

# *Analysis on the Key Influencing Factors of Power Generation Forecast of China's Power Generation Enterprises*

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**Abstract:** Under the current situation of accelerating and continuously deepening the construction of new power systems in China, the way of matching the basically measurable power system with an accurate and controllable power generation system in the traditional power system will no longer be applicable. The new system organization mode will change from "source follows load" to "source network load storage" interaction. Power marketing as the frontier of production and operation, under the background of building a unified national power market, carries out analysis and prediction system research on the power market supply and demand situation. It needs clarifying the medium and long-term power generation forecasting methods and models, which provides reference for the reform and development of the power market in the power industry, and is of great significance. The analysis of influencing factors is crucial to accurate forecasting of power generation. Therefore, this paper makes an in-depth analysis of the power market supply and demand situation of power generation enterprises in China and the influencing factors of power generation forecasting, and the purpose is providing a foundation for accurate forecasting.

## **1. Introduction**

Electric power is an important support for economic construction and an important pillar industry of the national economy. Rapid economic growth is the endogenous power for the growth of power demand [1], while providing safe and reliable power supply and ensuring the balance of power supply and demand have also become the basis and premise for the steady and healthy development of the national economy [2]. As one of the basic works of the power generation industry management department, power situation analysis and power generation forecast can directly bring significant economic and social benefits to power production, and play a very important role in energy conservation and emission reduction, resource utilization and sustainable development in China.

With the determination of China's carbon peaking and carbon neutrality goals, China's power generation industry continues the trend of green and low-carbon development, and the construction of new power systems has taken a new step. In recent years, with the transformation of China's new power system, more and more renewable energy, such as wind energy and photovoltaic power

generation, have joined the power market. Although renewable energy has brought a certain degree of cleanliness, its unstable power generation side has led to an increase in the volatility of traditional coal-fired power generation during supply guarantee. In 2021, China's electricity consumption will rise sharply [3], and the annual electricity consumption will achieve double-digit growth. Affected by multiple factors such as economic, weather, and rising coal prices, the overall supply and demand of electricity will be tight, and the price of electricity and coal market will continue to rise. In addition, in the first half of 2022, affected by the economic recovery and the cold current of low temperature, the demand for thermal coal increased significantly, and the supply of thermal coal was tight, pushing up the market price of thermal coal. In order to ensure the stable operation of coal power and other enterprises and the supply of coal, the National Development and Reform Commission recently requested that the number of medium and long-term contracts signed by coal enterprises should reach more than 80% of their own resources. Each medium and long-term contract for coal must specify the price level or implement the price mechanism within a reasonable range. However, the price level of power coal is still high on the whole, and coal power enterprises are still losing money in large areas. Since this year, the comprehensive price of power coal purchased by coal power enterprises has been higher than the upper limit of the benchmark price, and the unit price of standard coal delivered by large power generation groups has increased by 34.5% year on year. It is generally estimated that in the first half of the year, the cost of power coal purchased by national coal power enterprises has increased by about 200 billion yuan year on year due to the rise in the price of power coal. The purchase cost of electricity and coal has risen sharply, which is much higher than the increase in the price of electricity sold by coal power enterprises. As a result, more than half of the large power generation groups are still in a loss state, and some enterprises are short of cash flow. Under the new situation and the background of China's economic development, the forecast of power generation is very important for the power generation enterprises mainly relying on coal-fired power generation to manage their coal resource inventory and control the cost of power generation.

Accurate power generation forecasting is a very complex and difficult work. Due to the social nature of electricity, forecasting is subject to multiple interference from a large number of complexes influencing factors, such as weather, demand, spot, futures, economy, system, market, price, competition, policy, political activities, background, field, etc. However, most of the previous forecasting methods and models used their own data of power generation for forecasting, ignoring the important influence of these factors. Therefore, in recent studies, more and more researchers have found that if they want to improve the prediction accuracy in essence, they must consider more influencing factors scientifically, systematically and comprehensively.

## **2. Analysis of Influencing Factors**

There are three core issues in power situation analysis and power generation forecasting. One is to determine the influencing factors of power situation analysis and generation forecasting, the other is to select forecasting methods, and the third is to determine the parameter fitting of the forecasting model after the analysis of the forecasting model. Among them, the determination of influencing factors is the first and most important step. Therefore, the analysis of influencing factors is very important to achieve accurate power generation forecast. The influencing factors of power situation and power generation mainly include power generation timing itself, climate factors, economic factors closely related to power development, random factors and policy factors [4].

### **2.1. Power Generation Time Series**

It is the most common independent variable selected in the current prediction research to predict

the data of prediction points by using the self data in the power generation series that changes with time [5]. Since these independent variables have been deterministic values, the data of power generation is very easy to obtain. Moreover, because the power generation sequence itself has the characteristics of continuity and periodicity, we generally select the data of the previous time points and the data of the previous periods at the same time point when selecting variables [6]. It is described in mathematical language, that is, assuming that the generating capacity to be predicted is, the selected load variable can be recorded as  $l_{t-1}, l_{t-2}, \dots, l_{t-m}$  or  $l_{t-c}, l_{t-c*2}, \dots, l_{t-c*n}$ ,  $c$  refers to the time points of a cycle (for example, the cycle of monthly forecast is 12). Generally speaking,  $m < c$ .  $l_{t-1}, l_{t-2}, \dots, l_{t-m}$  refers to the data of the previous time point. These variables are used to predict the trend of extrapolation, while  $l_{t-c}, l_{t-c*2}, \dots, l_{t-c*n}$  refers to the data of the previous time point of the same cycle. These variables are used to predict the periodicity.

