Discussion on Urban Distribution Network Planning Based on Key Technologies of Smart Distribution Network

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Abstract. Urban distribution network planning is the key technology of smart distribution network. The survey method is used to summarize the economic evaluation, load forecasting, and power grid planning of urban power grids. On this basis, the corresponding methods and solutions to the problem are proposed, including: improving the professional literacy of relevant technical practitioners, establishing and improving a smart distribution network supervision mechanism, and strengthening relevant maintenance of smart distribution network equipment. Optimize planning quality. Enable power companies to fully meet the development needs of modern society, better ensure the safety of power grid projects, and effectively plan urban power grids.

1. Introduction

In the process of urban development, power supply capacity is one of the main assessment indicators, which has a crucial impact on people's production and life. How to improve the power supply capacity of urban power grid, ensure the normal daily electricity consumption of residents, and make the power grid enterprises achieve sustainable development has become the main research topic of power grid enterprises. Therefore, it is necessary to plan the urban power grid scientifically and reasonably so as to meet the needs of economic development and people's daily needs. However, in the current situation, in the process of urban power grid construction, many power enterprises in China only consider the immediate problems and ignore the research of sustainable development, which leads to the increasing investment cost of power enterprises.

The smart distribution network is the key link of the construction of the smart grid, which generally refers to the 110kV and below grid, and is directly connected with the whole power system and decentralized users. The smart distribution network combines traditional power technology with modern computer, information technology, sensor measurement technology, communication network technology, protection control technology and advanced distribution automation technology, and supports the intrusion of distributed power supply, real-time monitoring and protection of power system, so as to provide users with more safe and reliable power. The intelligent distribution network is not a simple smart grid technology, nor the upgrading of the traditional distribution network, but the application of various advanced distribution technology in the power system to improve the efficiency of the whole power system. The intelligent distribution network system consists of communication system, main station and automatic monitoring terminal system. It is a complete information processing system and information transmission system, which can manage the distribution network remotely. The communication system is the key to the whole system, which is the core of the whole data transmission. The communication system transmits the control command of the master station...
center to the remote terminal, so as to realize the control of the master station to each terminal system. The automatic monitoring terminal system collects and transmits the data information of remote equipment operation to the control center. The communication system of intelligent distribution network mainly adopts optical fiber and power carrier communication.

2. Urban distribution network planning of key technologies of smart distribution network
The planning and construction of new urban power grid can fundamentally improve the quality of power supply and ensure that power supply will not be affected by other factors. In the process of urban power grid planning, it is important to predict the load of power grid, plan the power grid correctly, and evaluate the planning economy of urban power grid[1-2]. Therefore, in the process of urban power grid planning and construction, it is necessary to analyze and study the existing problems in combination with the actual situation, so as to promote the rationality of power grid planning, and also the main means to improve the market competitiveness of power enterprises.

In the process of urban power grid planning, it is necessary to accurately predict the load of urban power grid, which is an important guarantee for the normal operation of power system. The load forecasting of power grid has certain complexity, it is difficult to predict it accurately, so it is difficult to guarantee the accuracy of forecasting. In the current development process, there are many factors that affect the accuracy of power grid forecasting, mainly load level, climate conditions and so on. These factors have become the key to accurate prediction. According to the actual characteristics of power enterprises, periodic prediction can be adopted[3]. Only by fundamentally ensuring the accuracy of prediction, can stable premise be provided for urban power grid planning and construction.

In the power system, the correct planning of power grid has become an important way to promote the development of power system. In order to ensure the urban power supply capacity and the improvement of power supply quality, the overall planning should be carried out to ensure the use time of power grid. Therefore, it is necessary to plan the power grid scientifically to ensure the operation of the power grid. Reduce the waste of construction funds, so as to promote the safety of power grid operation, so that the investment cost of power grid can be controlled in a reasonable range[4]. Therefore, the planning of electric power enterprises plays an important role in promoting the implementation of urban power grid planning projects.

