Some problems existing in rural power grids in the new era and their upgrading and reconstruction

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Abstract. Since the reform and opening up, with the development of China's rural economy, the demand for rural electricity has increased, and the investment scale for rural power grid construction and transformation has also increased, but there are still certain problems in the process of rural power grid development. The rural production and living electricity is not fully protected, and the rural power grid is in an overloaded state, especially the low voltage problem is more prominent. In order to meet the sufficient electricity and electricity safety in rural areas, the rural power grid plan is still marked as a key construction project in the 13th Five-Year Plan. This paper mainly analyses the problems in the construction of rural power grids, and proposes corresponding improvement methods to promote safer, greener and more coordinated development of rural power grids.

1. Introduction

The transformation and development of rural power grids is an important step in improving rural infrastructure and plays a key role in rural construction, economic development, and agricultural production. Since the implementation of the rural power grid reconstruction and upgrading project during the “Twelfth Five-Year Plan” period, the rural power grid structure has been significantly improved, the power supply capacity has been significantly improved, and the management system has been gradually improved. Due to the limitations of natural environmental conditions and the weak awareness of the people's safety, rural electricity safety is not compatible with the growing demand for electricity. There is still a certain gap between urban and rural power service levels, and more power distribution failures and problems occur in rural power grids. In the stage of building a well-off society in an all-round way, the “13th Five-Year Power Plan” pointed out that the overall level of rural power grids still needs to be continuously improved, and a new round of upgrading and improvement work will be carried out. This paper mainly introduces the current situation of rural network development, analyses some problems existing in the construction, management and power security of rural power grids, and proposes improvement measures and optimization methods for the reasons.

2. Current status of rural power grid development

2.1. Insufficient power supply

With the economic development of our society, people's living standards are constantly improving, and rural electricity consumption is also increasing. The original power supply system of rural power grids can no longer meet the daily electricity consumption of rural production and living, resulting in
insufficient power supply capacity. On the one hand, the number of rural distribution transformers is insufficient, which has a certain impact on the daily life and production of villagers. Some of the low-voltage line wires in rural areas are too thin, which makes the power supply capacity insufficient, so that it can’t meet the current rural electricity demand, and in the production and life of residents. When it is used frequently, if it is overloaded, the thin wire will pass through a large current, which will cause the wire to overheat and even cause fire. On the other hand, the rural power supply lines are relatively scattered, the number of professional maintenance personnel is small, the work intensity is large, and the maintenance is difficult. When a power accident occurs, the problem cannot be solved in time, resulting in a long power outage, which further reduces the quality of rural power supply.

2.2. Rural power grids have low overall equipment levels
At present, the most important problem in the further development of China's rural electric power industry is the aging of power grid equipment and the inefficient use of equipment. The backwardness of equipment is not consistent with the development of the times, especially in the context of rapid development of the power grid, derailing with technology and networks. The slow development of rural power grid construction has restricted the development of rural areas. Most rural power grids in China use simple outdoor equipment substations. This substation has a long history of construction, poor performance, and high energy consumption. Most of the transformers have begun to age slowly, and the subscriber line and meter the equipment in the box and the meter box are severely corroded, the original insulation performance is lost, and various failures are easily caused. Some transformers need to be eliminated immediately or upgraded or re-constructed, otherwise it will cause rural power supply tension, cause safety accidents, and bring great inconvenience to the lives of farmers. Some rural electricity customers are extremely lacking in safety electricity prevention measures. In the household use, there are few line inspections and repairs. Wire aging, socket damage, and switch exposure are common problems, which may cause serious consequences.

2.3. Rural power grid planning confusion
Rural power grids usually use low-voltage lines for power distribution and are installed directly on the low-voltage side of the transformer. Affected by the chaos of the line, some transformers have safety hazards and increase the difficulty of maintenance. Moreover, due to the quality problems of many incoming lines, the grid often trips during operation. Therefore, in the process of construction and transformation of rural power grids, it is necessary to solve the problem of chaotic line planning in a timely manner.

Usually, rural power grids only install one or two transformers during power distribution. Therefore, the carrying capacity is not large enough to complete the power distribution task well. With the continuous increase in the number of rural enterprises and the continuous expansion of their scale, the electricity consumption in rural areas has also increased faster and faster, increasing the demand for substation capacity in rural areas.

2.4. Rural power grid stability is not good
The meaning of grid stability means that the power supply line can provide power transmission and supply services effectively and stably. Unstable power supply may cause losses to local economic and social development, and is also extremely disadvantage for the construction of new rural areas. The stagnation of construction and slow development will be the result of unstable power supply. On the one hand, due to the serious shortage of social security management in rural areas, incidents of stealing power grid facilities, equipment and wiring often occur, and a large number of wires stolen are often seen in the news. On the other hand, rural power grids are aging, equipment is old, and failure to maintain and replace them in time is the cause of instability in rural power grids.

