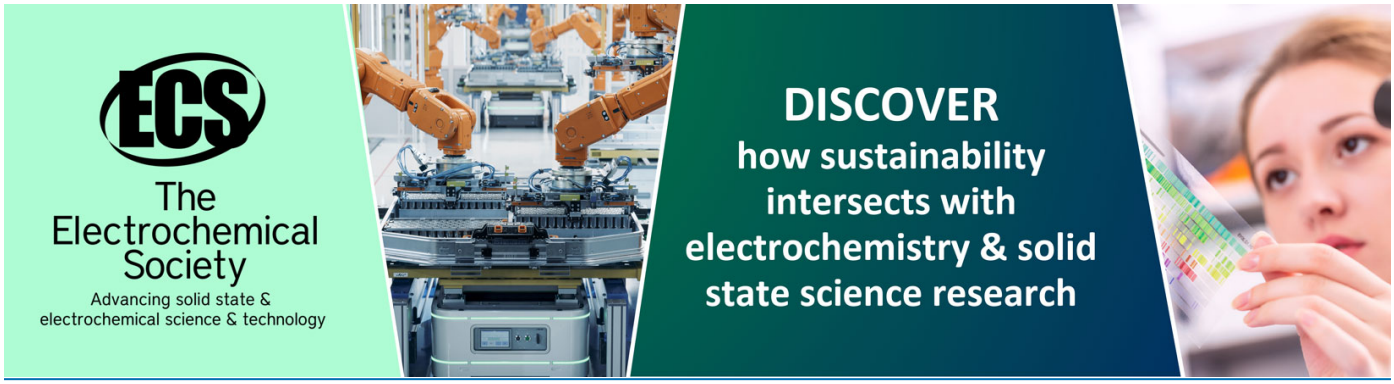
# Research on Pricing Mode of Overhead Transmission Line Adapted to 3D Design Development





# Research on Pricing Mode of Overhead Transmission Line Adapted to 3D Design Development

**Du Ying[1], Ma Tiannan[1], Wang Chao[1], Zhou Ping,[1] Zhang Jiyuan[1], Wan Mingyong[1] and Chen Chao[2*]**

[1]Economic and Technological Research Institute, State Grid Sichuan Electric Power Company, Chengdu 640041, China;

[2]School of Economics and Management, North China Electric Power University, Beijing 102206, China.

[*]Corresponding author's e-mail: juzen123@163.com

**Abstract.** The construction and development of overhead lines is an important support for power grid companies to ensure the safe and stable supply of electricity. For a long time, the estimated budget, completion settlement and financial final accounts of overhead transmission lines are all priced according to the entire line. The project construction management and asset collection have not formed a refined management system. The lack of individual pricing based on the actual investment of different towers cannot be reflected. With regard to the actual cost level of each base, the accuracy of cost needs to be further improved. Therefore, we must innovate the pricing model, strengthen the lean management of the construction cost determination of overhead line projects, rely on the development and application of three-dimensional design, strengthen the construction of the "tower-oriented" construction cost determination system, reasonably control the project investment, and improve the investment efficiency level of the power grid construction.

## 1. Introduction

In recent years, with the changes in the external situation and the continuous deepening of the reform of State Grid Co., Ltd., the number of power grid construction projects has increased and the investment in power grids has continued to increase. As the core work of controlling the company's construction cost, power grid cost management must follow the core principles of high quality and high efficiency. In the future, we must focus on the management and control of power grid investment cost, strengthen precision investment and precise control of infrastructure, practice the concept of safe, high-quality, economical, green and efficient power grid construction, strengthen cost management of infrastructure projects, innovate the concept of scientific cost control and reduce the balance rate To improve the accuracy of investment determination. Therefore, in order to adapt to the reform and development situation, it is necessary to strengthen and deepen innovative engineering construction and management models, explore new ideas for power grid project cost management in the new era, take service grid construction as a starting point, and comprehensively improve project cost management and control capabilities and levels[1].

