Study on measures to improve the reliability of power supply in mountainous areas

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Abstract: With the undertaking of industrial transfer and adjustment of industrial structure in mountainous areas, the contradiction between power supply and demand has gradually become prominent, and users put forward higher requirements for power supply reliability. Combined with the current situation of distribution network system architecture, operation and technical management in Heyuan area, this paper analyzes various factors affecting power supply reliability, and emphatically discusses the measures to improve power supply reliability of power supply enterprises in mountainous areas from the perspective of management and technology, in order to shorten the average power outage time of users and improve power supply reliability.

1. Introduction

Power supply reliability is an important index reflecting the security and quality of power sector. The level of power supply quality directly affects the local economic development. Therefore, improving power supply reliability has attracted more and more attention. At present, how to improve the reliability of power supply is an important issue for the work of the power sector, the demand for the development of the power sector itself, and the driving force to improve the technical level of power grid management. In recent years, the state has been increasing investment in power grid transformation, including continuous upgrading in remote mountainous areas. However, limited by regional conditions, the reliability of power supply system in mountainous areas is still lower than that in urban areas. Most mountain power grids take 110 kV as the power supply, and the power grid framework takes 35 kV substation and 35 kV line as the power grid network. The power supply lines are scattered, which is easy to produce a series of problems. Firstly, the unreasonable power grid structure, the weak power grid framework composed of substation and transmission line in mountainous area, unstable voltage and other reasons lead to the limited power transmission. Secondly, with the influence of different seasons in mountainous areas, it will also affect the power supply system, resulting in larger load. Finally, the power customers in mountainous areas are generally scattered, the lines of the power supply system need to be extended, and the power supply branch lines will also increase. This decentralized power supply greatly reduces the reliability of the power supply system

2. Influencing factors of power supply reliability of Mountain Power Grid

2.1 Frequent faults and low equipment level

Affected by the region, the equipment performance of power supply system in mountainous area is low. Because most of the power supply system in mountainous area is in the field, it is easy to cause equipment aging and failure, and the renewal cycle of equipment in mountainous area is long, which increases its risk and reduces its service performance. There are many equipment points and a wide range of power grids in mountainous areas, and there is a long-term shortage of personnel in grass-roots power supply stations. When equipment problems occur, they can not immediately arrive at the site for emergency repair, which has a serious impact on the reliability of power grid power supply system.

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2.2 Unreasonable power grid design framework

As the 110 kV dual power supply is adopted for the substation in mountainous area, but in fact, more substations are 35 kV, resulting in a small number of 35 kV substations in the area, so the output transmission lines are also reduced. This phenomenon causes the power supply range of mountain power grid to increase and there are more branches. With the increase of branches, the section switches are reduced, resulting in a large power supply range controlled by a main line. This power supply mode is prone to overload. When the number of users increases, it will do harm to the aging power supply system and greatly reduce the reliability of power supply. Once there is a problem with the line, the scope of power failure is generally too large.

