



Mixed Ownership Reform Framework of Power Grid Enterprises in the New Electricity System

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Abstract. The internal and external situations such as the reform of state-owned enterprises and the construction of new power systems require power grid enterprises to reasonably adjust the structure of the reform of mixed ownership. In terms of the structure setting of the mixed transformation at the lower level, factors such as the characteristics of emerging businesses should be considered, and a reasonable choice should be made between the three models based on emerging business platforms, hybrid platforms, and provincial industrial companies.

Keywords: SOEs · Mixed Ownership · New Electricity System

1 Introduction

The implementation of mixed ownership reform in the main business of power grid enterprises is mainly constrained by the following aspects:

The equity diversification of power grid enterprises may be put on the agenda in the future [1]. From the perspective of state-owned enterprise reform, the assets and revenue of the main business of power grid enterprises account for the absolute majority. In order to make a breakthrough in hybrid reform, the hybrid reform of the power grid sector must make progress [2, 3]. From the perspective of the evolution of power system, the construction of new power system may generate some self-balancing units at the end of the system. The relationship between these self-balancing units and the large power grid is relatively loose, and the localization characteristics are relatively obvious, which may naturally attract the entry of external capital.

External capital may widely enter the bottom units of the new power system [4]. Under the background of new power system construction and advanced technology application, a new type of distribution network may emerge. This kind of distribution network has access to a large number of distributed energy, energy storage and adjustable loads, and uses intelligent technology to assist scheduling, so it has strong self-balancing ability, and operates as a self-balancing unit, which is called external distribution network. The scope economy between the external distribution network and the large power grid is weak, while the scope economy between the external distribution network and the connected loads and power sources is strong. The operation of such distribution network by external entities may play a good synergy effect [5, 6].

The development of the new power system has led to an increase in the demand for coordination among various entities at the distribution network level. From the perspective of the relationship between each link, the interaction between power grid terminal source, network load and storage is strengthened, and the power grid management system should adapt to the demand of terminal interaction. From the perspective of business model, emerging businesses such as integrated energy services, electric vehicle V2G, online supply chain finance, virtual power plants, and blockchain-based new energy services have accelerated to emerge. From the perspective of technical economy, the scope economy of the transmission and distribution room presents a series of new features. The randomness and volatility of the new energy output lead to the complexity of the system operation mode, which may enhance the interaction between the transmission and distribution networks, and further improve the scope economy [7].

2 Potential Reform Modes

2.1 Main Problems to Be Solved

The adjustment of the mixed transformation structure at the bottom is mainly to solve the following problems:

The synergy between localized emerging businesses and main businesses. The localized emerging businesses mainly include integrated energy services, electric vehicle services and energy storage, and their common point is the circulation of electric goods. At present, there are some problems of poor synergy and insufficient support between the main business and localized emerging business of power grid enterprises, which are related to the unreasonable control structure. By changing the management and control structure, the problem of collaboration can be solved to a certain extent.

Attracting external investors. External units themselves are highly localized, and different external units may be very different in terms of load characteristics, business types, etc. In this case, attracting urban investment platforms and some local infrastructure construction and operation enterprises may be very helpful for the construction and operation of external units.

In addition, the optimization of the mixed transformation structure should also take into account the compliance of emerging businesses, the ability of professional development and other issues, which is a complex issue.

2.2 Introduction on Modes

Mode 1: mode based on emerging business platform.

The basic mode is that the power supply platform company and the provincial industrial company jointly establish the emerging business platform company, which provides various services in the business area of the power supply platform company. This business structure mainly involves the following subjects:

First, power supply platform company. This is a key platform enterprise for external distribution network business, mainly engaged in power supply business. This platform should generally be controlled by external enterprises, and the power grid enterprises should participate in it.