3D design is based on engineering information, geographic information data, through the integrated application of 3D modeling technology and digital collaborative design technology[2]. Through 3D design, the entire process of transmission and transformation engineering can be realized with 3D

visual design and information integration. State Grid". 3D design and big data application are integrated innovations in modeling, information, network and other technologies in the design field, which is conducive to optimizing the entire process control of design, construction, production, operation and maintenance. Therefore, to promote the in-depth integration of 3D design and big data application results with power grid cost management, and to explore the research on the cost management system based on 3D design, is to meet the development needs of the "Digital State Grid", is to fully implement the high-quality development of technology and economics, and promote technology and economics. "Eight Transformations" Lean management upgrade, comprehensively improve the important development guidelines and development needs of cost management standardization, standardization, specialization, leanness and informatization[3].

## 2. The current status and problems of the pricing of overhead line projects

### *2.1 Status of pricing model for overhead line projects*

At present, the overhead line project cost management mainly adopts the fixed pricing model in the design stage (feasibility study estimation, preliminary design budget estimate, construction drawing budget stage), and mainly adopts the list pricing model in the bidding stage and construction stage[2].

(1) Fixed pricing model

The fixed-rate pricing model is a method that uses the pricing standards approved and promulgated and implemented by the relevant competent authorities in my country for segment combination pricing[3]. According to the quota, the total cost of the power grid construction project is composed of construction engineering costs, installation engineering costs, equipment purchase costs, other costs, basic reserve costs and dynamic costs. Among them, the sum of construction engineering costs, installation engineering costs, equipment purchase costs, other costs, and basic reserve costs is a static investment.

(2) List valuation model

The engineering quantity list pricing model is used in the bidding process[4]. Combining with the actual bidding content, the bidder provides the engineering quantity list according to the project design plan and the unified standards of the power industry. Bidders will make their own quotations based on the actual situation of their own enterprises, combined with different considerations such as the contents of the engineering quantity list, design plans, and construction plans. Therefore, for the bidder, it is necessary to consider the construction cost and theory of the project in a unified manner, combine the actual situation of the project quantity list, and combine its own construction level, technical level, management level, etc. to reasonably control the site costs and other costs to determine the advantages Bid price.

### *2.2 Analysis of the problem of pricing management of overhead line projects*

With the continuous deepening application of new technologies, new materials and new processes in overhead transmission line engineering, as well as the deepening of precision, refinement and precise cost control, the applicability and accuracy of the overhead line engineering pricing system cannot meet the new The needs of the construction and management of overhead line projects in the era. The current problems of the overhead line project pricing system are shown in Figure 1 below:

