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DEVELOPMENT OF CHINESE ELECTRIC POWER

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Abstract. After 70 years of development, especially the 18th National Congress of the China, the development of China's electric power industry has entered a critical stage of transformation, adjustment and transformation. The qualitative development of the electric power industry is a development that reflects a new development concept, which must be implemented through qualitative changes in efficiency and capacity changes. It is necessary to deepen the reform of the electricity market and improve systems and mechanisms for the qualitative development of the electric power industry, scientifically resolve contradictions in the development of the electric power industry.

Keywords: electric power industry; quality development; electricity efficiency; power system reform.

РАЗВИТИЕ КИТАЙСКОЙ ЭЛЕКТРОЭНЕРГЕТИКИ

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Аннотация. После 70 лет развития, особенно 18-го Национального Конгресса КПК, развитие электроэнергетики Китая вступило в критическую стадию трансформации и корректировки. Качественное развитие электроэнергетики отражает новую концепцию развития, реализованную через качественные изменения эффективности и мощности. Необходимо углублять реформу рынка электроэнергии и совершенствовать системы и механизмы для качественного развития электроэнергетики, с научной точки зрения разрешать противоречия в развитии электроэнергетики.

Ключевые слова: электроэнергетика, качественная разработка, эффективность электроэнергетики, реформа энергосистемы.

Introduction.

Since the founding of the People's Republic of China 70 years ago, especially after the 18th National Congress of the Communist Party of China, China’s electric power industry has achieved rapid development and continuous breakthroughs, as well as great achievements that attract the attention of the whole world. These achievements underpin China’s economic development and the continuous improvement of people’s living standards. China’s energy industry ranks first in the world in terms of installed capacity, generated capacity, network scale, voltage class, clean energy production capacity and market transaction capacity [1].

Opportunities and challenges facing the qualitative development of the electric power industry.

The development of China’s electric power industry has entered a key stage of changing the development regime, adjusting the structure and changing the driving force. The features of new forces, green structures and intelligent systems are becoming more and more visible, presenting both opportunities and challenges. The electricity substitution policy represents important opportunities for the development of China's electric power industry. The development of China’s electric power industry is facing problems such as slowing demand growth, excess coal capacity, long-term pressure of clean transformation of the electric power industry, improving the efficiency of the energy system, as well as problems with the energy system and mechanisms. China’s energy industry is still unbalanced and underdeveloped in all aspects of electricity generation, transmission, conversion and distribution. There are weaknesses in the construction and management of electrical networks. The imbalance in the development of the main marketing network, retail network and agricultural network is obvious.

The pressure of China’s large-scale net transformation is enormous. Under the influence of coal stocks, the state of resources and the level of energy technology, coal energy will occupy a dominant position in China’s power structure for a long time to come. Coal has been dominating China’s power structure for a long time. Control over the development of coal-fired power contributes to the development of renewable energy sources, nuclear power and natural gas electricity generation [2].

Compared to most industrialized countries of the world, China's electric power industry is characterized by large scale and high share of coal-fired electricity generation, while small scale and low share of gas, electricity and nuclear energy, which leads to difficulties in providing environmentally friendly technologies. transformation of China's electric power industry. The structure of a country's energy supply may reflect to some extent the complexity of converting clean energy. The share of coal-fired power units may reflect the complexity of electricity conversion in the country. The higher the proportion, the greater the transformation pressure. In 2018, coal-fired electricity generation in China was still 66,5 %, which is much higher than the global average (38,0 %) and much higher than in the United States (27,9 %), the European Union (20,0 %), Russia (16,0 %) and other countries.

The share of gas-fired electricity generation may also reflect the complexity of electricity conversion in the country, that is, the lower this share, the higher the conversion pressure. In 2018, natural gas electricity production in China is only 3,2 %, which is lower than the level of gas electricity production in the world (23,2 %), lower than in the USA (35,4 %), Russia (46.9 %) and the UK (39,4 %), and the European Union (18,9 %), Germany (12,8 %), Japan (36,8 %) and India (4,8 %) depend on gas imports.

The development of waterless renewable energy sources is a trend of transformation of the global energy sector. The share of waterless renewable energy sources in electricity production may also reflect the complexity of electricity conversion in a country. The lower the ratio, the higher the conversion pressure. With 9,1 %, China is close to the global average (9.3 percent), slightly below the United States (10.3 percent) and well below the United Kingdom (31,6 %). China's nuclear power industry is 4,1 % lower than the global average (10,2 %), much lower than in the USA (19.0 %), the European Union (25,2 %), the UK (19,5 %) and Russia (18,4 %). This is also lower than in Germany, which plans to abandon nuclear power (11,7 %) [3].

