The transformation of the future transmission and distribution cost accounting method of power grid enterprises under the background of new electricity reform

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Abstract. Under the new round of electricity reform, China’s series of policies have put forward more and more detailed requirements for standardizing transmission and distribution cost accounting. This paper analyzes the current situation and existing problems of power transmission and distribution cost accounting of China’s power grid enterprises, and combining with relevant theories, this paper puts forward the transformation objectives, transformation paths and transformation challenges of transmission and distribution cost accounting mode in the improvement and perfection stages of power grid enterprises.

1. Background

Since the 21st century, the rapid development of China’s economic construction has not only driven the increasing demand for electricity, but also put forward more requirements for China’s power industry. Completing electricity pricing mechanism is crucial to smoothly promoting the reform of electricity market and promoting the sustainable development of power industry. Reasonable cost accounting can fully reflect the situation of power supply and demand, guide users to use electricity reasonably, and optimize the allocation of power resources. Under the influence of planned economy in the past, the current cost accounting method of transmission and distribution in China’s price system cannot meet the requirements of electric power market reform. Due to various factors such as economic development and social stability, the transmission and distribution cost accounting is often difficult to accurately reflect the true situation of the cost under the vertical integration of the power industry management system. From the development perspective, it will not only be conducive to the construction of an effective competitive power market, but also to the coordinated development of the national economy and the realization of the optimal allocation of social resources.

At present, there are four problems in cost accounting of power grid enterprises. First, there are differences between the accounting system and the regulatory system. According to the finance ministry, Enterprise Product Cost Accounting System - Power Grid Management Industry, Management Industry fixed assets depreciation, direct materials, direct labor and other operating expenses to be set up in power grid enterprises under “transmission and distribution costs”, but the disclosure requirements for detailed transmission and distribution costs of power grid enterprises are also limited to the above subjects, and only partially disclosed the details of “other costs” under the “transmission and distribution costs” of power grid enterprises, that is, depreciation under other operating costs. Fees, labor costs, etc. In addition, the accounting method cannot directly correspond
to the division of cost items in the supervision system, and there are even big differences. Therefore, it needs to be considered in many ways on how to link the accounting method with the supervision system through the adjustment of subjects, so that the cost accounting method can be implemented smoothly in practical operation.

Second, the cost boundaries of transmission and distribution are blurring. At present, the fixed assets of power grid enterprises can be divided into 16 categories according to their uses. The types of assets are numerous and scattered, covering a wide area and involving multiple management departments. However, the definition of transmission and distribution assets is not clear. First, the boundary between transmission and distribution assets and grid enterprise assets is blurred, and the two are often confused. On the one hand, the transmission and distribution assets should have the “property attribute” first and belonging to the grid enterprise may be included in the nuclear price. The second is the “functional attribute”, the assets serving the transmission and distribution business will be included in the verification price. On the other hand, after mastering the boundary of power transmission and distribution assets and determining the overall scale of power transmission and distribution assets, it is necessary to further classify these assets according to their functions, voltage classes, service life and other characteristics, especially to clarify whether such assets are directly or indirectly related to power transmission and distribution business.

Third, the cost of each voltage classes of common network can not be accurately aggregated. From the perspective of assets, transmission and distribution lines and equipment are classified according to voltage class in the management of power transmission and distribution assets. But electricity metering devices, automation control equipment, houses, vehicles and appliances can not be classified according to voltage class. As a result, the costs incurred by these facilities have not yet been not taken into account the specific voltage classes. From the point of view of power demand level, China's power demand level and distribution structure in each voltage class are more complex, and there are more voltage classes in the common grid. When the transmission and distribution costs are allocated according to the voltage class, the transmission relationship of transmission and distribution services in each voltage class is not clear, which affects the cost allocation among the voltage classes in the common network to a certain extent. From the distribution of assets and costs of power grids of different voltage classes, users with different voltage classes use power grid transmission and distribution resources differently in common transmission and distribution networks. Users with high voltage class grids do not use low voltage class. Users with low voltage class use high voltage class grids including this voltage class and above. However, the current accounting system of power grid enterprises fails to reflect the difference in the cost of power grid with different voltage classes among users.