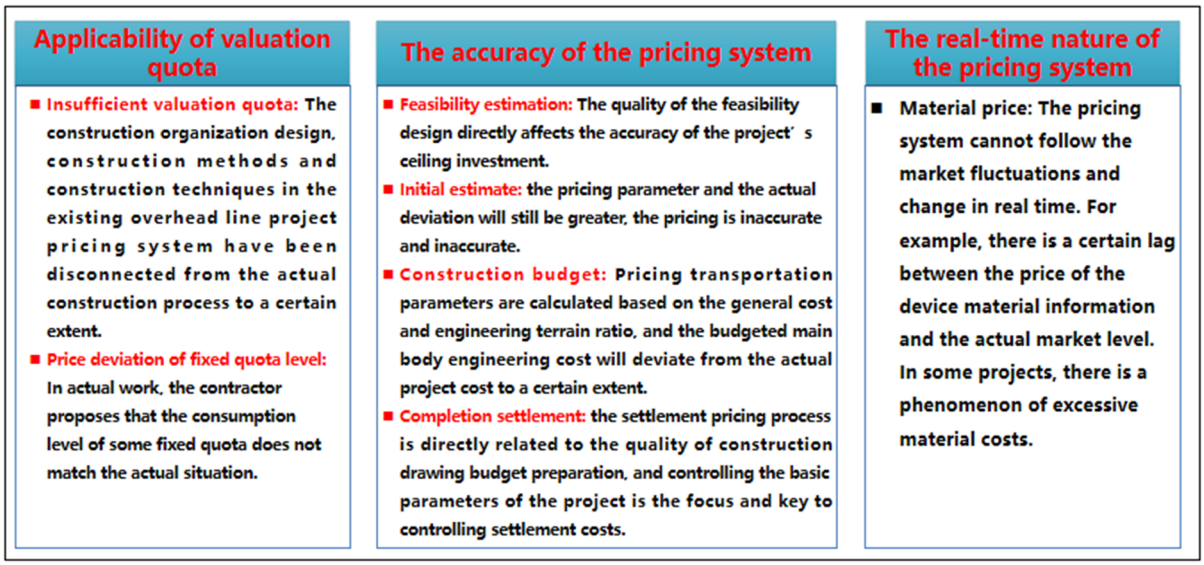



Figure 1. Problems in the pricing system of overhead line engineering at this stage.

## 3. Research on the innovative system design of the pricing model of overhead line engineering based on 3D design

The traditional pricing model is based on the terrain ratio of the entire project, and the transportation distance is weighted according to the terrain and control parameters. The engineering pricing parameters are not precise. This subject will transfer the main engineering parameters from the entire project to the single-base iron tower, analyze the project cost level under different engineering parameter conditions, and analyze its impact on project settlement and design change decision-making. After determining the refined engineering parameter conditions, the overall concept of "tower-tower" pricing is proposed around the pricing framework model system, and an innovative system of "tower-tower" pricing model is built. Based on the calculation method and pricing model of single base tower cost The possible combination of pricing schemes, verify different pricing methods to calculate the value of each base tower, compare the reasons for the cost difference, clarify the impact of different pricing methods on the cost accuracy, comprehensive comparison and screening to confirm the best "tower-oriented" pricing model innovation system .

Based on the three-dimensional design of the overhead line engineering pricing model innovation system, the overhead line engineering transportation parameters and terrain ratio parameters are used as the starting point, and the transportation parameters and terrain ratio are transitioned from the perspective of the whole project to the single base tower, excavation, foundation, tower, The material cost and installation cost of the main engineering quantities such as grounding, insulation and hardware string can be naturally attributed to the single base pole tower. The wiring cost and the cost of the metal fittings in the file can be collected and processed by amortization to reduce the cost of the single base. And the cost-sharing to be aggregated to form an innovative system for the pricing model of overhead transmission line engineering "towards the tower".

The innovation system of "tower-oriented" overhead line project pricing model can distinguish the cost difference between different towers of the whole project, better realize the collection of asset value, and can be more clear about the value difference between different towers. Project pricing provides an innovative model that provides a basis for the precise management of overhead line project assets.

The innovative system of overhead line engineering pricing model based on three-dimensional design includes a three-layer structure of data layer, rule layer and calculation layer, as shown in Figure 2 below.