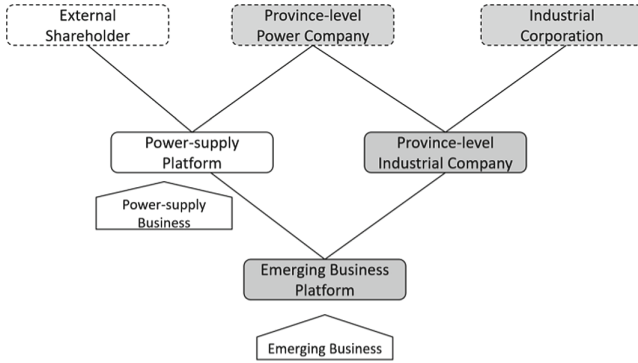


Fig. 1. Mode 1

Second, emerging business platform companies. Mainly engaged in localized emerging businesses such as electric vehicles and comprehensive energy. Due to the professional nature of relevant emerging businesses, emerging business platform enterprises are generally controlled by provincial industrial companies of power grid enterprises, and power supply platform enterprises are equity participants.

Third, provincial industrial companies. Generally, it is controlled by industrial groups, participated by provincial companies and introduced by external investors.

Mode 2: mode based on hybrid platform.

The basic mode is to establish a platform company through joint venture with external shareholders, provincial companies and provincial industrial companies, and to operate power supply business and emerging business at the same time. This business structure mainly involves the following subjects:

First, platform companies. This is a platform enterprise for distribution network business and emerging business. Generally, it is controlled by external enterprises, and the power grid enterprises share.

Second, provincial industrial companies. Generally, it is controlled by industrial groups, participated by provincial companies and introduced by external investors.

Mode 3: based on provincial industrial companies.

The basic mode is that the power supply platform company and the provincial industrial company operate independently, and there is no capital link between the two parties.

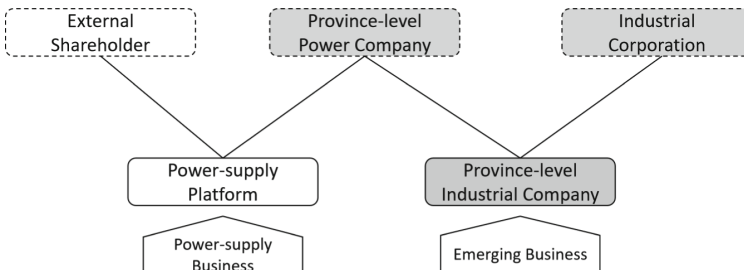


Fig. 2. Mode 2

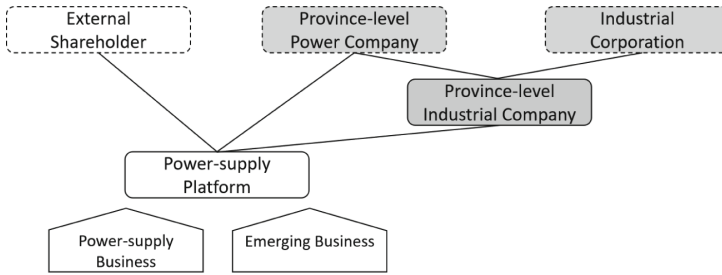


Fig. 3. Mode 3

The provincial industrial company itself or its subsidiaries provide services in the business area of the power supply platform company. This business structure mainly involves the following subjects:

First, power supply platform company. This is a key platform enterprise for the development of external distribution network business, mainly engaged in power supply business, which is generally controlled by external enterprises and shared by power grid enterprises.

Second, provincial industrial companies. Industrial companies carry out various kinds of emerging businesses, which are generally controlled by industrial groups, shared by provincial companies, appropriately introduced by external investors, and have no capital cooperation relationship with power supply platform companies.

3 Mode Comparison

Through comparison and selection of the three modes, the following conclusions can be drawn [8, 9].

