

On the Importance of Self owned Power Plants Participating in the Adjustment of Supply and Demand of Power Network under the Reform of Power System

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Abstract. Centralized power generation by self owned power plants of high energy consumption enterprises will lead to insufficient peak shaving capacity of the power grid. Once the self owned power plants have operational problems, they will easily lead to large-scale blackouts, which will have a great impact on power supply reliability. The national electric power system reform opinion points out that the regulation focus of ensuring the balance of power supply and demand in the power grid should be shifted from the generation side to the load side, and the potential advantages of self owned power plants that combine power generation resources with large loads can be utilized. Self owned power plants participate in the equal management and fair competition of public power plants, can better play its role while improving the supervision of self owned power plants, which is conducive to maintaining the order of the power market and improving the stability of the implementation of power reform.

1. Introduction

As the name implies, self owned power plant enterprises generate electricity for their own use, and generally do not enter the national grid to provide electricity for residents. Most of these enterprises are energy consuming enterprises, which generally have surplus heat energy or provide steam for power generation[1]. Self owned power plants are produced in a special historical period, which meet the economic development needs of industrial policies in a specific era. The self owned power plant has both power generation resources and a large number of loads, but it has been in the state of self use for a long time. Its potential as an available resource for the balance of power supply and demand of the grid has not been tapped. At the same time, the centralized power generation of the self owned power plant will lead to insufficient peak shaving capacity of the grid. Once the operation problem occurs, it will have a disastrous impact on the power supply reliability. Therefore, the operation supervision of the self owned power plant must be continuously strengthened.

The promotion of new power transformation has laid a strong policy basis for scientific guidance and standardization of the development of self owned power plants. *Several Opinions of the CPC Central Committee and the State Council on Further Deepening the Reform of the Electric Power System* clearly puts forward that "control the middle, open up both ends", and will introduce more market competition at the power sales side[2]. The implementation of power sales side liberalization has become the focus of power generation

enterprises. Enterprise owned power plants are an important part of China's power generation industry, and will also become a member of the power market reform to participate in market competition. *Guiding Opinions on Strengthening and Standardizing the Supervision and Management of Self provided Coal fired Power Plants* is a supporting document for the country to further deepen the reform of the power system and strengthen and standardize the supervision and management of self owned coal fired power plants. The introduction of this document is conducive to scientific guidance and standardization of the development of self owned power plants, promoting the equal management of self owned power plants and public power plants, achieving fair competition, effectively maintaining the order of the power market, and steadily promoting power reform[3].

In recent years, with the deepening of power system reform and the continuous improvement of marketization construction, some self owned power plant policies put forward by the state are being tightened step by step. The relevant guidance points out that no matter what the historical causes and institutional background of self owned power plants, they must stop their disorderly development, guide and standardize the development of self owned power plants, promote the joint management of all types of power plants, and popularize the auxiliary services of self owned power plants[4]. Deeply explore the regulation potential of self owned power plants, and carry out the strategy of self owned power plants participating in grid electricity and power interaction, which is conducive to strengthening the connection between the grid and self owned power plants, and

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improving the safety and reliability of self owned power plants and grid operation. The reasonable and reliable self owned power plant participating in the grid interaction strategy can strengthen the grid interaction and promote the safe and stable operation of the grid.

2. Development history and existing problems of self owned power plants

The development of self owned power plants in China can be divided into four stages: the first batch of self owned power plants were built by the government for specific industrial enterprises during the expansion of production scale; The second batch is at the weak stage of China's power infrastructure construction. In order to alleviate the problem of power shortage for large industrial users, the government encourages multi-channel financing for power generation and the development of local small thermal power plants; The third stage is to promote economic growth and create employment opportunities. The local government encourages the integration of self owned power plants and regional high energy consuming industries with investment promotion policies to make full use of local low-cost coal and other energy resources; The fourth stage is to standardize the operation and management of self owned power plants under the background of power reform and energy transformation[5,6].