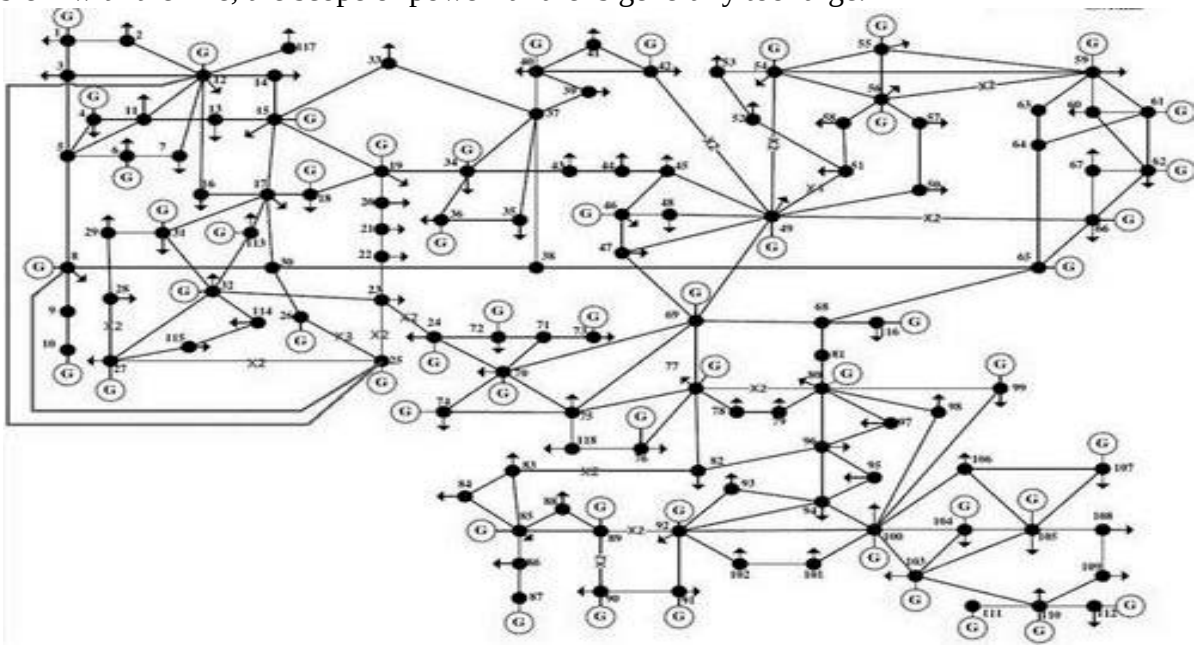

Figure 1 Power grid design framework design

2.3 The system is not perfect and the maintenance of power supply equipment is not timely

Due to remote transportation and lack of resources in mountainous areas, it is difficult to manage the power grid uniformly, and it is not easy to reach remote areas. The maintenance personnel of the power supply station need to spend a lot of time on the road, and the progress of patrol inspection and maintenance is slow. Once there are problems and potential safety hazards in the power system, it is difficult to carry out maintenance in time. Moreover, there are certain restrictions on the entry of power grid maintenance equipment into some mountainous areas, resulting in the power supply department being more passive during power grid fault emergency repair, which greatly reduces the emergency repair efficiency. Once the power failure lasts for a long time, it will not only affect the normal life of residents, but also affect the sustainability of power supply and reduce the reliability of power supply.

2.4 Damage of power grid caused by external factors

Because the power supply equipment of power grid in mountainous areas are mostly outdoors, the damage caused by natural and human factors accounts for a high proportion. Transmission line equipment is more prone to failure under adverse natural conditions, such as rainstorm or ice and snow weather. Most of the damage caused by human factors is the damage to the cable during underground excavation. This external factor causes power grid failure in mountainous areas. Blackout is one of the most common fault types, and it is also the most common factor affecting the power supply reliability of power grid in mountainous areas.

2.5 Inadequate planning and measures

Power grid construction is constantly improving and developing, and in the process of optimization, power facilities must be updated. During the project construction, planned power

failure will occur. Due to the remoteness of mountainous areas, the power supply cannot be restored immediately after the power equipment is upgraded, resulting in a long power failure time in mountainous areas and reducing the reliability of power supply.

2.6 The automation equipment of power grid in mountainous areas is low

In recent years, with the improvement and development of information technology, the power supply system is also upgrading, and the automation of power supply system has been gradually realized in the urban area. However, in remote mountainous areas, affected by regional influence and inadequate management, there are few advanced power supply equipment in mountainous areas, the technology is not perfect, the operation effect is low, and it is difficult to troubleshoot in case of failure, which reduces the reliability of power supply system of power grid in mountainous areas.

3. Effective countermeasures to improve the reliability of power supply in Mountainous Areas

3.1 Improve the management system of power supply enterprises to ensure the reliability of power supply

Power supply enterprises should establish relevant management systems and assessment systems for power supply reliability, classify the construction, production, marketing and other links in the process of power supply into the scope of assessment, divide these assessment factors into specific departments and teams, specify relevant responsibilities to individuals, and conduct assessment in strict accordance with relevant indicators and measures, Form a situation in which all staff participate to improve the reliability of power supply.

3.2 Strengthen the treatment and management of various comprehensive power outages

Strengthening the comprehensive outage plan management plays an important role in solving the contradiction between power grid transformation and power supply reliability. The relevant power supply department shall make the power outage plan of the relevant main network and distribution network in advance, implement the monthly power outage coordination meeting, closely connect the main network with the distribution network, strictly eliminate the original habit of coordinating all departments before power outage, and ensure the close coordination and unified relationship between the main network and distribution network. In addition, the key links in the power supply process shall be clearly managed, such as temporary power failure rate, implementation rate of power failure plan, transfer power supply rate, etc., and the implementation of these links by different departments shall be tracked and checked, so as to effectively avoid the reduction of power supply reliability caused by inadequate process management.

3.3 Strengthen the management of power transfer

Power supply enterprises should improve the potential of power supply reliability from management, resolutely implement power transfer for those who can transfer power supply, and ensure 100% of power transfer, so as to enable users outside the scope of maintenance and construction to obtain reliable power supply. The current technology of switching from uninterruptible power supply to power supply has been relatively mature. Therefore, power supply enterprises should actively promote this technology, especially in mountainous areas with low power supply reliability, which is also an important symbol for power supply enterprises to reflect their service concept and consciousness.