Fourth, The current cost accounting model of transmission and distribution needs to be optimized. The accounting method implemented by State Grid clearly stated that “the power product manufacturers do not separately calculate the sales expenses and management expenses, and all the costs and expenses incurred in the production, transportation and sales of power products in the current period are all included in the current production costs”. In fact, similar to the full cost method of accounting, on the one hand is not conducive to distinguish between operating costs and non-operating costs, uncontrollable costs and controllable costs in transmission and distribution costs, and it is also not conducive to strengthening the cost classification supervision of the government and improving the cost management efficiency of power grid enterprises. On the other hand, although the power products are so special, the separate accounting management fees and sales expenses will not have a substantial impact on the transmission and distribution price level, because all the expenses included in the current cost of the power products will be promptly fed back to the profit and loss items. In the meantime, regardless of the period cost or product cost, it will only affect the current profit and loss for the grid companies.
2. The relevant theory

2.1. Cost theory

2.1.1. Full cost method. For a long time, the so-called "full cost method" in electric power enterprises does not have the same meaning as the "full cost method" in accounting theory. The full cost method of electric power enterprises refers to not only the total production cost in the production process, but also the period cost in the production process. This is because the electric energy products are single, there is no inventory of products and finished products and before the "unified" management model, power generation enterprises and power supply enterprises are regarded as the production workshop of enterprises. Therefore, when calculating the cost of electric power products. The product cost includes not only the total manufacturing cost, but also the management cost and sales cost in the process of power generation and supply. Only the financial expenses are listed as the period expenses, and the cost items are more than those of the general enterprises. The main contents include fuel fees, electricity purchase fees, water fees, materials fees, wages, employee welfare fees, depreciation fees, repair fees and other expenses.

2.1.2 Manufacturing cost method. The manufacturing cost theory divides all the expenses incurred by the enterprise in the production and operation activities into two major items: the period expense and the manufacturing cost. The manufacturing cost is only included in the production cost, and the period expense is directly included in the current cost and profit method. The main difference between the manufacturing cost method and the full cost method is that the period expenses are listed separately, not in the finished product and in the product.

In 1993, China's accounting system was reformed, requiring the cost accounting method of enterprises to be changed from the full cost method to the manufacturing cost method. The expenses for management expenses should be separated from the product cost. However, considering the particularity of power products, the power companies did not make corresponding changes, but continue to include the management fees and sales expenses in the cost of electricity products, and only list the financial expenses.

2.2. Other theories

2.2.1. Regulatory theory.
Electric power supervision is mainly the sum of various measures of supervision, regulation and industry regulation by regulators. According to the technical, cost and economic characteristics of electric power industry, regulators set up mechanisms to guide electric power enterprises to regulate their operation and make reasonable profits, and to promote users to optimize their electricity consumption behavior, so as to ensure the healthy development of electric power industry and protect public interests.

2.2.2. Fine theory.
Fine theory is based on the conventional management, and leads the conventional management to the basic idea and management mode in depth. It is a management mode with the main objective of minimizing the resources occupied by management and reducing the management cost. With the gradual deepening of the reform of the electric power system, the business forms faced by power grid enterprises are becoming more and more severe. The traditional business methods cannot well adapt to the current development trend. It has become an urgent task to strengthen the fine management of power grid enterprises, develop management standards, clarify working procedures, reduce internal losses and improve management efficiency.
2.2.3. Resource allocation theory.
Resource allocation refers to the choice of different uses of resources by comparing them. The scarcity of resources determines that any society must reasonably allocate the limited resources to various fields of society in order to achieve the best utilization of resources, that is, to produce the most suitable commodities and services with the least resource consumption and to obtain the best benefits. The power construction in developed countries is allocated by market economy. In order to make the market decide the allocation of power resources, it is necessary to introduce competition mechanism in the field of power generation and sale. However, China is still in a monopoly state in the field of power generation and sale without completely liberalized. Therefore, it is necessary to implement market allocation of resources and reform the power system in the capital construction of power industry.

3. The transformation path

3.1. Improvement stage.
The improvement stage is the stage in which the current cost accounting of China's power grid enterprises is located. The goal of this stage is to establish a system combining multidimensional lean management and detailed accounting.

3.1.1. Establish and improve the cost accounting system. On the transition path, the transformation of the transmission and distribution cost accounting system has taken a preliminary direction. In 2019, the State Development and Reform Commission and the National Energy Administration promulgate the “Measures for Supervision and Examination of Transmission and Distribution Pricing Costs (Revised Draft for Consultation)” which further revised the previous Measures. The Measures also requires grid enterprises to establish and improve the cost accounting system in accordance with the regulation of power transmission and distribution pricing, and accurately record and rationally distribute the production and operation cost (cost) of power transmission and distribution in accordance with voltage classes, services and user categories. In addition, The Measures will strengthen the scientificality, refinement and standardization of supervision and examination. At the same time, "Enterprise Product Costing Accounting System - Power Grid Management Industry" further refines the subjects under "Transmission and Distribution Costs", requiring the establishment of fixed assets depreciation, direct materials, direct labor and other operating expenses, while "other expenses" Part of the disclosure was made.

