

# Research on Forecasting Method of Distribution Network Investment Scale of Municipal Power Supply Enterprise Considering Power Supply Division and Cost Difference Level

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**Abstract.** In recent years, in order to adapt to the situation of rapid economic and social development, my country's power supply companies have invested large-scale funds to build distribution networks, and upgraded urban and rural power grids, effectively supporting the rapid growth of power demand and the reliability of power supply. Continuous improvement of power quality. While the scale of investment in the distribution network continues to remain high, problems such as focusing on investment and neglecting revenue, focusing on project establishment and neglecting management also exist to varying degrees. Therefore, reasonably predicting the scale of investment in the distribution network and improving the lean management level of the investment and construction of the distribution network have become key issues that power supply companies need to solve. This paper takes my country's municipal power supply companies as the research object, combines the actual business development of the company's distribution network investment planning, and fully considers the impact of the company's power supply district management and the level of cost differences on the investment scale of the distribution network, and builds a fit on this basis. The distribution network investment planning forecast model of the actual business work of the enterprise guides the municipal power supply enterprises to improve the lean management level of the distribution network investment and construction.

## 1 Introduction

With the continuous development of my country's economy and the continuous improvement of power grid construction, distribution network investment and construction are gradually becoming the focus of power supply enterprises. Therefore, reasonably predicting the scale of distribution network investment and improving the lean management level of distribution network investment construction are important for improving the operating efficiency of my country's power supply enterprises.

Relevant scholars have done a lot of research on the forecast of power grid investment. Literature [1] first analyzed the main influencing factors of power grid company investment, and then used the support vector machine model to predict and analyze the investment scale of a certain city power grid company under different boundary conditions, and finally gave corresponding conclusions and suggestions. Literature [2] proposed a power grid investment portfolio forecasting model based on gray prediction, BP neural network, and multiple regression, and used the proposed combination forecasting model to predict power grid investment in a certain area. Literature [3] first explored the indicator system of external driving factors of power grid investment, from the

four aspects of power demand factors, grid security factors, energy transition factors and technological innovation factors, combined with gray correlation theory, screening key driving factors, and constructing provincial power grids. Long-term investment scale prediction model; finally, through the support vector machine algorithm, the investment scale of the provincial power grid from 2019 to 2022 is predicted. Literature [4] took the province A power grid company as an example, and proposed a power grid investment prediction model based on the asset wall theory. Literature [5] studied the influencing factors of power grid investment from the perspectives of macroeconomics and power market, and constructed a power grid investment prediction model based on the ARMA model.

To sum up, the current related scholars are more from the perspective of mathematical modeling, by analyzing the main factors that affect grid investment, and then constructing different prediction models to predict the scale of grid investment. However, this method does not fully consider the actual business development of power supply companies, and there is a certain lack of support for power supply companies.

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## 2 Major Problems Existing in the Investment of Municipal Power Distribution Network

At present, there are mainly the following problems in the precise control of investment in the distribution network of municipal power supply enterprises in my country:

(1) The numerous distribution network projects have increased the difficulty of investment management throughout the distribution network. In recent years, investment in the distribution network has entered the stage of large-scale and high-intensity construction. There are many distribution network projects. The entire process of management of the distribution network according to the accuracy of a single project requires a lot of manpower. The coexistence of load and heavy load, the problem of light load is prominent, the utilization efficiency of equipment is not high, and some automatic switches are built and not used.

(2) Regional differences make the contradiction between investment capacity and investment distribution gradually appear. City-level power supply companies have large regional differences, and there are large differences in economic development levels and industrial structure layouts between regions. In some areas, investment capacity is small, and the allocation of investment plans may exceed their actual investment needs, leading to investment in Type III and Type IV projects; In some areas, investment capacity is large, and the allocation of investment plans may not meet the actual investment needs, resulting in insufficient investment in Type I and Type II projects. In response to the problem of inadequate and uncoordinated development between regions, differentiated planning technical guidelines have been formed, but an investment strategy control model that takes into account regional development differences has not yet been formed.

(3) Lack of reasonable distribution network investment forecasting methods. At present, the investment management authority of distribution network projects has been delegated to the power supply bureaus of prefectures and cities, and there is currently no corresponding prediction method for the effect of investment on the power grid, which cannot support enterprises to scientifically carry out distribution network investment planning. How to reasonably predict the scale of investment in the distribution network and maximize investment efficiency has become a matter of great concern to municipal power supply companies.

Therefore, it is necessary to construct a reasonable investment prediction model that meets the actual investment planning business of the enterprise's distribution network investment planning in combination with the management of the distribution network construction of the municipal power supply enterprise.

## 3 Construction of Distribution Network Investment Forecast Model

### 3.1 Basic principles of the model

According to the actual management situation of municipal power supply enterprises, the investment in the construction of the distribution network can be divided into: investment in the replacement of existing assets and investment in new assets. The investment in the replacement of stock assets is mainly due to the long operating life of the stock assets, the high failure rate, and the failure to meet the operation requirements. The investment scale is mainly affected by the depreciation of power grid assets and the level of investment costs. The investment in new assets is more to meet the continuous growth of the electricity load and electricity consumption of the whole society, and the investment in new projects is mainly affected by the growth factor of the electricity load (capacity) of the whole society and the level of investment cost. Therefore, when constructing the distribution network investment prediction model, due to the full consideration of the differences and considerations between the two types of investment, a differentiated investment prediction method has been developed to meet the actual needs of power supply enterprises in the distribution network investment planning. The basic principle of the construction of the distribution network investment prediction model in this paper is shown in Figure 1.

