Analysis of China's Power Market Structure and Market Entities’ Business Interface under the Reform of Electric Power System

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ABSTRACT

On 15th March 2015, Some Opinions on Further Deepen the Reform of Electric Power System (No.9 document) was issued by the State Council with 6 supporting documents, indicating the all-round fulfillment of the new electricity system reform. China's new electricity system reform aims at forming a complete and orderly power market structure. Based on this, this paper analyzes the new electricity market structure, and lists the relation diagram. In addition, this paper analyzes the structure and business interface of power generation enterprises, power grid enterprises, electric power consumers and trading institutions.

KEYWORDS

Electricity power system reform, market structure, market entities’ business interface.

INTRODUCTION

On 15th March 2015, Some Opinions on Further Deepen the Reform of Electric Power System (No.9 document) was issued by the State Council with 6 supporting documents, indicating the all-round fulfillment of the new electricity system reform. Literature [1] has divided China's power system reform into six stages. The new electricity system reform focuses on reforming the power planning system and establishing an effective electricity market mechanism [2,3]. Literature [4] indicates the impact of the new electricity reform on the profit model and marketing mode of power grid. The literature [5] indicates that the six supporting documents are important to the reform of the power market, and the specific highlights are four aspects. Literature [6] analyzes the impact of new electricity power system reform on power generation enterprises and studies the value of power generation enterprises. Literature [7] has interpreted the new electricity reform from five aspects: electricity price mechanism, energy conservation and emission reduction, beneficiaries, challenges and legislation.
Since the release of "No.9 document", the "Three Release, An Independent, Three Strengthening" reform ideas have further accelerated the process of the reform of the electricity market. Under this background, it is very important for the power market construction to make clear the main body of electricity market and smooth the relation between each subject. Therefore, this paper mainly analyzes the main body of the electricity market and the business interface among the main bodies in China's future electric power system reform.

**MARKET STRUCTURE UNDER NEW ELECTRICITY SYSTEM REFORM**

In accordance with the requirements of the "No.9 document" and its supporting documents, the buyers of electricity market are power consumers, which are buyers of electric commodities and demand side of the market. The main body of the sellers are power generation enterprises, power supply companies and power distribution companies, including distributed generation suppliers. They are producers and suppliers of electric commodities, providing various types of power and services to customers in the electricity market. The composition of the main body of the electricity market and related relations can be summarized as shown in Fig. 1.

**COMPOSITION OF CHINA'S ELECTRICITY MARKET AND ANALYSIS OF BUSINESS INTERFACE**

The composition of the market members and their responsibilities will affect the operation of the electricity market. This section analyzes the functions and responsibilities of power generation enterprises, power grid enterprises, suppliers, power consumers, and trading institutions. Meanwhile, the government's market supervision function will be studied.

**Power Generation Enterprise and Its Business Interfaces.**

In the future target mode, the role of power generation enterprises as major power producers and suppliers remains unchanged. But in order to conform to the new
situation of energy reform, power generation enterprises should respond positively to energy conservation and emissions reduction responsibility given by the state and accept the corresponding supervision, actively participate in market competition, and accelerate the transformation of the industrial structure of enterprises.

(1) Power Supplier

In the future, as the supply side of the power industry chain, power generation enterprises, with natural resource advantages, should strictly implement the national energy conservation and environmental protection emission standards, undertake social responsibility fairly, explore diversified forms of energy supply, and develop market competition business by expanding their business scope. In addition, power generation enterprises need to actively respond to the encouragement policies which are listed in "No.9 document" for power generation enterprises to carry out direct trading of electricity, and establish cooperative relationship with high quality and large consumers.

(2) Auxiliary Service Provider

The electric power auxiliary service is an important part of the electric power market operation, and is the guarantee of the safe operation of the power system. The "No.9 document" proposed to improve auxiliary service assessment mechanism and compensation mechanism of power generation enterprises. Therefore, in combination with the consumer's own load characteristics, power generation enterprises can make full use of the market mechanism to sign auxiliary service contracts with power consumers, and obtain corresponding economic compensation.

Power Grid Enterprise and Its Business Interface.

In the new market model, the market will be gradually liberalized and the electricity will be sold competitively. The main functions of power grid enterprises in the field of transmission remain unchanged, and it shall assume basic power supply service and collect the wheeling charge according to the government-approved transmission and distribution price. But grid companies need to change the traditional profit model, and redefine the grid function and revenue mechanism.

(1) Be Responsible for Electric Power Dispatching, and Ensure Safe and Stable Operation of Main Network

The safe and stable operation of the main network is the basic guarantee for all power transactions. Therefore, power grid enterprises should give full play to the highly responsive capacity of their own dispatch departments, decisively adjust the grid operation mode according to the actual situation, constantly update the accident emergency plan, and carry out power dispatching economically and scientifically. The dispatching center is the most important public governance institution in power system, which has a series of public functions such as power grid operation command, accident treatment, mode arrangement and transaction realization. In order to ensure the security and stability of the whole power system, power grid enterprises should implement power dispatching right under the supervision of multiple layers, take charge of the safety of the power grid system, ensure the fair and non-discrimination of the power grid, and fulfill the universal service obligation of electric power in accordance with state regulations.

