on the premise of ensuring safe operation, save energy consumption and promote low-carbon economy.

In the aspect of safety monitoring and relay protection, through the application of Internet of Things technology, on the one hand, it can real-time perceive the force of tower, line and other operating components under external meteorological conditions, and feedback information in time. Under harsh weather conditions, real-time alarm is given when the force of tower and line is close to the critical state, and the action of adjusting device on tower is used to alleviate the situation of the heavily stressed parts, waiting for the replacement of staff. Even in the case of icing, the ability to automatically perceive the thickness of the ice layer, conduct hazard assessment, and automatically melt ice enhances the ability to resist disasters. On the other hand, real-time perception of the internal operation of the grid, such as changes in voltage and current, prediction of the occurrence of faults, through network reconfiguration, change the distribution of power flow will contain the fault in the budding state, and real-time feedback to the dispatching center. It has the function of self-healing. "Self-healing" is to isolate the faulty components from the system, and quickly restore the system to normal operation with little or no human intervention, almost without interruption of power supply services to users. Even in black startup, it can automatically configure

the startup scheme and reconstruct the network for dispatchers'reference.

With the application of Internet of Things technology, smart grid can manage the demand more accurately. The traditional power system is designed according to the demand of peak and valley, and the capacity of power grid should be large enough to meet the peak demand. But when electricity is scarce at night, many power stations stop generating electricity and part of the grid capacity is idle. Smart grid may fundamentally change this situation. For example, with the help of smart meters, power suppliers can formulate dynamic billing schemes to reflect the generation and transmission costs at different times, or encourage consumers to increase electricity consumption when renewable energy generates large amounts of electricity, which helps to ease peak and valley power consumption and maintain a balance between supply and demand in the power grid. In the aspect of metering and billing, through the application of the Internet of Things technology, the meter can automatically carry out the statistics and processing of electricity, realize the automatic charge collection of different levels of electricity users, save labor costs and possible errors. At the same time, statistics and judgment can prevent the occurrence of electricity theft. In the process of user side power consumption, the application of Internet of Things technology can realize smart home. In smart home, all kinds of electrical equipment are integrated with smart power chips or installed with smart power sockets, which can optimize their operation according to their respective operating characteristics, thus saving energy and electricity. For example, the detection of no one in the house, automatically turn off the lighting. It can monitor the change of electricity price information in real time, so as to realize the operation at low electricity price. For example, when the electricity price is low at night, the washing machine washes the clothes automatically. In the daytime, through the real-time interaction with the information of the power trading center, the solar panels will be sold online to achieve profits and so on.

3. Key Contents

The application of Internet of Things in power industry to realize smart grid mainly has four key application technologies: perception and identification technology, network and communication technology, computing and service technology and management and support technology. Perception and identification technology is the basis of the Internet of Things. It is responsible for collecting physical events and data in the physical world and realizing the perception and recognition of information in the external world, including a variety of technologies with great differences in maturity, such as sensors, RFID, two-dimensional codes and so on. The network is the infrastructure of information transmission and service support of the Internet of Things. Through the ubiquitous interconnection function, high reliability and security transmission of perceived information can be realized. The calculation and processing of massive perceptual information is the core support of the Internet of Things. Services and applications are the ultimate value of the Internet of Things. Massive perceptual information computing and processing technology is one of the major challenges after the large-scale development of Internet of Things applications. It is necessary to study the key technologies of massive perceptual information such as data fusion, efficient storage, semantic integration, parallel processing, knowledge discovery and data mining, and to overcome the virtualization, grid computing, service and intellectualization technologies in the Internet of Things Cloud Computing. Cloud computing technology is used to realize the distributed sharing of information storage resources and computing power, which provides support for the efficient use of massive information. With the expansion of Internet of Things (IOT) network scale, the diversification of carrying services and the improvement of service quality requirements, as well as the increase of factors affecting the normal operation of the network, management and support technology is the key to ensure the realization of "operational-manageable-controllable" IOT, including measurement and analysis, network management and security assurance.

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