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Research on Power Optimization Operation Based on Computer Analysis of Energy Saving Dispatching and Demand Side Management

Zhaoguang Yang¹, Mingyuan Ren², Juan Shao¹, Jiongxuan He²

¹State Grid Gansu Comprehensive Energy Service Co, Ltd. China
²Gansu Electric Power Company of State Grid Marketing Department, China

*Corresponding author e-mail: mingyuan@gansu.epc.org

Abstract. At present, the energy-saving application of power system has become an important means to ensure the sustainable development of social economy. However, there are still many deficiencies and problems in energy-saving dispatching and demand side management of power system, which urgently needs innovation and improvement. Based on this, this paper first analyzes the development status of energy-saving power operation mechanism, then studies the power operation optimization based on computer-based energy-saving dispatching, and finally gives the power operation optimization strategy based on power demand side management.

Keywords: Power Optimization Operation, Computer, Energy Saving Dispatching, DSM

1. Introduction
With the iterative development of social economy, the increasing demand for energy has led to a series of energy problems, such as the increasing consumption of fossil energy and land resources, leading to the lack of sustainable contribution to social and economic development. Especially for China, which is short of fossil energy, it faces the pressure of fossil energy reserves, production capacity, transportation capacity and environmental capacity, and the excessive development of energy leads to the transition from flow restriction to stock limit [1]. In this context, saving energy and improving energy efficiency have become an important task to ensure energy security. The energy-saving application of power system has become an important measure to ensure the sustainable development of social economy. To apply energy-saving thinking to power system, we need to make efforts at the level of power generation dispatching and demand side management, so as to reduce energy consumption and environmental impact in the process of stable operation of power grid.

On the other hand, with the progress of computer tech represented by intelligence, its intelligent application in power grid energy-saving dispatching effectively promotes the energy-saving, economic and stable operation of power security [2]. Under the concept of intelligent energy-saving dispatching of power grid, it is required to give priority to renewable power generation energy, and the operation equipment in the power grid system should be ranked according to their energy consumption level and pollutant emission, so as to realize the optimization of resource utilization and the minimization of...
environmental pollution. Under the optimal thinking of energy-saving dispatching, the generating units with low energy consumption and low pollution should be given priority and more arrangements should be made for power generation, so as to promote the construction of an intensive society.

In addition, as an operation mode with the characteristics of network industry, the operation of power grid enterprises is affected by many factors as shown in Figure 1 below, only by fully investigating and understanding the user's demand and energy-saving potential, can it carry out DSM with the goal of energy conservation and emission reduction while realizing the optimization of power grid dispatching and reducing energy consumption [2]. As a complex system engineering, to carry out the optimal operation of the power system requires the organic integration of many factors, so as to improve the comprehensive energy efficiency of the system. This requires to realize the comprehensive coordination of various resources in the system within the limited cost, and realize systematic energy saving.

![Figure 1. The operation factors of power grid enterprises](image)

At present, there are still many deficiencies and problems in energy-saving dispatching and demand side management of power system, which are embodied in the interchangeability of internal resources and the sharing of resources [4]. On the one hand, the reliability and stability of power supply are affected; on the other hand, the distribution of power load in time and space is seriously unbalanced and uneven on the demand side. With the gradual maturity of computer analysis tech, smart grid plays an important role in promoting bidirectional interaction with energy flow, guiding demand side load reasonably, and encouraging demand side load to participate in optimal dispatching operation of power grid, and has become the future development trend and direction. Therefore, it is of great practical value to optimize power operation based on energy-saving dispatching and demand side management based on computer analysis.

2. Development status of energy saving power operation mechanism

2.1. The necessity of developing energy saving power operation mechanism

With the rapid development of social economy, energy conservation and emission reduction in the power industry is gradually in-depth promotion. The national average power supply coal consumption, line loss rate and pollutant emission level have steadily decreased, and the proportion of ultra-low emission transformation of coal-fired power units has further increased. With the deepening of domestic carbon market construction, the pressure of carbon management in thermal power industry is increasing [5]. At present, clean energy mainly composed of hydropower, solar power and wind power has been widely applied and developed. The installation of various types of generating units is shown in Figure 2 below.

As a complex system engineering, the development of energy-saving power operation mechanism requires the government, the association and energy-saving enterprises to form a joint force. In this process, power grid operation enterprises should strengthen their own strength [6]. With the adjustment of national energy conservation and emission reduction policy and the change of industrial structure, power grid operation enterprises should also adjust their own business model, broaden the
field of energy conservation and environmental protection, pay attention to the development of tech and products, and strengthen the internal risk control system of the company. In order to avoid the risks in power energy management projects, it should change our innovative thinking and develop new models to enhance our ability to resist risks and adapt to market demand.

![Figure 2. The installation of generating units in last 4 years](image)

In addition, China's power consumption is large and growing rapidly. The development of energy-saving power operation mechanism is suitable for China's overall development strategy and is conducive to the coordinated and sustainable development of economy, energy and society. At present, the domestic power efficiency is low, and there is a significant gap with advanced countries. There are a series of problems such as high resource consumption, high environmental pollution and high investment [7]. On the other hand, China's electricity saving market potential is huge, social benefits and economic benefits are considerable, so the development of energy-saving power operation mechanism is a necessary condition to realize the sustainable development of electric power.