3. Key technologies of smart distribution network
There are three key technologies of intelligent distribution network, which play an important role in urban distribution network planning.

3.1. Distributed generation
Distributed generation, simply speaking, is a kind of power generation method based on innovation consciousness. When generating power, different modules will be combined to generate power under its function. Its power generation has clear requirements. For some countries and regions, according to the development characteristics of the region, the power generation can be adjusted to keep within a reasonable range to meet the actual needs[5].

The planning flow chart of networked distributed generation system is shown in figure 1. Distributed generation has many advantages, the main advantage is that different modules can be integrated to improve the efficiency of power generation. The construction of distributed generation mode usually combines the specific situation of the actual area, on this basis to develop a sound and reasonable construction and installation program. Distributed generation is mainly based on self-control power generation, which can use a variety of electrical equipment provided by the user synchronously and control and debug the power reasonably. During the regulation, the surplus electricity can be reused. Distributed power generation mainly uses new energy as power generation energy, which plays an important role in environmental protection, because new energy has important energy-saving advantages. It can be seen from this that distributed generation technology is the best demonstration of the application of green new energy technology.
Input the selected capacity combination of WT and PV, the maximum transmission capacity of transmission network

Input the load of each hour, the distribution state of distributed power source

Simulate the output power of each component per hour and other operating states for each power supply combination

Whether the constraint is met per hour

Yes

Calculate the total annual planning cost for each feasible combination

Obtain the capacity of optimal combination and the planning cost of system

End

No

Increase the capacity combination of WT and PV

3.2. Distribution automation

Distribution automation technology can comprehensively analyze the level of power consumption within a certain range, and also promote the improvement of power grid planning within a certain range. Actively study the management and operation mode of urban distribution network, improve the content of service, and reasonably optimize the smart distribution network technology to meet the needs of distribution network planning and construction, so as to improve the scientificity and rationality of distribution network construction[6].

The basic structure of distribution automation system is three-layer structure, which are main station, substation and terminal. In the distribution automation system, the main station is located at the core, which is mainly responsible for data storage and calculation; the substation is located in the middle, which is mainly responsible for data collection and transmission; the terminal is located at the bottom, which is installed on the distribution equipment. Distribution automation structure diagram is shown in figure 2.
The automation technology of smart distribution network can adjust and improve the power system, and establish an effective mechanism. The main body of this mechanism is the distribution master station system, which can effectively cooperate with the distribution communication system, determine the location of the distribution network combined with the geographic information system, and build the relevant network model. The model can be used for remote control of smart distribution network to ensure the authenticity of the information transmitted by distribution network technology.

The automation technology of smart distribution network can realize real-time monitoring control and fault control. In the process of distribution network, if the technical maintenance personnel want to keep the whole system stable in operation, they should follow up the data content in real time, collect and analyze the data content, strictly control the current and voltage values of all transmission lines to be within the normal range, and avoid overload of transmission current. Technical maintenance personnel also need to check all kinds of instruments in real time to prevent their data judgment from being affected by abnormal data, so as to effectively reduce the occurrence of accidents.

The automation technology of smart distribution network can control line loss and power quality. As we all know, the current has a certain loss in the transmission process of the line, this seemingly small loss, in fact, is a serious waste of power energy. Therefore, line loss control means to effectively control the loss of power energy in the transmission process, so as to reduce the economic loss and resource waste of power enterprises. In the urban power supply and distribution system, the real-time voltage and current are inconsistent with the residents' power consumption because the size of the urban residents' power consumption changes every moment. Therefore, it is difficult for technicians to design real-time power flow engineering. In view of this situation, the technical maintenance personnel should follow the load distribution method in the conventional line, so that the power loss voltage can be controlled within the minimum range. Although this method is not more practical and effective than the real-time power flow, it has a good effect to control the voltage loss.