3.1.2. Refine the subjects under "Transmission and Distribution Costs” Further. At present, the existing policies do not give specific requirements for the refinement of specific accounting subjects. According to the requirements for multi-dimensional cost accounting in the future, a series of adjustments or modifications should be made to the general and detailed account settings of related cost expenses to meet the requirements of internal management and external reporting. At the same time, it needs to adapt to the new cost accounting system of power grid operation industry, and take the improvement of accounting system and the change of concept into consideration.

    In view of the specific policy, the goal of this stage is that the multi-dimensional cost accounting method should meet the regulatory requirements in the power reform, the transmission and distribution cost accounting model is optimized, and the assets and costs can be divided and collected according to the voltage class. The multi-dimensional attributes of the cost are shown. At the same time, at this stage, we can also consider the promotion from the government. For example, the relevant measures required that grid companies should use the manufacturing cost method to calculate the transmission and distribution costs, or the government can clarify the requirements for cost accounting.
3.2. Polishing stage.
In the polishing stage of multi-dimensional transmission and distribution cost accounting, the transformation method is to enable the cost accounting of grid enterprises to meet the needs of internal management and achieve the goal of external reporting. While promoting the internal management efficiency of power grid enterprises, it also promotes the coordinated development of national economy and the optimal allocation of social resources.

3.2.1. Change Cost Accounting Method. Convert the full cost method to the manufacturing cost method because the full cost method cannot reflect the causal relationship. Under the background of the rapid decrease of labor-related expenses, the adoption of the full cost method will result in the lack of rationality and scientificality of the grid enterprise cost information. Power grid enterprises should complete the transition to manufacturing cost method as soon as possible based on advanced management concepts and cost calculation methods, and take effective measures to improve the actual cost of grid enterprises, thus realizing effective cost control and improving the cost management level of enterprises.

3.2.2. Change Cost Accounting Mode. Power grid enterprises need to divide the operation links into transmission cost and distribution cost, and combine the voltage division with sub-category pricing requirements to normalize the cost function to different asset classes and voltage classes, then rationally select cost drivers and refine them to different users and Category. According to the different types of transmission and distribution services, the cost is divided into the cost of the shared network and the cost of the special service. The two different price models are connected, and the factors such as the amount of electricity sold, the number of users, the system capacity, and the user demand are considered, and distinctions between fixed cost and marginal cost of power grid are reasonable. This will lay a foundation for the scientific formulation of electricity tariff and basic electricity tariff.

3.2.3. Adapt to the Change of Supervision System. The general direction of electric power reform requires power grid companies to further improve the cost accounting system when adapting to the cost information measurement and disclosure of management dimensions. Consideration should also be given to external supervision, enterprise development and future electricity price reform. Therefore, power grid enterprises should establish multi-dimensional, multi-caliber cost collection methods, statistical methods, and disclose the relevant cost information according to the management dimension, which is also conducive to the government's supervision.

4. Change the challenge

4.1. Improvement stage
The challenges faced by power grid enterprises in the transformation of cost accounting methods in the Improvement stage are as follows: As far as the transmission and distribution cost limit is concerned, the transmission and distribution assets and the grid enterprise assets are always mixed together. If they are not effectively defined, the subsequent transmission and distribution cost accounting will lack of rationality; First, there is no clear distinction between direct collection and distribution of various types of costs, and second, there is no clear allocation of various types of cost drivers, so that the current grid companies can only carry out cost collection according to the cost accounting requirements of the Ministry of Finance; As far as the sharing of network voltage classes is concerned, the types of transmission and distribution networks shared by power grid enterprises are complex and numerous. The current accounting system cannot reflect the difference in the use of grid voltages for users of different voltage classes. It is also impossible to accurately verify the cost of each voltage class of the shared network. In terms of period expenses, management expenses as a period of cost under the manufacturing cost method lacks a clear measurement method, and was not separately
listed for accounting. This will not only influence the scientificality of transmission and distribution cost accounting, but also unable to truly reflect the transmission and distribution cost. As far as the cost information presentation method and the related data requirements for accounting are concerned, the basic information needed for cost accounting, such as cost driver data, cannot be obtained, and the transmission and distribution cost accounting cannot be carried out according to the voltage class.