2.2. Development status of energy saving power operation mechanism

At present, with the optimization and adjustment of the domestic economic structure, the downward pressure on the economy is constantly increasing [8]. In the context of the spread of the new epidemic, domestic economic growth is expected to continue to decline. In the level of social electricity demand, the development environment of power enterprises is more complex.

![Figure 3. The relationship between electricity consumption and economic growth](image)
At present, the power consumption of the whole society is growing steadily, and the power consumption structure is continuously optimized. As the power demand involves all walks of life in the whole society, there is a strong correlation between the growth rate of general electric power and the growth rate of GDP [9]. However, under the situation of the transformation of new and old kinetic energy, the growth rate of electricity consumption has gradually increased and is decoupled from economic growth, as shown in Figure 3 above.

In addition, the electricity consumption structure continues to be optimized, the national installed capacity and growth rate of power generation are slowing down, the proportion of clean energy installed capacity is further increased, the green transformation of power generation installed capacity continues to advance, and the proportion of non fossil energy installed capacity is nearly half [10]. The new installed capacity of wind power continued to grow, the new scale of optoelectronics, nuclear power and hydropower decreased significantly, the overall balance of power supply and demand was maintained, and the average utilization hours of thermal power equipment decreased year on year. The main energy consumption indicators continued to decline, the power system reform was further promoted, the growth rate of power consumption was stable and slowed down, the growth rate of power generation installed capacity was basically stable, and the proportion of non fossil energy power generation capacity continued to increase. The transformation and upgrading of major electric power enterprises will promote the overall improvement of industry benefits.

3. Power operation optimization of energy saving dispatching based on computer

3.1. Principle of energy saving power generation dispatching based on computer
On the basis of ensuring the power system safety of power grid operation enterprises and the stable operation of power grid, according to the basic requirements of energy conservation and environmental protection, the generating units are sorted according to the energy consumption and pollutant emission level, and the organic optimization and coordinated dispatching are carried out according to the sorting results. In this process, it needs to be combined with the power market demand and application potential, so as to reduce environmental pollution and energy consumption as much as possible. Secondly, based on the energy consumption ranking of various types of generating units, the generation sequencing is carried out according to the principle of giving priority to the use of low energy consumption and low pollution units. The ranking method is shown in Figure 4 below. In addition, based on the capacity of different types of generating units, priority should be given to the generation of large capacity units, and the corresponding optimization and energy-saving dispatching should be carried out according to the dispatching planning.

![Figure 4](image_url)

3.2. Index system of energy saving power generation dispatching based on computer
First of all, in the establishment of the index system, it is necessary to calculate the power supply cost of generating units, and the power supply cost calculation model of thermal power units considering environmental costs [10]. Secondly, the operation reliability of generator set is calculated, and the indexes are standardized from comprehensive equivalent availability coefficient, comprehensive
unplanned outage influence coefficient and auxiliary power rate. In addition, in order to construct the objective function of energy-saving power generation scheduling, an energy-saving generation optimal scheduling based on entropy weight and improved multi particle swarm optimization algorithm is established. At the government level, it is necessary to formulate corresponding optimization policies to reduce the losses caused by the use of energy-saving power generation dispatching by power enterprises, so as to stimulate the enthusiasm of power grid enterprises to carry out energy-saving power generation dispatching by computer means.

4. Power operation optimization based on DSM

4.1. Analysis of influence factors of DSM in computer smart grid

The main influencing factor of DSM under the computer smart grid is the orderly power users. In the classification level of orderly power users, the value of grid users should be classified, so as to provide classification basis for the optimal dispatching of power supply. For example, priority should be given to the use of electricity by residents directly related to people's livelihood, while the power demand of industries with high energy consumption and high pollution should be limited. In addition, the non power supply security users are classified according to the subordination relationship, and based on the load of power grid users and other factors, the order of power consumption priority among similar users is defined, and finally the evaluation index system of power consumption order of users is generated.

4.2. Improvement of DSM in computer smart grid

First of all, in the power DSM level of smart grid based on computer analysis tech, it is necessary to use and allocate power resources reasonably. Secondly, on the DSM mode level under the computer smart grid, mainly through the use of load response control tech, intelligent equipment control tech and distributed energy access tech, to adjust the implementation price to balance the power load, improve the level and efficiency of power DSM, and improve the security, stability and economy of power grid system operation. In addition, in the level of DSM improvement measures under the computer intelligent power grid, it is necessary to strengthen information sharing, promote user participation, establish a reasonable electricity price system, and promote the construction of automation system and the development and utilization of new energy.

5. Conclusion

In summary, as a complex system engineering, to carry out the optimal operation of the power system requires the organic integration of many factors, so as to improve the comprehensive energy efficiency of the system. The application of energy-saving thinking to the power system is helpful to reduce the energy consumption and reduce the impact on the environment in the process of stable operation of power grid. This paper analyzes the necessity and current situation of the development of energy-saving power operation mechanism through the research on the development status of energy-saving power operation mechanism. Through the analysis of power operation optimization based on computer energy-saving dispatching, the principle and index system of energy-saving generation dispatching based on computer are studied. Through the research on power operation optimization of DSM, this paper analyzes the influencing factors of DSM and the improvement strategy of DSM.

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