The coal-rich structure of electricity production in China is directly related to the long-term growth model of energy supply. The expansion of China's production capacity, with the largest increase (72 %) in the period from 1949 to 2012 accounted for coal-fired power plants; Despite the fact that clean energy accounts for most (57 %) of new energy generation from 2013 to 2018, the growth of coal-fired power units was significant. This is different from the United States, which between 1949 and 1983 relied on coal-fired power plants for most of its economic growth; In the next four years, nuclear power will be one of the main factors in the growth of U.S. generating capacity; since then,

natural gas-fired electricity generation has become dominant, and almost all new generating capacity in the United States from 1990 to 2005 came from gas-fired power plants. Recently, wind energy has been a major factor in the growth of electricity production in the United States. years. As of 2018, the United States generates 7,1 times more electricity from natural gas and 3.0 times more from nuclear power. The reasons lie not only in the objective reality of the availability of energy resources, but also in subjective factors, such as the emphasis in China's energy development strategy and energy conversion policy. In addition, there is a large amount of sewage and problems with the landscape. In 2018, China will give up about 69,1 billion kWh of water, or 5 % of water. The rejection of wind load was about 27,7 billion kWh, while the rejection rate of wind load was 7 %; the rejection of light lighting is about 5,49 billion kWh, and the rejection rate of light equipment is 3 %.

Increasing the efficiency of the power system.

The qualitative development of the electric power industry is primarily reflected in the high efficiency of the power system. The efficiency of the power system can be measured by load and other indicators. The level of utilization of the Chinese power grid is low. Network load speed and line power factor are important indicators of efficiency on the part of the power supply. Currently, the problem of low-load transmission lines in China is quite acute, most lines have been in a low-load state for a long time. (1) The average load of transmission lines in China is only 8 %, while the reasonable average load of transmission lines in the conservative case should be about 40 %. (2) China's power transmission line capacity factor of 9,72 million kWh/km is lower than that of the USA (14,86 million kWh/km) and Japan (3,08 million kWh/km) [4].

The load level of the power grid decreases from year to year, and the difference between peak and minimum values becomes more and more. Download speed is an important indicator for measuring the effectiveness of demand management. The load rate is the ratio of the average annual load to the maximum annual load. The lower the load level, the greater the difference between the average and maximum load, the greater the difference between the peak and minimum values, the worse the efficiency and efficiency of the power system will be. In China, the difference between peaks and troughs is still huge. With the exception of the power grid of Northern China (32,5 %) and the Northwestern Power Grid (29,4 %), the difference between the peak and minimum values of other power systems exceeds 35 %.

Currently, the efficiency of data transmission in China still has something to work on. The network loss ratio is an important indicator for measuring

transmission efficiency. In 2018, the level of losses in China's power transmission lines was 6,21 %, which is the highest level in the world with the same load power density. However, there is a gap compared to the countries with the lowest net loss rates.

The system and mechanism of qualitative development of the electric power industry.

The existing pricing mechanism for transmission and distribution may cause an increase in investments in the energy system and lead to excessive investments. The reform of electricity transmission and distribution prices in China is still at an early stage, there are many problems in the supervision of costs and evaluation of electricity transmission and distribution, and the separation of transmission and distribution is not affected.

The reform of prices for transmission and distribution of electricity is the main content of the qualitative development of the electric power industry and an important means of improving the efficiency of the energy system. By increasing the efficiency of pricing in the transmission and distribution of electricity, it can direct the development of investments in electricity in a reasonable and efficient direction. At present, the price of transmission and distribution of electricity in China is based on the pricing method "permitted income = permitted costs + income", which to some extent leads to the transformation of investments of electric grid enterprises, effective investment, but also causes the enterprise's energy system to increase investment, expand the scale of assets, which leads to excessive investment. The data show that after a new round of electricity market reform, investments in the energy system continue to remain at a historical maximum. Since 2014, investments in electric networks have started to exceed investments in electricity supply, and their share has been increasing annually. The share of investments in the electric grid complex in the electric power industry was 52,77 %, 52,94 %, 61,44 %, 64,8 % and 66,4 %, respectively. Investments in the energy system have been increasing from year to year. In 2018, China's investments in electric grid projects reached a record level of 537,3 billion yuan. This phenomenon of high investment growth rates reflects the fact that the problem of distorted resource allocation in the current energy construction has not been solved and even tends to worsen. It also reveals internal contradictions in the existing mechanism of electricity pricing, indicating that the possibilities of state supervision are insufficient, and the level of monopoly enterprises is low [5].