Self owned power plants generally have low power generation efficiency of coal-fired units, idle environmental protection facilities and illegal operation. Taking Hebei Province as an example, according to the *Supervision Report on Air Pollution Prevention and Control Sites of Electric Power Enterprises in Hebei Province* issued by the National Energy Administration, in 2013, the average coal consumption of self owned generating units of 100000 kW and below in Hebei Province was up to 384.5 g/kWh, much higher than the average coal consumption of 321 g/kWh of coal-fired units nationwide. Some self owned power plants adopt intermittent operation of environmental protection facilities to reduce operating costs; Some self owned power plants for comprehensive utilization of resources adopt coal blending incineration measures to increase power generation and utilization hours; Some cogeneration units fail to meet the heat to power ratio and thermal efficiency standards set by the state[7]. These illegal means enable some enterprises with their own power plants to obtain lower power consumption costs than similar enterprises, gain unfair competitive advantages, hurt the enthusiasm of public power plants and the whole society to implement energy conservation and emission reduction, and will have a negative impact on the country's prevention of air pollution and building a harmonious society of ecological civilization.

Self owned power plants in some regions also have some outstanding problems, such as large proportion of power generation, bad operating environment and low level of safe operation. On the one hand, a large number of self owned power plants generate electricity in a centralized manner, resulting in insufficient peak shaving

capacity of the power grid. Once operating problems occur, it is very easy to cause large-scale blackouts, which will have a significant impact on social stability. In some regions, for example, the installed capacity of self owned power plants in Xinjiang accounts for 26% of the total installed capacity in the region, and the average annual utilization hours of power generation is nearly 1493 hours higher than that of public units; In 2014, in Gansu Province, two thirds of power generation enterprises shut down in turn, while self owned power plants were basically fully operated; Heilongjiang and Jilin have insufficient peak shaving capacity due to their own power plants. Especially in the winter heating period, it is difficult to arrange the minimum startup mode, which reduces the safe operation level of power supply and consumption[8,9]. In some regions, enterprises rely on their own power plants to build power grids in violation of regulations, or even cross with public power grids in violation of regulations, which brings serious hidden dangers to the safe operation of power grids. On the other hand, enterprises with their own power plants are often important users above the national level II, and have a large number of important loads that can not be interrupted to supply power. However, the operation level of their own power plants is relatively weak, especially the self owned power plants operating in isolated networks. Without the backup of the power grid enterprise system, the safety problems of their own power plants are extremely prominent.

For the government funds and surcharges unpaid by the self owned power plants, the collection of system reserve fees needs to be further standardized. In order to promote the development of public utilities and maintain a fair market order, the State makes reasonable compensation for the power consumption of key people's livelihood such as agricultural production, residents' lives and remote areas, and clearly stipulates that self owned power plants need to bear funds and surcharges, and pay system reserve capacity fees. The actual implementation effect of self owned power plants is not good. Some self owned power plants with comprehensive utilization of resources and cogeneration refuse to pay on the pretext that the relevant national ministries and commissions have differences in the project and scope of government fund collection for such self owned power plants; Some provinces and cities have even made it clear in the local implementation rules that they will not levy or only levy a few of them, especially for self owned power plants operating in isolated networks, and will not pay any government funds; Some enterprises refuse to pay the reserve capacity fee of their own power plant system[10]. The behavior of these enterprises and self owned power plants has destroyed the market order of fair competition, evaded the national obligation to subsidize the people's livelihood, damaged the national interests, and played a negative role in guiding, which has led some public power plants to request to turn to self owned power plants to avoid fees.

3. Necessity Analysis of Self owned Power Plant Participating in Supply and Demand Regulation of Power Grid

The self owned power plant has now reached a critical period of decision. It will continue to face challenges in environmental protection supervision, supplementary payment of energy efficiency supervision funds, safe operation and other aspects. If it is closed for operation, the business development of the enterprise will be changed or even difficult to sustain. Self owned power plants are mostly multi energy cogeneration, with the effect of comprehensive utilization of resources. They play an active role in comprehensive utilization of resources, easing the contradiction between power supply and demand, and improving the economic benefits of enterprises. In the face of the continuous promotion of power system reform and the continuous improvement of market-oriented construction, self owned power plants need to be rectified in an orderly manner. Their participation in power grid supply and demand regulation is of great significance in improving the efficiency of energy comprehensive utilization, improving the supply and demand balance of regional power grids, and improving the energy consumption and environmental protection level of self owned power plants.

