

Research on cost analysis of new power system under dual carbon target

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Abstract: Under the influence of the concept of sustainable development, how to build a clean, low-carbon, safe and efficient modern electric power energy system is the focus of innovative development of new electric power enterprises. Especially after the proposed dual carbon target, new energy in various countries shows an explosive growth trend, and the traditional fossil energy power system begins to transform to a high proportion of new energy power system. Therefore, After integrating previous accumulated experience, China's electric power enterprises study the development path of new energy themed new power system from multiple perspectives. In this paper, based on the understanding of the current development status of new energy in China, according to the framework of new power system planning and development, the actual system cost expenditure is deeply discussed, and the future development trend is clarified based on the dual carbon development goal.

Key words: Dual carbon target; New energy; Power system; Cost analysis

1. Introduction

In the face of the challenges posed to human survival and development by global climate change, it is the basic consensus of all countries to adhere to green and low-carbon development and actively respond to climate change for long-term development. In September 2020, China proposed at the United Nations General Assembly that carbon dioxide emissions should reach their peak before 2030, and strive to achieve the "dual carbon" goal of carbon neutrality by 2060. Then, put forward again in the 9th meeting of the central financial "double carbon" goal, and the important deployment of carbon and carbon neutral, both into the construction of ecological civilization in the overall layout, put forward to the new energy as the main body of the new type of power system, and to determine the "double carbon" under the background of the main development direction of electrical energy transformation in our country. In the face of economic globalization, energy should be regarded as the main carrier and electricity as the main force to fully realize the goal of "dual carbon" development. Nowadays, fossil energy accounts for too much in China's energy structure, and the application efficiency of actual energy is low, which directly affects the high-quality development of China's energy. [1.2] Combined with the "dual carbon" goal, gradually improve the green and low-carbon market mechanism, accelerate the development of non-fossil energy, and comprehensively optimize the operation structure of new energy, which can promote the clean and low-carbon transformation of the power industry and improve the production and utilization efficiency of new energy.

Nowadays, in the context of energy transition, the installed growth rate of solar energy, wind power and other new energy sources in China is gradually exceeding that of traditional energy sources, and their proportion in the total installed capacity of national power generation will also increase accordingly. During the 13th Five-Year Plan period, the annual average growth rate of installed new energy power generation can reach 32%. According to the data provided by the National Bureau of Statistics, by the end of 2020, the installed capacity of new energy in China had reached 534.96GW, accounting for 24.32% of the total capacity. The proportion of the capacity of all kinds of new energy is shown in Figure 1:[3.4]

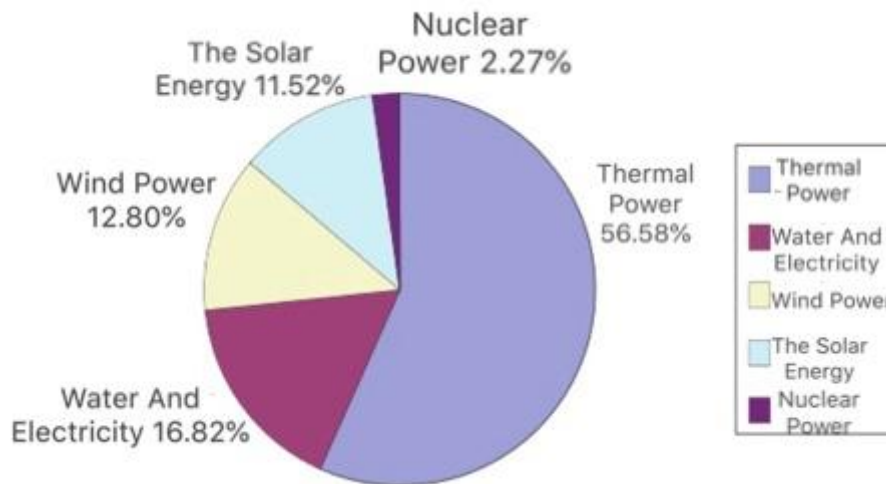


Figure 1 Proportion of China's installed power capacity in 2020

At the same time, in the gradual improvement of the number of new energy generation, the actual proportion will also increase. According to practical investigation and research, in 2020, China's annual total power generation will reach 7779300GW•h, and the amount of new energy generation will reach 727600GW•h, accounting for 9.36% of the total power generation. The proportion of capacity of various new energy sources is shown in Figure 2 below:

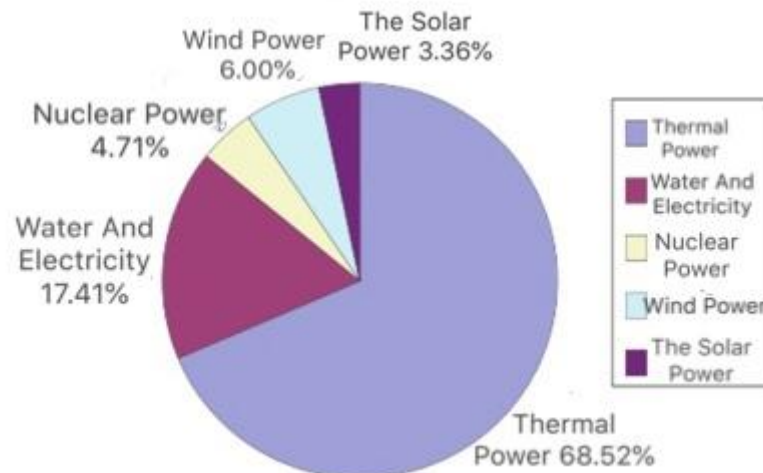


Fig. 2 Proportion of Electricity generation in China in 2020

The 14th five-year Carbon peak is an important stage, the development of new energy gradually entered the accelerated development period, both installed proportion and the number of power generation, have been greatly increased, the acceptance and regulation of the power system and other functional requirements are becoming higher and higher. At present, the existing power system cannot meet the multiple growth demand of new energy, so it is necessary to build a new generation of power system in line with the development of high proportion and large-scale renewable energy. Therefore, based on the understanding of the current situation of the development of new energy in China, this paper defines the structure of the new power system with new energy as the main body, and then takes the cost of the new power system in a certain area as an example, focusing on the analysis of the changing trend of the system cost, so as to clarify the operation measures of the new power system in China in the future.[5.6]

2. Method

2.1 New power system planning

After the new power system is proposed, and the new energy began to dominate, the corresponding technical characteristics, embodied in two aspects: on the one hand, the system can make full use of transmission channel, in the protection of renewable energy get interregional transmission at the same time, using the energy scale access technology, flexible technology, etc., to upgrade the grid to ideal electronic level; On the other hand, the characteristics of the system on the user side can be regarded as the coupling of the existing energy storage equipment and the new load, so as to ensure that the load can be accurately classified and effectively managed, and the utilization efficiency of relevant energy resources can meet the needs of users and reach the expected level.

Combined with the analysis of the framework diagram of the new power system shown in Figure 3 below, it can be seen that it contains the following contents:

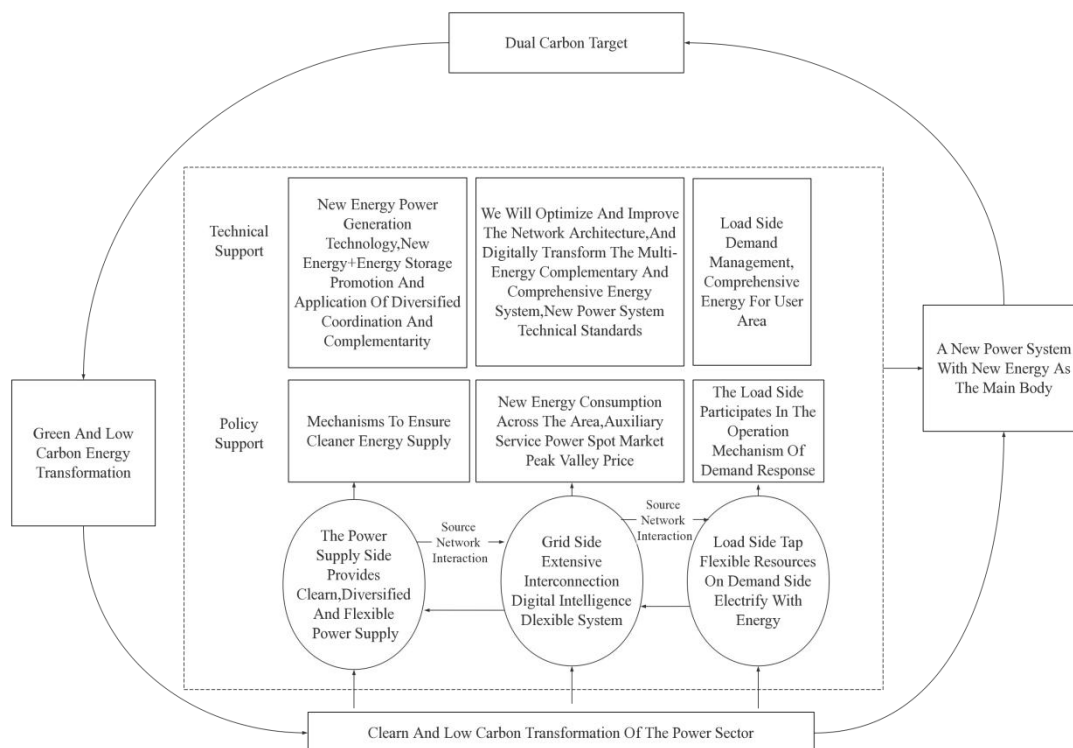


Fig. 3 Frame diagram of the new power system

First, carbon level evaluation. Carbon accounting is the core basis for quantitative evaluation of system carbon level. Using this method, a scientific and perfect evaluation system can be constructed. Secondly, source-charge prediction. A comparative analysis of the original power system and the new power system shows that the biggest difference between the two is that the latter has stronger randomness. On the consumption side of the power system studied in this paper, there are many new loads related to power grid dispatching. The capacity configured by energy equipment is generally affected by energy ratio, user demand and other factors. Therefore, based on the large-scale application of energy storage, deep research on load characteristics is the focus of the operation of the new system. For the above procedures, the electric power enterprise can be in big data and the support of artificial intelligence technology, using prediction method of deep learning, accurate prediction of micro system, to provide effective basis, such not only can long-term projections for multivariate composite and processing the data analysis, can also build can meet the demand of times development of electric power system model; Finally, low carbon market mechanism. According to the characteristics of energy Internet, a scheduling model that meets the demand side management needs is proposed, and the original economic scheduling and

carbon trading mechanism of the power system are integrated together. On the basis of this model, the economic value brought by carbon dioxide emissions is predicted.[7.8]

2.2 Development Objectives

Build a new power system with new energy as the main body, and the scale of new energy connected to the grid will continue to expand in the future. Nowadays, new energy has entered the development era of competition with traditional energy. From the perspective of system analysis, it can be seen that the effective capacity of photovoltaic power generation is low. Therefore, in order to meet the demand of power balance development, investment in reserve power capacity, flexible power supply, connection network and distribution network should be appropriately increased. The flow chart of power system development demand forecast is as follows[9]:

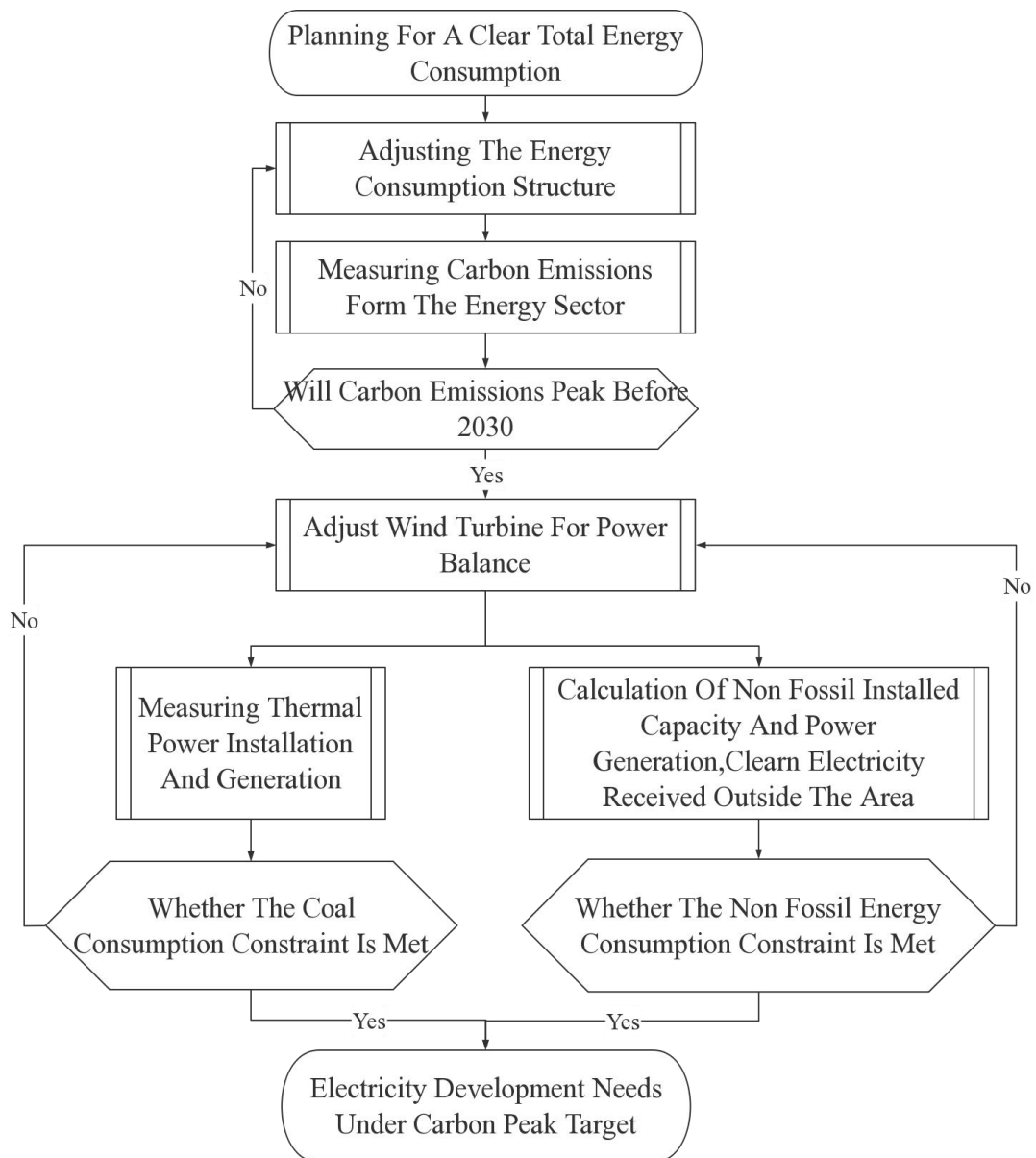


Fig. 4 Flow chart of power development demand forecast

3. Result analysis

3.1 Cost Analysis

The electric power development demand forecasting flow chart shown in Figure 4 is used for research and analysis, and the main factors affecting the cost of the electric power system are identified as follows: First, the cost level of major power supply projects. Under the trend of decreasing unit cost of wind power, technological progress is the key factor of wind power parity. With the continuous improvement of wind power technology, the independent manufacturing capacity of wind power will be improved. The policy environment of wind power value-added tax and income tax generally tends to be stable, which proves that the development prospect of wind power is very clear. Second, the power grid project cost level. The gradual rise in the price of wire, tower and other materials will promote a small increase in the unit cost of line engineering; Third, other influencing factors. With the continuous improvement of power grid dispatching and control level, there will be greater investment demand. In order to adapt to the double fluctuation of power supply survey and composite survey quickly, and improve the control level of complex and large power grid, it is the key and difficult point for the investment and development of power grid enterprises in the new era. Integrating the power grid control and regulation technology into the whole process, the integrated regulation of all voltage levels can be carried out. At the same time, the integration of innovative blockchain, human computing, big data, artificial intelligence and other new technologies can accelerate the pace of power grid scheduling technology iteration and upgrading.

From the overall research point of view, the on-grid electricity price is the development trend of rising first and then falling. Combined with the analysis of the characteristics of the new power system shown in Figure 5 below, it can be seen that, on the one hand, the price will gradually rise along with the proportion of paid quota in the carbon market, which is likely to increase the quotation of thermal power enterprises in the power transaction. On the other hand, subsidies for wind power and photovoltaic power generation will drop, and the feed-in tariff for incremental projects will be determined through competition, with the guide price lower than the original listed feed-in price. In the future, with the continuous expansion of market-based transaction electric quantity scale, the reform dividend will be released. It is estimated that the transaction price of market-based transaction electric quantity will be generally lower than the guiding electricity price. From the perspective of long-term development, in the innovation and development of modern information technology, the cost of new energy generation will continue to decline. Considering the low marginal cost of new energy generation, it is expected to reduce the on-grid electricity price. At the same time, in order to better meet the large-scale wind power photovoltaic development needs, there will be new investment demand in camera construction, energy storage construction and other aspects, and strengthen the investment in technological iteration and upgrading, power grid construction and other aspects, so as to reduce the construction cost based on technological progress.[10]