### 3.3. Electric vehicle charging

With the continuous promotion of urbanization, people pay more attention to energy and environmental pollution. In order to make the air fresher, improve people's quality of life, and effectively control the ecological environment, China's automobile industry has carried out innovation, upgrading and reform of production mode. In the current development process, many cities begin to implement public transportation and electric vehicle transformation. After reasonable modification, and technology improvement and upgrading, the overall use performance of electric vehicles has
surpassed the fuel consuming vehicles, and has also been more recognized and loved by users in economic benefits.

With the increasing number of electric vehicles, it will definitely bring more high-intensity power consumption. At the same time, the future market of electric vehicles has a broader development prospect. Behind the large-scale growth, higher standards and requirements are put forward for urban distribution network planning. Smart distribution network will not only effectively reduce the load of distribution network, but also cause other quality problems. Therefore, we must pay more attention to it, so that the operation quality of distribution network can be significantly improved, so as to lay a good foundation for the construction of smart distribution network. Figure 3 is the framework of battery charging and renewal network’s scheduling[7].

![Framework of battery charging and renewal network’s scheduling](image)

Figure 3. Framework of battery charging and renewal network’s scheduling.

From a long-term perspective, the progress of science and technology in China can solve the problems related to the cost of electric vehicles to a certain extent. At the same time, under the joint action of the government and the market, electric vehicles will get rapid development. As a random and intermittent facility, electric vehicles will increase the pressure of power supply and reduce the quality of power supply if they don't make corresponding rules. Therefore, it is necessary to strengthen the research on electric vehicles and accelerate the development of electric vehicles in China.

4. The significance of rational planning of urban smart distribution network

4.1. Optimize distribution network resources
If the key technology of the updated smart distribution network is effectively introduced into the planning system of the urban distribution network in China, the advanced supervision technology contained in this technology will monitor and manage the operation status of the entire smart distribution network in real time, and further expand the operation capacity of the urban distribution network. In addition, it can scientifically dispatch, allocate and optimize the current power grid resources to ensure the lossless operation of all equipment in the power grid system, greatly improve the overall efficiency of network operation, and create greater economic benefits for the urban economic development.

4.2. Guarantee economic development
The application of key technologies of smart distribution network adheres to the principle of "user centered", strives to solve the needs of power users as much as possible, provide sustainable and efficient power services, meet the stable operation of various social enterprises, and meet the service standards of energy purity, stability and reliability. Therefore, under the smart distribution network technology, the reasonable planning of urban network in our country can better alleviate the problem
of power outage caused by power and voltage fluctuation in the past power consumption of enterprises, make the production of enterprises in a stable, smooth and efficient environment, and then provide guarantee for the sustainable development of national social economy.

4.3. Improve environmental pollution
The key technology of the smart distribution network focuses on the type of new energy, which makes the chemical fuel consumed in the operation process of the distribution network in the past reduce, and the pollutant emission of the fuel is also significantly reduced, to some extent, reducing the pollution of the surrounding air environment. It can be seen that the application of key technologies of smart distribution network conforms to the concept of national sustainable development, which is conducive to the smooth progress of environmental governance, energy conservation and emission reduction.

5. Key technologies of smart distribution network in optimizing the quality of urban distribution network planning

5.1. Forecast distribution network load
The correct prediction of the distribution network load can ensure the scientific of the overall planning scheme of the distribution network, and provide guarantee for the distribution network to maintain good operation status. Power load forecasting is based on the change of load and external factors, through the analysis of historical data of power load, to estimate the demand of power system. Therefore, to forecast the distribution network load, we need to set the load index according to the use nature of the long-term planning map of the urban area. At the same time, we use the interface of data platform, GIS system and production management system to obtain the whole network data of the distribution network in this area, and analyze and calculate the reliability of each node of the distribution network. Forecasting load has the following advantages: first, it can effectively improve the proportion of distributed energy access; second, it can optimize the distribution of distribution network, reduce network loss, and solve the problem of high load rate of heavy-duty lines; third, when the power supply of the main grid is interrupted, it can provide Island operation power supply, so as to reduce the load outage time.

