

Impact of new energy supporting delivery repurchase on transmission and distribution price and investment and operation of power grid companies under the new situation

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Abstract. The new round of power system reform is profoundly affecting the functional positioning and profit model of power grid companies, and puts forward higher requirements for the investment decision-making management of power grid companies. Based on the cost accounting and pricing mechanism of power transmission and distribution prices for grid enterprises, and the linkage mechanism of grid investment-transmission and distribution prices based on system dynamics, this paper briefly analyzes and summarizes the impact of new energy repurchase work on power transmission and distribution prices and investment.

Keywords: new energy; matching delivery and repurchase; transmission and distribution price cost accounting; pricing mechanism; investment management; linkage relationship.

1. Introduction

In the context of carbon peak and carbon neutrality goals, the installed capacity of renewable energy such as wind and solar is growing rapidly. In order to ensure the consistency of the construction sequence with the supporting delivery project and meet the urgent demand for grid-connected consumption of new energy, the relevant state departments have recently issued relevant announcements. The document clarifies that new energy supporting delivery projects that have difficulties in the construction of power grid companies or do not match the planned timing, allow power generation companies to invest in construction, and the power grid companies can repurchase them in accordance with laws and regulations at an appropriate time after consultation and agreement with the power generation companies. The self-built supporting delivery projects of power projects have a long history and complicated situations, which are closely related to my country's power investment system and electricity price mechanism. In recent years, with the rapid development of new energy, some local power grid construction projects have lagged behind, and power generation companies have begun to advance funds for new energy delivery projects. The issue of disposal of project assets sent by power generation companies has gradually affected the harmony between power plants and power grids and increased the burden on power generation companies. An important factor that is not conducive to the safe and stable operation of electric power. At the same time, the project repurchase work has also raised questions on the operation and management of power grid companies, and is of great significance to straightening out the relationship between the power plant and the grid and the safe operation of the power grid.

2. Transmission and distribution price cost accounting and pricing mechanism

The total level of transmission and distribution prices is related to two parameters: the total permitted revenue of transmission and distribution and the total sales of electricity. The core of the total permitted revenue calculation of transmission and distribution is effective assets. The relationship between existing grid assets and the provision of transmission and distribution services determines whether they are classified as effective assets, and also determines the level of total permitted revenue for transmission and distribution of grid companies. The structure is verified by voltage level, and the power delivered directly determines the benefit of this voltage level.

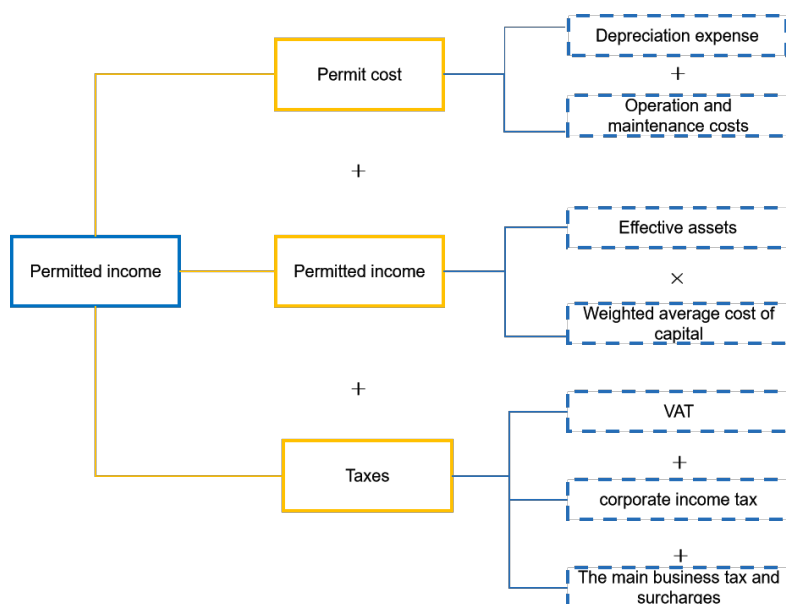


Figure 1. The allowable income composition of grid companies

1. Permitted income of power transmission and distribution. Permissible income consists of permissible costs, permissible benefits and taxes. (1) Permissible costs include depreciation expenses and operation and maintenance expenses. Due to the huge assets of the power grid company, the depreciation fee has a large impact on the allowable cost, and the operation and maintenance fee has a relatively small impact. (2) Permissible income includes the effective assets for which the income can be withdrawn and the weighted average return on capital. Since the weighted average return on capital can be determined by government departments, the effective assets that can be withdrawn become the key to the level of allowable income. (3) Taxes include corporate income tax, urban maintenance and construction tax and educational surcharges, which are relatively clear.