3.4 Add 10kV outgoing line and tie switch to improve the transfer power supply capacity of power grid

In the current environment of rural power grid transformation, relevant power departments in mountainous and rural areas should, if conditions permit, add new 10kV lines, so as to change the original situation that one line supplies one area or even multiple areas, cut off the original power grid load, and make a reasonable distribution and balance of the number of users in a line, At the same time, reduce the area affected by normal power failure. In addition, necessary tie switches are

set at the cut-off points of the two lines, so as to form an organic whole and improve the transfer power supply capacity of the power grid.

3.5 Actively explore the reclosing technology of 10kV feeder with small hydropower on the grid

Reclosing technology is an important means to reduce the impact of fault outage. There are abundant small hydropower resources in mountainous areas. 10kV lines with small hydropower on the grid are put into reclosing, which has the risk of unsuccessful reclosing due to non synchronous reclosing of lines and impact on small hydropower units. According to the small installed capacity of small hydropower, the power supply department can select "non inspection reclosing" as the reclosing mode. When the small hydropower is disconnected from the main network, the generator overvoltage protection will cut off the machine and set the reclosing time to the maximum allowable setting time of the device. When the installed capacity of small hydropower is large, the reclosing mode is "non inspection reclosing", and the reclosing setting time is 0.8s. When the phase angle difference at both ends is not enlarged, reclosing is carried out to increase the reclosing success rate and reduce the impact on small hydropower units.

3.6 Actively apply new technologies and means in power grid

Actively promote live working. Live working is an effective measure to prevent maintenance and construction power failure of power grid, which can effectively ensure the reliability of power supply. However, due to the high hardware requirements of this technology and the professional skills and knowledge of relevant operators, this technology can be selected and carried out according to its own actual situation for mountain power grid. In addition, actively promote the equipment condition detection and maintenance technology, and vigorously promote the application of portable infrared imager in the power grid, so as to more efficiently predict the faults of various distribution equipment, especially before some power consumption peak periods. In addition, promote the live measuring instrument of grounding resistance of power grid grounding device, so as to find the hidden dangers in the power grid more timely and accurately, and take necessary measures in time to avoid the occurrence of power grid tripping caused by lightning stroke. Then accelerate the application of GIS operation and distribution integration platform, and establish the corresponding power supply reliability index record and analysis module. Then we can obtain basic data from the platform and real-time data from the production and operation system, and finally ensure the accurate recording and perfect preservation of various reliability indicators, and use these statistical data for more refined power supply management. Evaluate the user range and power supply reliability that may be affected by power failure in advance, so as to ensure the improvement of the whole power supply reliability. Finally, establish and improve the power supply department's power grid fault rapid restoration mechanism, optimize the whole management mode and process, use the above-mentioned integrated platform to improve the supervision level of the whole power grid, and ensure the rapid discovery, reporting, diagnosis, isolation and recovery mechanism of power grid faults.

3.7 Improve the working environment and strengthen user communication

As the power supply system in mountainous areas has long lines and relatively scattered lines, and the voltage is unstable at the end due to long-distance transmission, modern facility management should be used to improve production and office conditions. The office, tool room, reading room, intelligent archives room, monitoring platform duty room and other functional areas shall be configured in strict accordance with the unified standards of State Grid Corporation, and one table and one chair shall be placed according to the fixed position, so as to make the window clear, the ground clean and the things neat, so as to make the working area rigorous and orderly; Set up the exhibition hall of Xiaoqiang "sunshine" service team to show the style of the station; The first "circuit demonstration platform" to guide rural users to use electricity safely; Establish staff reading room, sports activity room and ball playground to provide employees with a good learning and sports environment and make employees feel at home. The power supply station should

actively expand the "offline + online" dual service channel, earnestly implement the "quick response" service mechanism of customer service offline, further improve the construction of convenient service points in administrative villages, and pilot mobile service stations to serve customers in remote mountainous areas; Online actively promote Internet plus service platform to customers, organize employees to enter streets, markets and campus to publicize WeChat public official account, so that customers can experience the convenient service provided by WeChat electric power without leaving home. Therefore, the power supply station should strengthen timely communication and regular visits with power customers (including production enterprises, village and town residents, etc.), understand customer needs and deal with problems in time. Effective and timely communication can avoid the dissatisfaction of power users caused by power failure caused by equipment or line failure and reduce complaint work orders.

4. Conclusion

With the continuous development of power enterprises and the gradual standardization and standards of management degree, the power supply reliability index of rural distribution network will be gradually improved from the current simple digital statistics to the fields applied to power grid planning, technical design and daily production, and the power supply reliability index will be improved year by year. Only by continuously improving the management measures and technical measures of power supply reliability, can we improve the best scheme to ensure the healthy operation of rural power grid, ensure that farmers can use "reassuring electricity and comfortable electricity", and enable power supply enterprises to embark on the track of benign development

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