3. Improvement and optimization of rural power grid planning
3.1. Strengthen power supply capacity
In order to effectively solve the problem of insufficient power supply in rural power grids, improve power quality, and reduce power loss during power supply, it is necessary to upgrade the overall power supply capacity of the power grid. Specifically, we can do it from the following aspects:

First, the rural power grid should increase the power supply node, reduce the power supply range, optimize the capacity of the distribution transformer, and adopt measures such as simplifying the voltage level. Second, the power supply equipment that has been scrapped or about to be scrapped should be inspected and replaced in time, and the aging equipment of the substation should be modified to improve the utilization rate of the equipment and realize the intelligent operation of the substation. Third, reduce the load, optimize the distribution network, improve efficiency, improve the quality and speed of repair. Fourth, the security personnel regularly inspect and repair the power supply equipment. Once problems are found, effective measures are taken to solve them in time to minimize power outages.

3.2. Increase capital investment in rural power grids
Before the power construction in rural power grid investment is far from enough to meet the needs of new rural development and construction, equipment aging and line failures occur frequently. Funding should be increased now to maintain and replace facilities, equipment and lines in a timely manner. At the State Council executive meeting, Li Keqiang pointed out that by adjusting the structure, increasing the arrangement of central government investment, and focusing on upgrading the rural power grid. In terms of the use of funds, it is necessary to strengthen management. It is strictly forbidden to embezzle public funds, and seriously implement rural power grid reconstruction projects to benefit the people. Raise funds through multiple channels, continue to arrange central budget investment to support rural power grid reconstruction and upgrading projects in the central and western regions, and raise project capital through various means such as project legal person's own funds, local financial investment or special construction funds. Power grid enterprises should increase capital investment in rural power grid construction and transformation. Local governments should use relevant financial funds and social funds in accordance with regulations, bear corresponding construction costs, and support the transformation and upgrading of rural power grids.

3.3. Rational planning of rural power grid structure construction
Reasonable planning of rural power grid structure construction is an important step in the transformation and upgrading of rural power grids. It can improve the operational safety of rural power grids and resist the ability of severe natural disasters such as strong winds and heavy rains, thus improving the reliability of power grid power supply. Accurately assess the future development of rural areas, improve the scientific and rationality of line layout and equipment selection through scientific argumentation, thus avoiding waste. At the same time, we should break through the regional restrictions in the past, coordinate the development of urban and rural power grids, and achieve the harmonious development of rural economy and society.

3.4. Improve the stability of power supply in rural power grids
In order to improve the stability and reliability of power supply, it is necessary to rely on the support of government departments and the active cooperation in rural areas, and the power grid construction can be carried out smoothly. In the management, the power company should formulate a strict power supply management method and assessment system; the power outage management should be prearranged, notify the individual in time, and make overall arrangements for the power outage maintenance plan; electric customers conduct safe electricity education, thereby reducing the serious consequences caused by equipment failure during personal power consumption; cooperating with the public security system to crack down on theft of equipment lines, and strengthening legal publicity to announce the seriousness of theft of power equipment. In the technical aspect, we will promote a new round of upgrading and upgrading work, optimize the power grid structure; strengthen the
management of substations, relay protection devices and roadside lines, and actively organize maintenance and inspections to improve the equipment's integrity and utilization rate.

4. Real case analysis of security incidents
On October 31, 2018, Chongqing and Wujiang Electric Power Company suffered personal injury and death. Causing 2 deaths. During the operation of replacing the lightning strike insulators, when two operators completed the lower tower, one person accidentally touched the electrified line and an electric shock occurred. The other person was frightened and fell from the tower, causing two deaths.

The accident exposed the following problems. First, the safety awareness is weak. The deceased did not take safety precautions during the operation, which seriously violated the safety regulations, and the safety awareness was weak. Second, the anti-violation work is not effective. As the person in charge of the work, he did not promptly discover and stop the violations of the deceased, and failed to accomplish the guardian responsibility. Third, the operational risk analysis is not in place. The deceased did not to realize the risk of this operation and did not take preventive measures. Such incidents exist every year, so each unit must attach great importance to the safety control of small scattered operations.

5. Conclusion
The transformation of rural power grids is the key to promoting the current development of rural economy. The important prerequisite for the transformation of rural power grids is to make a reasonable analysis of the status and characteristics of rural power grid reconstruction, and it is necessary to make reasonable solutions to the various problems that arise. Reasonable rural network transformation measures can not only improve the safety and stability of rural power grids, but also provide support for the construction of new rural areas in China to improve the living standards and quality of life of people in rural areas. It is inevitable to encounter problems in the process of rural power grid construction, but in the process of rural construction in the new era, we must actively participate in practice. Starting from practice, we will continuously improve the efficiency and quality of rural power grid construction, benefit the people and promote the construction of a new socialist countryside.

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