2. Approval of transmission and distribution prices for various voltage levels. There are many voltage levels in China, which are roughly divided into UHV AC 1000 kV and UHV DC 800 kV; Ultra high voltage AC 750 kV, 500 kV, 330 kV, DC 500 kV, 400 kV; The voltage levels of AC voltage 220 kV, 110 kV, 35 kV, 10 kV and less than 1 kV shall be classified and approved by each province according to the existing regional voltage levels. The approved voltage-level transmission and distribution price can be directly aggregated according to the assets corresponding to the voltage level, and the public cost of the assets that cannot be corresponded to should be reasonably amortized in proportion to the original value of the voltage-level assets.

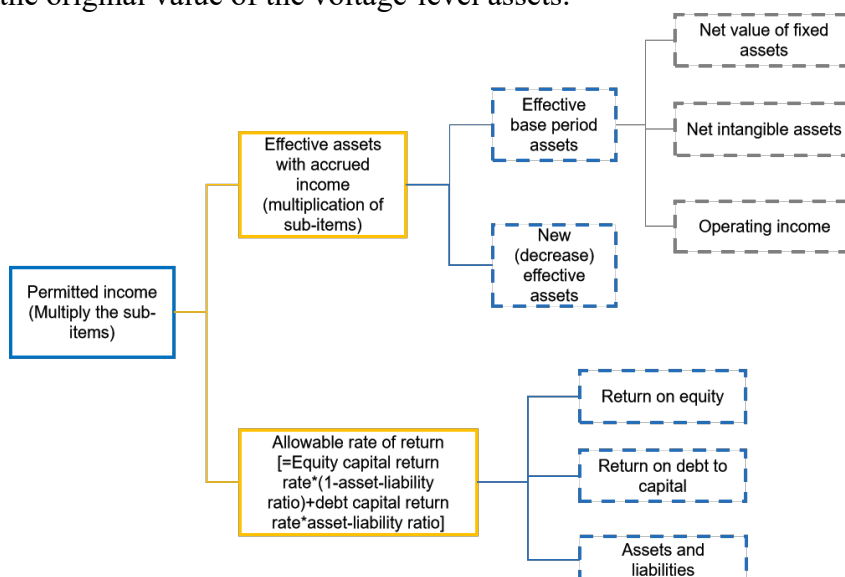


Figure 2. The calculation method of permitted income

3. The linkage mechanism between grid investment and transmission and distribution prices

In view of the current new round of power system reform and the dynamic external changes in the reform of transmission and distribution prices, as well as the need for internal investment optimization of power grid companies, the investment scale management of power supply companies urgently needs to change from a framework qualitative analysis to a systematic quantitative analysis. Change from one-way drive to two-way feedback. At the same time, the influencing factors of transmission and distribution price approval are relatively complex and dynamic. Based on SD's ability to achieve the complementarity of simple causality and complex causality, as well as the complementarity of static and dynamic indicators, the idea of system dynamics is introduced in the simulation process. Establish a causal driving relationship between the transmission and distribution price and the investment scale of the power supply company, and guide the investment decision of the power supply company under the background of the supervision of the transmission and distribution price.

According to relevant regulations, the transmission and distribution price should be determined by voltage level, and it is composed of the transmission price and the distribution price. The linkage relationship between the grid investment and the distribution price is shown in Figure 3. It can be seen from Figure 3 that under the situation of the reform of transmission and distribution prices, the distribution network investment and the distribution price present a relationship of mutual influence and two-way restriction. 1) Distribution network investment is an important factor in determining the transmission and distribution price in the regulatory cycle. Distribution network investment will follow the transmission chain of "distribution network investment-new effective assets-effective assets at the end of the period-distribution price". The approval of electricity prices has an important impact. The level of income allowed by the grid company depends on the size of the distribution network investment; 2) Distribution prices will restrict the investment in distribution networks in the opposite direction along the above transmission chain. Distribution prices are the government's means of monitoring the income of power grid companies, and their prices remain stable within a reasonable range of control and will not generate excessive amounts. Fluctuations restrict the investment in the distribution network to a reasonable scale. Excess investment will be difficult to count as effective assets, resulting in lower investment returns and investment efficiency.