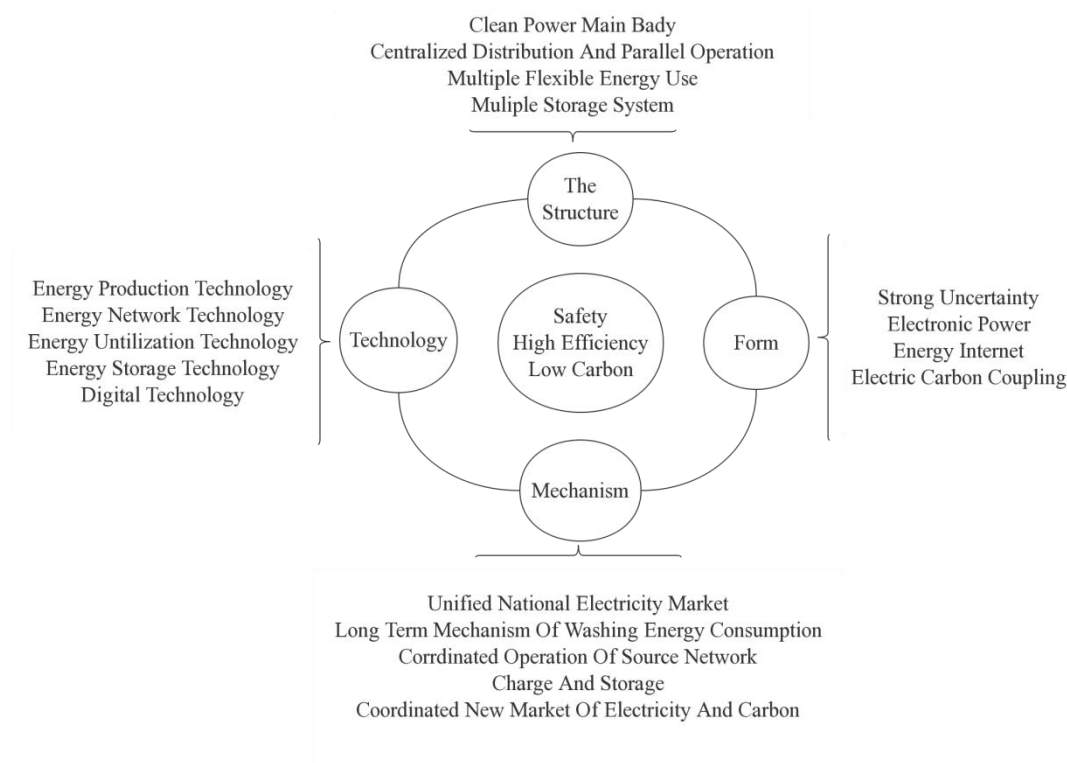


Fig. 5 Characteristic analysis of the new power system

3.2 Suggestions for the development of new power system

In order to achieve the development goal of carbon peak and carbon neutrality in China, the power sector should strive to achieve net zero emissions in advance and take the lead in reaching the peak. Among them, technological innovation breakthroughs are the basic conditions for the construction of new power systems, such as nuclear power and hydrogen energy and other technological innovations, which have a positive impact on the construction and development of new power systems. Although the future new structure form of the power system uncertainty, but the development direction of the next decade is clear, therefore our country should solve the traditional electric power system and the contradiction on the basis of a new type of power system development, correctly deal with the governance method, policy system, institutions and mechanisms and other issues, as a new type of power system cost analysis to provide effective basis. For example, in the planning mechanism, the development goals of energy economy, safety and environmental protection should be coordinated, and various reserve resources should be allocated in a coordinated manner. Based on the dual carbon target, the inverse driving of carbon neutral target is studied, and a refined operation simulation model is constructed for various energy storage planning schemes, so as to comprehensively evaluate the planning results. Under the operating mechanism, low-carbon power dispatching should be emphasized to ensure the safe and stable operation of dual-high power system. Promotion play in construction of power system, to focus on the high proportion of renewable energy grid safe operation of the problem, after deeply discusses kinds of low-carbon electricity technology and emission reduction strategy to coordinate with each other, the problems of clear understanding to the power system security and stability of equipment and the control measures, to improve the power system of the positive function of carbon reduction; In the market mechanism, it is necessary to speed up the construction of the national unified power system and comprehensively promote the coordinated development of the electricity and carbon market. The main reason for the lack of flexibility in China's electric power system lies in the lack of perfect incentive mechanism, which can not realize the asset value of flexibility, and all kinds of economic subjects have no power to provide flexible resources. Therefore, in the future

development of electric power industry, it is necessary to build an orderly, safe and efficient, unified and open electric power market system.

4. Conclusion

To sum up, in the context of the new era, the construction and promotion of a new power system in line with China's basic national conditions is an inevitable choice for the full implementation of China's new energy security strategy and the realization of dual carbon goals. When China proposed to promote the revolution of energy production and consumption, it built a safe and efficient energy system, and made clear the main direction of energy development in China under the era of innovation. Therefore, in the construction and promotion of the new power system under the dual carbon target, researchers and scholars should strengthen the study of system cost, pay attention to the development of the new power system to put forward clear suggestions, and pay attention to the training of professional and technical personnel, only in this way, can fully show the application value of China's new power system.

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