The advantages and disadvantages of the three modes under various circumstances are mainly determined by the following factors:

The first is the volume of external units. Generally speaking, if the external unit itself is small, it is suitable to take the form of mode 2 or 3. The business is directly carried out by the provincial industrial company or power supply platform. It is of little significance to establish an independent emerging industrial platform company. If the

Table 1. Comparison of 3 Potential MOR Modes

Capability	Mode 1	Mode 2	Mode 3
Business Collaboration	Medium	High	Low
Attract Investment	High	High	Low
Complexity	High	Medium	Low
Regulation Compliance	Low	Medium	High
Professional	High	Low	High

Table 2. Possible Modes of Comprehensive Energy Business

Type	Main Content	Business Model	MOR Mode
Town	Expansion and reconstruction of new urban areas, old urban areas or counties and towns. The main client of the comprehensive smart energy construction and services that need to be carried out in combination with the requirements of the new smart city construction is the local government. This type focuses on solving the problems of large energy demand, multiple types and high environmental protection requirements.	Franchise, joint venture, engineering consulting	1
Industrial Park	It mainly refers to industrial park or high-tech park. The park can also be a single type of industrial park or multiple types of industrial park. The energy demand density is relatively high. In addition to the energy demand of electricity, cold and heat, there are demands for steam, hot water, comprehensive utilization of waste heat, charging pile and charging field.	Franchise, joint venture, engineering consulting	1, 2
Building	Projects that rely on commercial buildings, headquarters bases, office buildings, hotels and hotels to carry out comprehensive smart energy construction. Generally, comprehensive smart energy construction is carried out in the form of single form, “main body + podium” and small-scale group buildings.	Contract energy management and engineering consultation	3

external unit itself has a large scale, and there are many emerging business projects and types in the business area, and some unique business models can be developed according

to the power and load characteristics of the self-balancing unit itself, then it is suitable to adopt Mode 1, which is a joint venture between the power supply platform company and the provincial industrial company to establish a special emerging business platform company.

Second, the nature of the emerging business itself. If the localization characteristics of emerging businesses in the business area are strong, and the internal business forms are relatively rich and diversified, it is suitable to adopt mode 1 or 2 to establish a localized platform company to carry out business. If the localization characteristics of emerging businesses are not strong and the degree of standardization is high, it is suitable to adopt mode 1 or 3, with specialized provincial industrial companies participating in the business.

Taking the emerging business of comprehensive energy as an example, Table 1 shows the optional business models of various projects.

Generally speaking, since the electric vehicle business needs to provide standardized services for vehicles in a wide range, the model is relatively uniform, and there is little room for model innovation in specific regions, which is relatively applicable to model 3. Only some special vehicles may apply Mode 1. Comprehensive energy business has the characteristics of diversified energy supply and value-added services, and the modes are quite different. Modes 1, 2 and 3 can be applied in different situations. In the energy storage business, the businesses with large scale, large land occupation and strong localization characteristics such as pumped storage may apply to mode 1, and the projects such as chemical energy storage may apply to mode 3.

To sum up the above two points, we believe that the hybrid transformation architecture at the bottom of the new power system will present a situation where three modes coexist in the future. Generally speaking, smaller external units may apply Mode 3, while larger external units use Mode 1 and 2. The specific mode to be adopted depends on the specific attributes of emerging businesses in the business area.

4 Relevant Measures

In order to promote the smooth implementation of the hybrid transformation of the bottom layer of the new power system, the following supporting measures should also be taken:

In terms of equity ratio, the respective advantages of power grid enterprises and partners should be considered, and a reasonable equity structure should be set on this basis. If the emerging business in the business area belongs to the type with high degree of standardization, low implementation difficulty, and more experienced power grid enterprises, it can consider holding operation. If it belongs to the type with high degree of localization and personalization, the power grid enterprises should be in a shareholding position, and introduce energy and power enterprises, equipment manufacturing enterprises, local urban investment platform enterprises and other active shareholders to participate in the operation [10].

In terms of partner selection, generally speaking, we hope to further promote in-depth cooperation at the business level through cooperation at the equity level, so as to achieve

the fundamental goal of improving business level and market competitiveness. Specifically, we need to conduct differentiated research according to the industrial attributes, development status, development goals and other conditions of different businesses.

In terms of price mechanism, the government should be urged to introduce a price mechanism suitable for the external units at the end of the new power system. In the absence of a reasonable and predictable electricity price mechanism, it is difficult for external capital to predict the return on investment and actively participate in the construction of the terminal units of the new power system. The establishment of a special price mechanism will provide a stable expectation for external capital to participate in the construction of the new power system. At the same time, this is also a necessary measure to ensure the reasonable cost recovery and system operation safety of the large power grid.

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