(2) Provide power transmission and distribution services, and collect the wheeling charge according to regulations

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The supporting document "The Implementation Opinions on Promotion of Power Transmission and Distribution Price Reform" has put forward concrete opinions on "Mechanism of Rationing Electricity Price and Price Reform of Power Transmission and Distribution". With the deepening of the reform, the transmission and distribution price will gradually transit to the principle of "Permitted Cost plus Reasonable Income", which is approved by voltage grade. In the meantime, power grid enterprises should actively cooperate with electricity transmission and distribution price reform, objective provide all kinds of information required for audit and supervision of transmission and distribution cost and price verification.

(3) Provide Universal Service

In the future, under the new electricity reform policy, the profit-making mode of power grid enterprises will change, and their basic attributes will change accordingly, highlighting its public service attributes. In the case of not violate relevant regulations, power grid enterprises will assume the responsibility of social universal service, provide application and installation, metering, meter reading, maintenance, charging and other electric power services to market participants without discrimination, provide real-time production, trading, and energy information to the market, and ensure fair and open of power grid platform.

(4) Provide Auxiliary Service to Ensure Power Quality

Auxiliary service transactions involve transmission reserve capacity, black start, frequency modulation and other aspects. It needs to work out the rules that conform to the market and implement the principle of "Who Benefits and Who Undertakes". As the link of electric power market, power grid enterprises should take an active part in electric power auxiliary service, and maintain the balance of power supply and demand and safe operation. Combined with the consumer's load characteristics, power grid enterprises and consumers sign guaranteed supply protocol and interruptible load protocol voluntarily and agree on the relevant rights and obligations, which will ultimately ensure safe operation of the system and quality of power supply.

(5) Provide Value-Added Service

Value-added service refers to providing electricity customers with services beyond the standardized service scope according to the needs of customers. This kind of service is mainly customer-centric, aiming at improving customer satisfaction and value growth, which brings short/long-term benefits to the implementation subject while continuously creating value for customers. In the natural hub of communication between supply and demand parties, power grid enterprises have network infrastructure and big data resources. Therefore, power grid enterprises should give full play to their advantages in the future, develop integrated energy services, and provide diversified value-added services for consumers.

(6) Provide Basic Power Supply Service

Power grid enterprises have the right to operate transmission and distribution network, and they should ensure the electricity supply of residents, agriculture, important public utilities and public welfare services, and assume the basic power supply service in their power supply business district. Power grid enterprises have four meanings as basic power suppliers. First, the power grid enterprises assume basic power supply service. The consumers who are not willing or able to accept the power supply of third party suppliers can be directly supplied by the power grid enterprises. And the electricity price shall be controlled by the state. Second, when suppliers terminate the business or do not have the ability to provide the electric services, the
power grid enterprise shall supply power to the consumers and collect the fees according to the government regulations. Third, when the power distribution company of social capital investment cannot fulfill its responsibilities, the government shall designate other power grid enterprises to fulfill it. Fourth, when implementing basic power supply, power grid enterprises have the constraint of safe operation.

Suppliers and Its Business Interface.

There are two main aspects of suppliers’ business.
(1) The Business of Selling Electricity
Suppliers can conduct a competitive selling business through its own power generation or the market.
(2) Value-Added Services
In addition to the traditional business of selling electricity, based on cloud computing, big data technology and other advanced technology, suppliers can understand various demands of different types of energy required by consumers, and provide consumers with electricity diagnosis, contract energy management, integrated energy solutions services and other value-added services.

Power Consumers’ Rights and Responsibilities.

In the electricity market environment, consumers can choose to participate in or withdraw from the electric energy trading market, and sign power supply contracts with power generation enterprises or suppliers. At the same time, power consumers should actively participate in the demand response project, and sign the demand response protocol based on the price or incentive with power suppliers. Power consumers should also install corresponding measurement and response devices, adjust the behavior of using electricity according to the instructions, and get compensation.

Trading Institution and Its Business Interfaces.

According to the "No.9 document" and supporting documents, electricity trading institution can take the following forms including Grid company's relative holding company system, subsidiary system and membership. Its main function is to serve power transactions, and its main responsibilities are as follows: constructing, operating and managing the market trading platform, undertaking market transactions and organizations, managing registration of market subjects, and disclosing and releasing market information and so on. In addition, trading institution and dispatching institution are complementary. In order to ensure the coherence of trading and dispatching, we should accurately divide their rights and responsibilities. Trading institution’s main responsibilities are as follows: organizing market transaction, drawing up trading plans which are used for settlement and handing over to the dispatching institution. Dispatching institution’s main responsibilities are as follows: keeping the system balanced and secure, providing basic information about security conditions and line power flow to trading Institution, and forming dispatching plans and executing them.
SUMMARY

China's new electricity system reform aims at forming a complete and orderly power market structure. Under this structure, power generation enterprises and suppliers can participate in power purchase and sale transactions in the form of free consultation or centralized bidding through electricity trading institutions or trading platform, and provide electricity commodities and corresponding services to power consumers. Power consumers have the ability to negotiate the price with them and is free to choose the seller of the transaction. Among them, power generation enterprises provide required electricity to power grid enterprises and suppliers, and power grid enterprises collect the wheeling charge from power generation enterprises and suppliers in the form of transmission and distribution price.

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REFERENCES

6. Yang He: Research on re-evaluation of POWER ENTERPRISES in power system reform based on FCFF by Guangdong Electric power(Master, Jlnan University, China 2016). p. 7