## 2.2. Climate Weather Factors

Climate weather factors is a common major factor closely related to the power situation, such as general temperature change, precipitation and wind speed. The impact of temperature is most obvious, especially in some extreme natural environments. In cold winter and hot summer, the power generation is significantly greater than that in other seasons [7]. As shown in Figure 1, power generation is high when the temperature is too high or too low. In addition, precipitation, solar radiation, wind speed, etc. will have an important impact on renewable energy power generation.

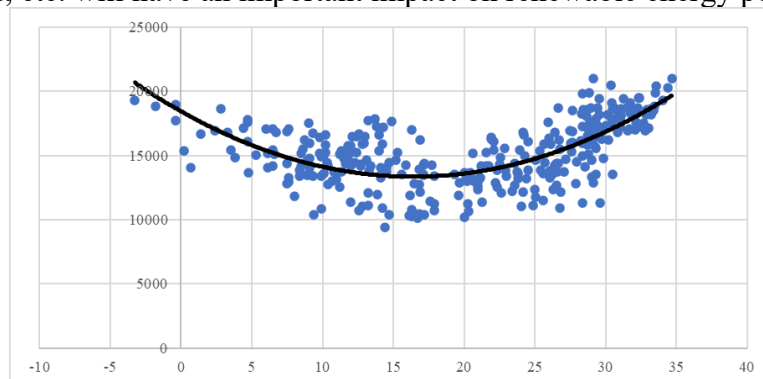


Figure 1: The relationship between temperature and utilization hours of power generation equipment

## 2.3. Economy

Macroeconomic situation is an important factor affecting power situation [8]. Under the influence of economic fluctuation, power load also shows obvious fluctuation. When the economic growth momentum is good, the power load increases rapidly. When the economic growth situation changes, the power load pattern also changes accordingly, and the corresponding power generation will also change with the economic situation. As shown in Figure 2, there is a linear relationship between power generation and GDP. It can be seen from the figure 2 below that  $R^2=0.9793$ , with good fitting effect. It can be seen that there is a strong correlation between macroeconomic and power load.

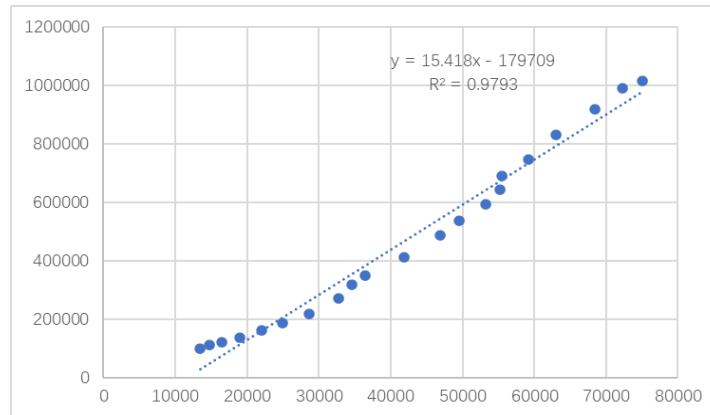


Figure 2: The relationship between GDP and power consumption of the whole society

Different economic structures have different industrial structures, and the power situation under different industrial structures is also very different. Industrial power consumption accounts for a large proportion of the power consumption of the whole society, which has always been the main factor of power growth. Generally, the greater the proportion of the secondary industry dominated by industry, the greater the power load and the greater the power generation.

## 2.4. Radom Factors

Due to the soaring international coal price and oil price, the cost of many equipment operated by oil, gas and coal also rose, and then turned to electricity. In addition, the contradiction between the current coal price growth and the poor coal quality also affects the economic benefits of power plants, leading to a large part of power plants are generating electricity at a loss. Power plants cannot ensure stable power generation and transmission, which also affects the power situation to a certain extent.

The COVID-19 has affected the relevant market of social and economic entities [9], thus affecting the relevant characteristics of power generation. However, the outbreak of the epidemic is difficult to predict, so it can be classified into random factors for learning and consideration.

## 2.5. Policy

Among the national policies, the power price policy, industrial structure adjustment policy, energy conservation and emission reduction policy, low-carbon economic policy, clean substitution and electric energy substitution have a great impact on the power situation analysis. These policies are the need to vigorously promote the development of green, low-carbon, environmental protection and efficient industries and promote supply side reform in recent years. Therefore, some industries with overcapacity, low added value, high energy consumption and high emissions will be restricted and phased out. For the provinces in the central and western regions of China where the high load energy industry accounts for a large proportion of electricity consumption in the whole society, the in-depth promotion of relevant policies will inevitably prompt relevant enterprises to carry out large-scale technological improvement, transformation and upgrading, which will lead to a decline in electricity consumption, which will have a greater impact on the power supply and demand situation and further affect the power generation of power generation enterprises.

## 3. Conclusion

This paper analyzed various influencing factors and their influencing mechanisms that affect the

power situation and power generation, including power generation timing factors, climate factors, economic factors, random factors and policy factors. Timing factors reflect the periodicity of power generation and the trend of extrapolation; the quality of macroeconomic situation reflects the status of power load, thus affecting power generation; climate factors directly affect power generation, and extreme high and low temperatures will greatly increase power generation; various energy conservation, emission reduction and low-carbon development policies further affect the power situation and power generation by limiting high energy consumption and high emission industries; under the influence of random factors, the power supply guarantee has a certain fluctuation, and the power supply and demand situation will change.

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