Therefore, at this stage, the problems to be solved include: First, distinguish between transmission and distribution assets and grid enterprise assets, and dividing assets of different voltage classes to facilitate the calculation of voltage-level cost; Second, clarify the allocation of various indirect accounting costs Standards; Third clarify the responsibilities, authorities, and costs of responsibility at all levels of the cost center, which will provide the basis for the assessment and evaluation of the cost center; Fourth, Identify the types of business activities to support multi-dimensional lean management; Fifth, Define the specific composition of management costs, in order to separate management costs from transmission and distribution costs; Sixth, Design information supply and presentation forms to meet the needs of transmission and distribution cost accounting with different voltage classes; Seventh, Define the corresponding voltage class of each level cost center, and provide the basis for strengthening cost management.

4.2. Polishing stage
The challenges faced by power grid enterprises in the transformation of cost accounting methods in the polishing stage are also worthy of attention. The first challenge is that the transformation of accounting methods in power grid enterprises is not clear enough, including the definition of effective assets, the allocation of indirect costs, and the divestiture of management costs. The second challenge is how to clarify the corresponding management between cost center and voltage class. It is necessary to divide the voltage class and cost center according to the reasonable determination of the object of cost accounting according to the voltage class. But this way is only based on the different voltage class and user's electricity characteristics and cost structure. In the practical application of the development stage, this division and its corresponding applicability are also worthwhile further research. In view of the actual situation, the improvement methods are constantly put forward. The third challenge is how to deepen the integration of cost accounting and management dimensions. For power grid enterprises, the more data dimensions, the more convenient it will be to transfer data in the future, but too many data dimensions will also increase the difficulty of accounting and increase the cost of accounting. This part focuses on building a set of dimension system that matches accounting subjects and meets the needs of external supervision as well as internal lean management. The fourth challenge is to correctly handle the relationship between cost accounting and management dimension. This requires that the management dimension of power grid enterprises should be accurate in data disclosure and reasonable in caliber. It should not only be consistent with the total amount and classified aggregate of accounting data, but also ensure the accurate availability of statistical data, and take into account the requirements of supervision and future reform as a whole.

Therefore, at this stage, the problems that need to be solved include: First change the cost accounting mode of power grid enterprises, then provide information of transmission and distribution cost accounting with different voltage classes. Second, clear up the corresponding management relationship between cost center and voltage class, then design a dynamic management system to realize uninterrupted and undifferentiated management according to the actual situation of different places. Third, according to the trial situation of the previous stage, improve and determine the information supply and presentation forms to meet the needs of transmission and distribution cost accounting with voltage grading, so as to facilitate the cost accounting with voltage grading. Forth, When a specific business occurs, the voltage class can be accurately distinguished and the cost accounting of voltage class can be simplified. Fifth, in budgeting, full consideration should be given to the requirements of price verification, and appropriate use of relevant costs should be made to ensure the sustainable operation of enterprises. Sixth, deep integration of transmission and distribution cost accounting and multi-dimensional lean management dimensions.
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References
[1] Chao, H., DePillis,M. (2013) Incentive effects of paying demand response in wholesale electricity markets. J. Journal of Regulatory Economics. 43(3):265-283.
[2] Chao,H. (2011) Demand response in wholesale electricity markets: the choice of customer baseline. J. Journal of Regulatory Economics. 39(1):68-88.
[3] Iozzi,A, Jonathan,A., Edilio Valentini,P,. (2010) Social Preferences and Price Cap Regulation. J. Journal of Public Economic Theory. 4(1):95-114.
[4] Dale,E, Dennis L., Weisman. (2000) The Political Economy of Price Cap Regulation[J]. Review of Industrial Organization. 16(4):343-356.
[5] Thomas, S. (2015) Evaluating the British Model of Electricity Deregulation[J]. Annals of Public & Cooperative Economics. 75(3):367-398.
[6] Barton,Barry.(2008) Electricity Regulation in New Zealand: the Early Stages of a New Regime[J]. Journal of Energy & Natural Resources Law. 26(2):207-233.
[7] Parker,D., Kirkpatrick,C.(2005) Regulating prices and profits in utility industries in low-income economies: Rate of return, price cap or sliding-scale regulation?[J]. International Journal of Public Sector Management. 18(3):241-255.
[8] Iozzi,A., Poritz,J,A.,Valentini,E. (2010) SOCIAL PREFERENCES AND PRICE CAP REGULATION[J]. Journal of Public Economic Theory. 4(1):95-114.