The experience of building a spot electricity market is insufficient, and the standardization of electricity trading institutions has not yet been resolved. The

market reform of electricity sales is a full-fledged game of the market mechanism and an efficient electricity market, as well as the main content of high-quality electricity development. The lack of experience in the construction of the wholesale electricity market, the implementation of the transformation of the capital of the electricity trading center, the reform of the marketing of retail electricity supply were not on the agenda.

The purpose of creating a spot electricity market is to optimize the allocation of resources using a scientific mechanism for managing reasonable prices, which is an important part of the qualitative development of the electric power industry. However, due to this round of reforms, such phenomena arise as the seizure by electric grid enterprises of the creation of electricity trading institutions and the prevention of the creation of regional electric grid companies, as well as the delay in the trial operation of pilot areas of energy flow. Market and energy trading institutions of the unfavorable situation of reforming non-tradable stocks. All this shows that the promotion of the spot electricity market is very difficult.

Implementation of the path of qualitative development of the electric power industry. Stimulating the development of the electric power industry through technological innovations and institutional innovations.

Strengthening the basic technology of the electric power industry and investing in the research and development of key technologies, energy storage technology, ultraviolet radiation technology, nuclear equipment, gas power generation equipment technology, renewable energy generation technology, electric vehicles and basic technologies in the field of electric power, such as applied technologies of the highlands, can turn technical innovation into the basis of China’s energy development in the future.

It is necessary to break the monopoly and weaken the supervision of the electric power industry. It is necessary to standardize the energy system by reforming transmission and distribution prices and improve the efficiency of investments in the energy system. Creation and improvement of the electricity market, creation of a market pricing mechanism for electricity and creation of an electricity market system, including a wholesale electricity market, a capacity market and an interregional electricity trading market.

Improving the efficiency of the electric power industry.

Thanks to technological innovation and openness, technical efficiency, resource allocation efficiency and the overall factor productivity of electricity production, transmission and distribution and electricity consumption are

constantly improving. The efficiency of the electric power industry is one of the important indicators for measuring the quality of growth of the electric power industry of a country or region. On the one hand, compared to developed countries, technical efficiency, aggregate factor productivity and resource allocation efficiency in China's electric power industry are low. A large number of studies have shown that the ownership structure, the price of electricity, the price of coal and environmental regulation have a significant impact on the technical efficiency of China's electric power industry. The share of state capital in the electric power industry and the price of thermal coal negatively correlate with technical efficiency, while the price of electricity positively correlates with technical efficiency, and environmental regulation has an inverted U-shape. Technological progress, changes in technical efficiency, economies of scale and distribution efficiency are important factors affecting the overall factor productivity in China's electric power industry. On the other hand, due to the influence of the intensity of investments, the level of economic development and the conditions of placement, the technical efficiency of China's electric power industry demonstrates an obvious imbalance in regional development. Therefore, it is necessary to promote the reform of the energy system, technological innovations and openness to the outside world, as well as to constantly improve the efficiency of the electric power industry [6].

Establishment of a scheme for the coordinated development of various energy sources, coordinated development of urban and rural areas, balanced development of regions.

At present, efforts must be made to solve the structural problems of unbalanced development in all aspects of "distribution, transportation, transformation and distribution". In the electricity generation link, it is necessary to reasonably control the installed capacity of coal-fired power, as well as optimize and adjust the structure of power supply. As for the power system, it is necessary to optimize the structure of the power system, increase the level of intelligence and efficiency of the power system, as well as solve the problem of "unbearable" ultra-high voltage power lines. It is necessary to strengthen planning and reasonable assessment of construction needs, as well as coordinate the development of large electric networks, distribution networks and rural power grids. It is necessary to reform the electricity pricing policy, formulate the science of electricity transmission and distribution prices, create a reasonable and scientific pricing mechanism in the electricity market, fully use the price

lever for the supply of thermal energy, gold, silver, copper, promote the mechanism of load aggregation and other aspects of response measures.

Construction of an industrial system of environmentally friendly energy.

Continuing to increase the level of final energy and electricity consumption, contributing to the development of vehicles using new energy sources and the conversion of coal into electricity. The vigorous development of clean energy production, such as wind, photovoltaic, hydropower, nuclear energy and gas, and the constant increase in the share of environmentally friendly and low-carbon energy contributes to the development of the global energy Internet, the creation of a market mechanism to promote environmentally friendly electricity exports and increase the level of interregional and transnational electricity trade.

Conclusions.

Achieving the qualitative development of China's electric power industry is not only a matter of the development of the electric power industry itself, but also an important issue of China's economic transformation and modernization, as well as qualitative development. The qualitative development of the electric power industry is intensive and efficient development, innovative development, balanced development, green and ecological development. The overall goal of the qualitative development of the electric power industry is to make the transition from large-scale expansion to improving the quality of the power system, characterized by the establishment of clean, low-carbon and high efficiency.

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