It is conducive to tapping the huge potential of self owned power plants in supply and demand regulation and improving the comprehensive utilization efficiency of energy resources. The research on the behavior characteristics and flexibility evaluation methods of self owned power plants can effectively tap and utilize the potential of self owned power plants in supply and demand regulation. The comprehensive utilization of resources can be realized by mastering the operation technical characteristics and comprehensive utilization of resources of the self owned power plant, formulating the grid safe operation management strategy, analyzing the behavior characteristics of the self owned power plant based on the collected data and using the data analysis method, and establishing the flexibility evaluation index system and evaluation method for the self owned power plant to participate in the grid interaction. It will lay a foundation for self owned power plants to orderly participate in project market and auxiliary service transactions. To some extent, it can also smooth the power demand curve of the power grid and improve the economic operation level of the power grid.

It is conducive to promoting the government to establish a mature and perfect market mechanism, assisting in solving the imbalance between supply and demand of regional power grids, and providing relevant policy recommendations to the government. The establishment of the market mode for self owned power plants to participate in grid auxiliary services and the proposal of the technical specification for self owned power plants to participate in flexible interaction can effectively guide self owned power plants to reasonably participate in power market transactions, and promote self owned power plants to participate in the real-time supply and demand balance of the grid by market-oriented means.

By proposing the price mechanism that the power grid provides reserve capacity, reserve electricity and reliability for users of self owned power plants, the self owned power plants are encouraged to actively participate in the interactive market of the power grid. At the same time, in case of large renewable energy generation in the distance, greater renewable energy can be absorbed through the interaction between the self owned power plant and the power grid to help solve the imbalance between regional supply and demand.

It is conducive to improving the professional operation and management level of self owned power plants, improving the high energy consumption level of self owned power plants, and improving the environmental protection level of the whole society. The establishment of market mechanism and platform for flexible interaction between self owned power plants and power grid supply and demand can improve the environmental protection level of self owned power plants. By strengthening the overall planning and access standards of self owned power plants, strengthen operation management and energy efficiency and environmental protection supervision, use national industrial policies and energy efficiency and environmental protection standards to force self owned power plants to form a benign development mechanism, improve the professional operation management level and supervision ability of coal-fired self owned power plants, improve the energy consumption level of self owned power plants and reduce environmental emissions; By promoting power generation enterprises to participate in direct transactions with users, and on the basis of implementing the social responsibilities of self owned power plants such as government funds, policy based cross subsidies, and pollutant emission control, we will give full play to the power generation cost advantages of clean and efficient units, and improve the environmental protection level of the whole society.

It is conducive to improving the overall power service quality of the public and promoting social and economic development. The establishment of a flexible interactive platform between self owned power plants and power grid supply and demand can effectively improve the energy efficiency of self owned power plants. The establishment of an interactive potential assessment model can effectively monitor the environmental friendliness of self owned power plants and improve the environmental protection level of self owned power plants. At the same time, the research on the market mechanism of flexible interaction between self owned power plants and power grids can promote self owned power plants to participate in the real-time supply and demand balance of power grids through market-oriented means, It ensures the overall power service quality of the public under fault and stress conditions. The establishment of market mechanism can also provide relevant policy recommendations for relevant government departments to formulate policies on self owned power plants.

4. Summary

This paper describes the development history and existing problems of self owned power plants, and analyzes the importance of self owned power plants participating in the supply and demand regulation of the power grid in combination with the new power reform policy. The development direction of the supply and demand interaction between self owned power plants and the electricity market is clear, but through the analysis of existing research results and the investigation of several self owned power plant projects, it is found that due to the imperfect method system of flexible interaction design and operation optimization between self owned power plants and market-oriented supply and demand regulation, the actual operation effect of most demonstration projects has not reached the expected goals. The main reasons are as follows: the theoretical research on the behavior characteristics and flexibility evaluation methods of self owned power plants is still insufficient, and there is a lack of detailed operation technology characteristic model of multi type self owned power plants, leading to the lack of planning means; Inadequate evaluation and analysis of power generation and consumption behavior characteristics of self owned power plants, lack of analysis of online monitoring technology and external related data, resulting in unclear objectives for flexibility improvement; The research on the operation method of market mechanism coordination and optimization is insufficient; Inadequate policy guidance and low willingness of self owned power plant users to participate in market-oriented supply and demand interaction services. Therefore, it is the focus and direction for self owned power plants to participate in the research on power grid supply and demand regulation to carry out research on the operating characteristics, evaluation, market mechanism, etc., and to form an operable and scalable evaluation system and market mechanism based on the results of theoretical and technical research of demonstration projects.

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