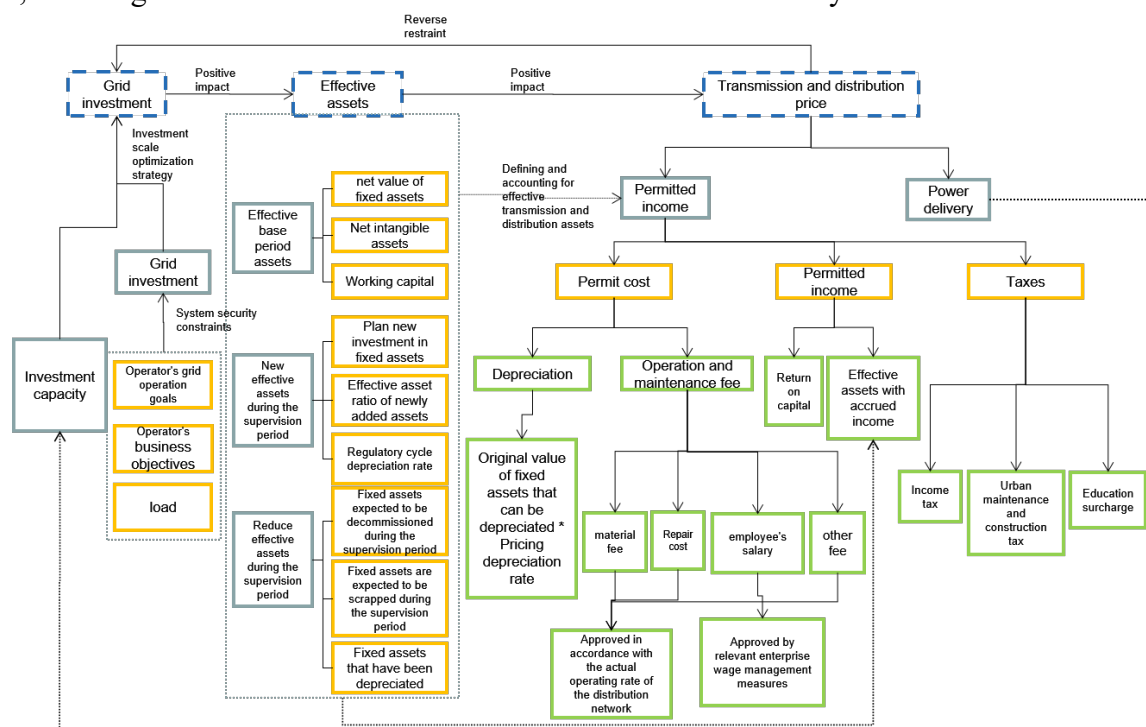


Figure 3. The linkage relationship between grid investment and transmission and distribution prices

4. The impact of repurchase on the operation and management of power grid enterprises

(1) Security and stability impact. First of all, due to the different subjects involved, for the grid company, the corresponding technical equipment selection and construction requirements need to meet the specifications of the grid company. As a central enterprise under the key supervision of the State-owned Assets Supervision and Administration Commission, grid companies need to establish and improve unified technical regulations, management norms and standard procedures for the repurchase of new energy connection lines. How to meet the requirements of specifications such as technical equipment selection and construction and repurchase procedures, ensure coordination and unity with the main grid lines, scientifically and reasonably repurchase, and firmly adhere to the premise of safe and stable operation of power grid is a major issue facing power grid repurchase.

(2) The impact of economic benefits. Economic factors are important considerations that cannot be ignored by power grid companies in the repurchase process. By comprehensively weighing the power generation capacity of new energy projects, transmission line length, line loss, operation and maintenance expenses and other necessary factors, power grid enterprises maximize cost reduction and improve their own income. They are often more inclined to choose supporting transmission projects with large power generation capacity and close to the main grid for repurchase. At the same time, in recent years, with the deepening of the reform of the electricity market and the continuous improvement of electricity price policies, the pricing mechanism and approval results of transmission and distribution prices have become the key to determining the profitability of power grid companies. Whether the repurchased infrastructure assets can be included in the scope of the calculation cost of the transmission and distribution price, and how to fully recover the repurchased assets through the transmission and distribution price to ensure sufficient profitability are issues that we have been paying close attention to.

If the new energy supporting project assets are repurchased by the power grid company, it may increase the depreciation and operation and maintenance costs of new assets, that is, the allowable cost increases. At the same time, the effective assets with accrued income related to the permitted income will also increase, and the permitted income of transmission and distribution will increase. On the other hand, the integration of new energy sources will likely increase the transmission and distribution of provincial power grids, which is closely related to factors such as the installed capacity of new energy sources and the line loss of transmission lines. Whether the power transmission and distribution price increases after the repurchase needs to be judged by the ratio of the current transmission and distribution permitted revenue to the provincial power transmission and distribution volume. For changes in the actual income of power grid companies caused by new investment, power generation growth, and changes in power structure during a regulatory cycle, the provincial price authority will organize annual statistics and deal with them as a whole in the next regulatory cycle.

5. Conclusion

On the basis of explaining the basic content of the cost of transmission and distribution price, the linkage relationship between grid investment and transmission and distribution price, this paper briefly analyzes the impact of grid repurchase on grid transmission and distribution prices and investment benefits under the new situation. It has laid a theoretical foundation for the determination of investment benefits and the establishment of models for subsequent power grid companies under the power grid repurchase policy. On the one hand, how to fully recover the repurchased assets through the transmission and distribution price, optimize the management of investment benefits, ensure the efficiency of asset utilization in the enterprise's own operations, win market competitiveness, further optimize the investment structure, and improve the economic benefits of power grid operations. On the other hand, how to ensure the safe and stable operation of the power system and power quality at the same time, steadily and orderly promote the delivery and consumption of large-scale centralized and distributed clean energy to ensure the social and

environmental benefits of project investment. It is a new challenge faced by power grid companies under the new situation, and it is also an important guarantee for achieving a long-lasting foundation and boosting the orderly and healthy development of the economy and society.

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