5.2. Improve the professional quality of relevant technical practitioners
Urban distribution network planning, which is the key technology of smart distribution network, plays an important role in national development and construction. In order to ensure the continuous improvement of work quality, the overall quality of relevant planning technicians should be improved. In the current development process, there are still problems to be improved in the quality of personnel, the level of professional skills to be improved, in the face of smart distribution network technology cannot be used correctly, it is difficult to plan as a whole, not to promote the real value and role of urban distribution network planning. Only the personnel with strong overall quality and high professional and technical level can lay a good foundation for the application of key technologies of smart distribution network.

Therefore, in the construction of smart distribution network, relevant staff must strengthen their own learning, master more advanced science and technology, conduct in-depth research on the correct concept, and make reasonable use of it. At the same time, we need to pay more attention to the dynamic economic development of the region. We should adhere to the integration of quantitative and directional analysis to plan the overall facilities reasonably.

5.3. Establish and improve the supervision mechanism of smart distribution network
Using the key technology of smart distribution network to plan urban distribution network should be restricted and controlled by a reasonable and perfect system. Therefore, we should continue to strengthen the construction of smart distribution network supervision mechanism, so that it can provide a strong guarantee for the improvement of distribution network planning quality. At the same
time, the government should play an active role in guiding, combining with the actual situation of macro-control, making a reasonable decision for urban distribution network planning, and making clear the direction of decision-making, when planning, it can provide scientific and normative guidance. Carry out comprehensive assessment on the construction level and qualification of relevant staff to ensure that all staff can play a real role in the construction of distribution network, ensure the basic ability of relevant staff, and meet the actual quality of distribution planning. At the same time, the government and relevant departments should conduct real-time supervision and management of the operation of urban distribution network. For the safety problems, targeted analysis should be carried out, and a reasonable way should be taken to solve them and strengthen the construction.

In the specification of technical indicators, automation is divided into three levels, including distribution automation, line feeder automation and distribution network line fault location success rate. Among them, distribution automation terminal coverage can reflect the relationship between distribution automation and equipment utilization. Line feeder automation ratio index layer is the proportion of feeder automation between substation outlet and user electrical equipment, and it is an important index for distribution network to evaluate the advanced nature. The success rate of line fault location in distribution network is the index of line automation level.

5.4. Strengthen the related maintenance of smart distribution network equipment
In order to optimize the key technologies of the smart distribution network and improve the quality of urban distribution network planning, it is necessary to maintain the equipment of the smart distribution network on a regular basis, and control the loss of the equipment reasonably so that the equipment can maintain a good running state. On this basis, the work concept of management personnel is innovated so that they can correctly use smart power distribution equipment according to strict regulations and requirements. In addition, relevant personnel shall be organized to inspect the equipment regularly. In the process of daily maintenance, the skill level of relevant personnel should meet the actual development needs, so as to grasp the operation state of the equipment reasonably and make the use performance of the equipment play the best state. Therefore, the daily activities of the relevant staff should be carried out in accordance with the equipment maintenance system. At the same time, the staff must take the initiative to shoulder the responsibility of maintenance, so that the maintenance work can no longer stay in the form. All in all, in order to improve the key technologies of smart distribution network, we must strengthen the system maintenance and management, reduce the loss of power equipment to a certain extent, so as to improve the efficiency and quality of operation.

6. Conclusions
In conclusion, urban distribution network as an effective platform for communication between power users and power supply enterprises, the establishment of a complete distribution network system can provide a guarantee for people's daily electricity use. Under the influence of energy problems, the application of new energy has brought more development space for distribution network planning and design. Applying the key technology of smart distribution network to the planning and design of urban distribution network can fully meet the needs of the development of reality. Relevant designers should plan accurately according to the actual construction needs, so as to meet the actual development needs and promote the development and improvement of the power system. The application of smart distribution network technologies to the planning of urban distribution network is an important means to achieve sustainable development, which is of great significance to improve the work quality of power enterprises.

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