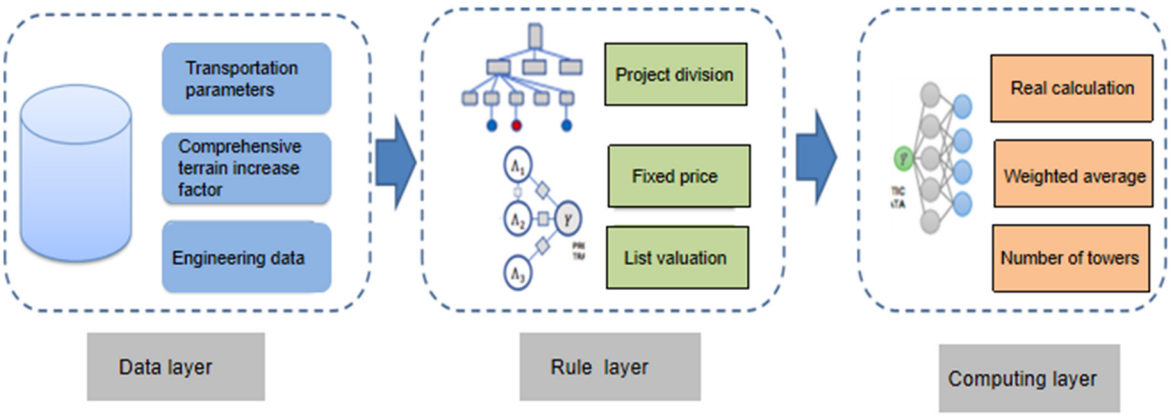



Figure 2. Overall Framework of Pole Tower-oriented Overhead Line Project Valuation Model

## 4. Empirical analysis

Select a 35kV line project to verify the applicability of the model innovation system. The total length of the line project is 2.7kM (overhead 2.5kM, cable 0.2kM). The terrain ratio is 100% hills, and the geology is divided into rock 40%, pine sand 50%, and ordinary soil 10%.

The construction drawing budget calculated using Bowei software is shown in Table 1 below.

Table 1. Budget table of engineering construction drawing under traditional pricing system.

unit: ten thousand yuan

| Project or expense name | expenses | Proportion (%) | Unit investment (ten thousand yuan/km) |
|---|---|---|---|
| **Overhead transmission line body engineering** | 351 | 82.33 | 140.37 |
| **General line body engineering** | 351 | 82.33 | 140.37 |
| **Auxiliary facilities engineering** | | | |
| **Subtotal** | 351 | 82.33 | 140.37 |
| Compile the base period spread | 51 | 11.96 | 20.40 |
| other fee | 64 | 14.97 | 25.53 |
| Among them: construction site acquisition and clearance fees | 23 | 5.49 | 9.37 |
| Basic reserve | 8 | 1.99 | 3.40 |
| Special project costs | | | |
| Project static investment | 426 | 100.00 | 170.50 |
| Dynamic cost | 4 | | |
| Spread reserve | | | |
| Construction loan interest | 4 | | |
| Engineering dynamic investment | 430 | | |
| Including: deductible value-added tax of fixed assets | 38 | | |
| Underlying liquidity | | | |
| Total project investment | 430 | | |

Under the innovative pricing model for "tower-tower" overhead line engineering, the project budget investment calculation results are shown in Table 2 below.

Table 2. Budget investment under the innovative pricing model.

unit: ten thousand yuan

| Tower | Tower type | expenses |
|---|---|---|
| 1 | 1GGD2_24 | 41.2532 |
| 2 | 1GGD2_33 | 38.3352 |
| 3 | 1D2-SJC2/23 | 45.3531 |
| 4 | 1D2-SJC2/20 | 44.3221 |
| 5 | 1D2-SJC3/24 | 48.6553 |
| 6 | 1D2-SJC4/18 | 44.2312 |
| 7 | 1D2-SJC4/22 | 36.8432 |
| 8 | 1D2-SJC4/26 | 31.5835 |
| total | | 330.5768 |

According to Table 1 and Table 2 above, the project capital balance rate under the traditional pricing model and the innovative pricing model is shown in Table 3 below.

Table 3. Project fund balance rate under traditional pricing model and innovative pricing model.

| Pricing model | The initial estimated budget (ten thousand yuan) | Completion settlement amount (ten thousand yuan) | Balance rate (%) |
|---|---|---|---|
| Innovative pricing model | 330.5768 | 312 | 5.46% |
| Traditional pricing model | 351 | 312 | 11.11% |

It can be seen from Table 3: Compared with the existing pricing system, the final actual settlement of the project has significantly improved the accuracy of the ontology investment in the innovative pricing system, and the accuracy rate of the balance rate is 5.65%.

## 5. Conclusion

The text proposes an innovative pricing system based on the three-dimensional design of the "tower-oriented" overhead line engineering pricing model. The innovative pricing system can distinguish the cost differences between different towers of the whole project, better realize the collection of asset values, and make the value difference between different towers clearer.

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