Performance-Based-Ratemaking and Its application in China’s Power Transmission-Distribution Price Regulation

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Abstract. In current power transmission-distribution price reform, China has established a cost plus revenue regulatory method to power transmission-distribution price, which is featured of incentive effects to some extent. By summarizing and analyzing the traditional regulation and performance-based-ratemaking regulation as well as their respective applications, this paper analyzes the characteristics and limits of price cap and revenue cap regulation models, and proposes, as specific to the actual conditions in China, PBR targets and price cap regulation or rate-of-return regulation and yardstick competition regulation combined model while introducing performance benchmarking to give incentive initiatives to efficiency varied enterprises to improve their efficiency.

Introduction of Traditional Regulation and PBR

The role of regulation is to encourage adequate investment to satisfy the demand of consumers, while compensating investors with reasonable rate on return. Two basic regulation models are: rate-of-return (“ROR”) regulation and PBR regulation. ROR is also known as cost-of-service (“COS”). This regulation model requires the regulation authority to apply active supervision on electric power enterprises. PBR includes the stipulation of power transmission-distribution price, including price cap, revenue cap, yardstick competition and other regulation and pricing models. PBR requires the regulation authority to apply less interference. Under ROR regulation, the regulation authority needs to determine the suitable expense, the value of investment cost and the allowable ROR of investment cost, so, comparatively speaking, PBR more likely spend less regulation expense. In order to bypass the inadequate efficiency of ROR regulation, more and more countries are switching to adopt PBR model.

PBR addresses to give financial incentive initiatives to those enterprises subject to regulation in reducing price or cost, or give them financial incentive initiatives based on the improvement of non-price based performance. By reducing the times of variation to ROR or upon increased regulation, PRB weakens the interrelationship between enterprise regulation price and enterprise cost. During the cycle of regulation, the regulation authority will set up a formula for enterprise ROR and price, the regulation authority thereafter will re-assess the enterprise cost and investment to determine a new ROR and price that are to be applied to the next regulation cycle. Typical electric power PBR model is Revenue cap and price cap based regulation.

Price Cap Regulation Model and Application

Price cap is in essence an agreement between the government or the regulation authority and those enterprises subject to regulation, and a kind of effective regulation solution to be applied in circumstances where enterprises have better understanding and knowledge to their own advantages in technology and cost than the regulation authority—the regulation authority sets up a price cap (average price or weighted price) for all products or for a blanket of products, under which enterprises have discretionary power to finalize their own price. The maximum price finalized in the first year
will be subject to adjustment in coming years based on predefined economic index and factor collection. The general form of price cap is:

\[ P_{j,t} = [P_{j,t-1} \cdot (1 + RPI - X)] \pm Z \]

\( P_{j,t} \) = the maximum price charged to Class \( j \) consumers in Year \( t \); \( RPI \) = retail price index, i.e., rate of inflation; \( X \) = production efficiency compensation factor, i.e., the percentage of enterprise production efficiency increase during a certain period of time defined by the regulation authority; \( Z \) = adjustment to incidentals. Price cap regulation is a “blanket price” regulation, where the difficulty is the determination of the efficiency coefficient value \( X \). Looking at the practice of UK in regulation, Value \( X \) depends on the technical and economic nature of the industry and the cost variation arising from progress of technology, and has significant difference among different industries even among different regions of a same industry. Value \( X \) of power grid operating enterprise ranges 0-3%. Price cap regulation now has been widely applied to US telecommunication PBR regulation and UK power distribution regulation.

**Revenue Cap Regulation Model and Application**

Revenue cap regulation is purposed to apply effective control over power transmission cost, while enabling enterprises the ability to gain reasonable return on investment; now, Australia, Norway and Philippines and some other countries are using this regulation model.

Revenue cap regulation is actually the maximum allowable revenue of the monopoly businesses of natural monopoly enterprises determined by the regulation authority, and generally contains the investment plans of the monopoly businesses of natural monopoly enterprises, which is thereafter adjusted pursuant to \((RPI-X)\), and the value of \( X \) herein has the same meaning with the value of \( X \) in price cap. General rate-of-return regulation model is:

\[ TR_t = [TR_{t-1} + (CGA \cdot \Delta C)] \cdot (1 + RPI - X) \pm Z \]

\( TR_t \) = allowable enterprise revenue in Year \( t \); \( CGA \) = user growth adjustment factor (USD/user); \( \Delta C \) = annual user quantity variation; \( RPI \) = retail price index, i.e., rate of inflation; \( X \) = production efficiency compensation factor, i.e., the percentage of enterprise production efficiency increase during a certain period of time defined by the regulation authority; \( Z \) = adjustment to incidentals. The adjustment to revenue each year is purposed to simulate how enterprise cost changes along with system the change of system characteristics, such as the number of users and the price of the product invested. The rate of inflation may be evaluated by using CPI and RPI and other price indices. The production efficiency compensation factor \( X \) ensures that users are benefited from the increase of enterprise production efficiency. Incidental event \( Z \) include taxation increase, change to environmental protection law, natural disasters and restructuring cost, etc.

Though revenue cap regulation model is simple, the final price is not controlled yet, as such, a company has no restriction in pricing, which is not so wise to the regulation authority. Many US electric power companies adopting revenue cap regulation model in the past now are switched to price cap regulation model.

**Discussion Power Transmission-distribution Price Regulation Models in China**

**Objectives of Power Transmission-distribution Price Regulation**

Specific to the actual conditions in China, in setting up the objectives of the power transmission-distribution price regulation, the first thing is to make adequate consideration on the current status of power transmission-distribution price, as well as the demands of the regulation authority and those subject to such regulation; secondly, effective incentive initiatives shall be made to those enterprises subject to regulation for improving their efficiency, so that the benefits of electric
power consumers are protected while the survival and development of enterprises are preserved; this effort is to stimulate enterprise to make active investment to power grid construction, and, to ensure electric power quality requirement.

**China’s Power Transmission-distribution Price Regulation Models**

Along with the deepening of electric power market-oriented reform and taking-apart of each phase, different regulation methods and measures shall be applied to each phase according to its different features. In electric power generation and electricity selling phases, loose the regulation and encourage competition; in electric power transmission and distribution phase, strict regulation still shall be applied for the current period, but the regulation method and means shall be innovated, as such, PBR model now has been widely used in the electric power industries in many countries, due to, as the main characteristics of it, the weakening of the interrelationship between enterprise cost and its price, and the strong compatibility to introduced competition.

Currently and in the process of this round of power transmission-distribution price reform, China has established a cost plus revenue regulation model to power transmission-distribution price, which is featured of incentive function, to some extent. As specific to China’s electric power transmission and distribution regulation, PBR model may realize the maximized utilization of existing assets and produce incentive initiatives for improving operation efficiency and other functions. Among these functions, price cap regulation, revenue cap regulation and other models may enable those enterprises subject to regulation to be benefited from reasonable cost compensation and gaining normal profit, while improving user’s satisfaction; and it is a truly win-win model.

In order to achieve a sound incentive effect and avoid the impact of information asymmetry on regulation, price cap regulation or ROR regulation and yardstick competition regulation model is general used, based on which, by introducing performance benchmarking to give incentive initiatives for encouraging efficiency varied enterprise to improve their efficiency, the overall electric power grid efficiency can be improved; also, the practice of the regulation models combined with several regulation modes by the electric power companies of US different states can be referenced in our practice. Of course, price cap model still has disadvantages, such as, inability to reflect demand for electric power and insignificant stimulation to investment, etc., and all of these limits shall be fully considered and optimized in China’s practice of power transmission-distribution price regulation models.

**References**