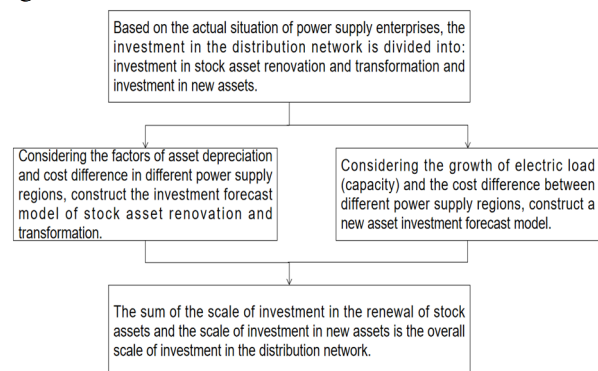


Figure 1. The principle of predictive model construction.

### 3.2 Predictive model construction

(1) Construction of the prediction model for the investment scale of stock assets

The replacement investment of stock assets is more to maintain the balance of stock assets. The stock assets of municipal power supply companies can be divided into four types: cables, overhead lines, public distribution transformers and low-voltage lines. Therefore, the investment scale of stock assets is the sum of the investment scale of stock assets of cables, overhead lines, public distribution transformers and low-voltage lines. The specific model is shown below.

$$Q_1 = \sum Z_i / h, \quad i = 1, 2, 3, 4 \quad (1)$$

In the formula,  $Q_1$  represents the predicted investment scale of stock assets in the distribution network,  $Z_i$  represents the predicted investment scale of different types of stock assets (cables, overhead lines, public distribution transformers and low-voltage lines),  $h$  represents the depreciation period.

$$Z_i = z_i * L_i (i = 1, 2, 3, 4) \quad (2)$$

In the formula,  $z_i$  represents the scale of stock assets of different types of stock assets (cables, overhead lines, public distribution transformers and low-voltage lines), and  $L_i$  represents the comprehensive cost of different types of stock assets in different power supply zones.

(2) Construction of the prediction model for the investment scale of new assets

$$Q_2 = G * k * f \quad (3)$$

In the formula,  $Q_2$  represents the investment scale of new distribution network assets of municipal power supply enterprises,  $k$  represents the comprehensive cost of unit capacity,  $G$  represents the capacity scale of public distribution transformer stock, and  $f$  load growth rate. Among them,  $k$  is the ratio of the total

value of the stock assets of each power supply district to the total capacity of the public distribution transformer.

(3) Construction of Forecast Model of Overall Investment Scale

$$Q = Q_1 + Q_2 \quad (4)$$

## 4 Empirical analysis

In this study, taking the investment in the renewal and transformation of the distribution network cable assets of a power supply company in a province C city as an example, the company's 2018 data was selected as the basic data for prediction, and the actual investment scale in 2019 was compared and analyzed to verify the validity of the model. It is known that the actual cable asset investment scale of the municipal power supply company in 2019 is 1,162,335,500 yuan. The basic data for 2018 is shown in Table 1.

**Table 1.** Basic data statistics of C enterprise in 2018.

Cable inventory scale (Km)	A+ power supply zone (Ten thousand yuan/km)	A power supply zone (Ten thousand yuan/km)	B power supply zone (Ten thousand yuan/km)	C power supply zone (Ten thousand yuan/km)	Dpower supply zone (Ten thousand yuan/km)	Depreciation period (year)
3684	195.43	210.22	205.26	190.63	198.75	30

According to the method provided by the forecast model, the comparison analysis of the estimated investment scale and actual investment scale of cable

stock assets of city C power supply enterprises in 2019 is shown in Table 2 below.

**Table 2.** Comparison and analysis table of predicted value and actual value.

Forecast investment scale of cable stock assets (Ten thousand yuan)	Actual investment scale of cable stock assets (Ten thousand yuan)	Deviation level (Ten thousand yuan)	Deviation rate (%)
122835.61	116233.55	6602.06	5.68

It can be seen from Table 2 that according to the prediction model studied in this paper, the deviation between the investment prediction scale of the distribution network and the actual scale is 5.68%, and the deviation rate is small, indicating that the prediction model has better prediction accuracy.

## 5 Conclusion

In order to improve the scientific rationality of the distribution network investment scale forecast, this paper combines the actual development of the distribution network investment planning of municipal power supply enterprises, comprehensively considers the type of enterprise distribution network investment and its influencing factors, and constructs a plan that conforms to the enterprise distribution network investment plan. Investment forecast model for actual business development. This model not only meets the investment planning requirements of the distribution network of municipal power supply enterprises, but also can effectively improve the lean management level of

enterprise investment.

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