



Design of the Electric Power Market Operating Model for Excess Electric Energy Consumption in Inner Mongolia

Junfang Wu

North China Electric Power University, Beijing 102206, China

E-mail: wujunfang_1010@163.com

Lei Guan

North China Electric Power University, Beijing 102206, China

Tel: 86-10-8079-8250 E-mail: helloguanlei@yahoo.com.cn

Abstract

The Inner Mongolia Autonomous Region of China possesses abundant primary energy sources, and the quick developments of coal and electric power industry have established stable base for the high-speed growth of the economy of the autonomous region. Under the premise that the Inner Mongolia region pushed the electric power market oriented reform and established the electric power trading market, the basic principles to construct the electric power market in Inner Mongolia were discussed, and the market mode, market characters, market subject and trading mode in various phases of the grading reform were designed, and the trading type and the trading flow of the present reform phase were described in detail in the article. The research result of the article could be used for references to push the electric power market reform in Inner Mongolia Region.

Keywords: Inner Mongolia, Electric power market, Operating model, Excess electric energy consumption

1. Introduction

The Inner Mongolia Autonomous Region with abundant primary energy sources such as coal, wind energy and solar energy is located in the north of China, and its economy has kept sustainable and quick development for many years, and the quick developments of the coal industry and the electric power industry establish stable base for the high-speed growth of the regional economy. The Inner Mongolia Electric Power Co. Ltd possesses special status, and it is the exclusive electric grid enterprise directly under the Autonomous Region independent of State Grid Corp. of China and China Southern Power Grid Corp. Ltd. And the level of on-grid price is relatively low, and the price distribution is relatively centralized, so the purchase and sale price difference is small. Inner Mongolia is the important province with electric power output, and the electric power exchanges are very frequent between the Inner Mongolia Grid and the North-China Grid and the Northeast-China Grid.

It is very necessary to establish the Inner Mongolia Grid Electric Power Trading Market. First, it is the effective approach to promote the economic development of Inner Mongolia, consume surplus electric energy and realize the harmonious win-win among power generation enterprises, grid enterprises and electricity consumers. Second, it can promote the electric power export of Inner Mongolia to optimize the electric power allocation in the North-China even the whole China. Third, it is the necessary condition to establish the electric power trading platform and promote the healthy and orderly development of larger consumer directly-purchasing electricity. Fourth, it is the important composing of the North-China regional power market and the national electric power market. Therefore, it is necessary and feasible to start the multilateral electric power trading market in Inner Mongolia.

2. Construction principles of Inner Mongolian electric power market

The construction principles include following the socialistic market economy law and the development law of electric power industry, using the experiences in foreign and domestic electric power markets for references, actively cultivating the subjects of the market, establishing fair, standard and high-effective electric power trading platform, constructing "power generation enterprises orientated, large-consumer oriented and out-of-regions" Inner Mongolia grid electric power trading market, organically combining with the national and regional electric power markets, exerting the basic function of the market-allocated resources, promoting the sustainable and harmonious developments among economy,

environment and electric power industry in Inner Mongolia, and realizing the optimized allocation of Inner Mongolia electric energy in the North-China even the whole China.

(1) Constructing the Inner Mongolia grid electric power multilateral trading market quickly, actively participating in the regional electric power market, actively cooperating with the construction of national electric power market, and developing the electric power market of Mongolia.

(2) Carrying out the scientific outlook on development, and establishing the market mechanism which makes for the development of “saving energy, economic and environmental protection” electric allocation and the electric energy trading.

(3) Organically combining with the present policies of China, and establishing and perfecting the power price mechanism.

(4) Based on the regional electric power market, developing the out-of-regional electric power market.

(5) Giving attention to various interests, and fully mobilizing various parties' enthusiasms to participate in the construction of the electric power market, and promoting the win-win among electric generation enterprises, grid enterprises and consumers.

(6) Totally designing and gradually implementing the market construction from simple to complex, stably pushing the construction, and realizing the link with the regional and national electric power markets.

3. Total objective and grading tasks

3.1 The total objective of the electric power multilateral trading market of the Inner Mongolian Grid

The total objective includes cultivating the “electric power generation enterprise oriented, large consumers oriented and out-of-region oriented” opening electric power market, driving the construction of the Inner Mongolia electric power energy base and the implementation of the energy conversion development strategy in virtue of the market mechanism, promoting the resource optimization allocation of Inner Mongolia electric energy in the North-China even the whole China, establishing fair, standard and high-effective Inner Mongolia electric power trading platform, Developing the electric power trading with multiple forms such as out-of regional electric energy trading, electric power generation rights trading and large consumer directly purchasing electricity trading, carrying out national and autonomous regional policies about “replacing small enterprises by large enterprises, energy conservation and emission reduction” by the market means and promoting the experimental unit of large consumer directly purchasing electric power to be developed orderly, and realizing the win-win among electric power generation enterprises, grid enterprise and consumers, establishing opening, transparent, orderly and competitive Inner Mongolia electric power multilateral trading market according with the system characters of the autonomous region and the Inner Mongolia grid to guarantee the harmonious and sustainable development of Inner Mongolia economy, environment and electric power industry.

3.2 The grading objective of the electric power multilateral trading market of the Inner Mongolian Grid

Based on above total objective, according to the basic principles of uniform layout, totally design and gradually implement, according to the total deployment of national electric power system reform and the grading construction objective and task of North-China regional electric power market, Combining the actuality of the Inner Mongolia Grid, the grading construction objectives of the Inner Mongolia Grid electric power multilateral trading market are seen in Table 1.

4. Primary design of the electric power market operating model

4.1 Competitive trading type

The concrete classification of the trading type is seen in Figure 1.

4.1.1 Electric energy trading out of the autonomous region

Out-of-regional electric energy trade means the electric energy trade between the Inner Mongolia Electric Power Co., Ltd and other grid enterprise out of the autonomous region, and it includes trans-provincial transmitting/receiving electricity trading, trans-regional transmitting/receiving electricity trading and transnational transmitting/receiving electricity trading.

The market subjects in the out-of-regional electric energy trading include the Inner Mongolia Electric Power Co., Ltd and other electric power generation enterprises (sets) with market admittance. The trading can be organized by two sorts of mode. For the first mode, according to the demand, price, electric power transmission of the out-of-regional electric power market, the electric power corporation mainly purchases the electricity quantity of local regional electric power generation enterprises, and sell to other grid enterprise, and it is the primary electric energy trading mode among regions, i.e. the annual contract electric energy trading. For the second mode, the electric power corporation acts as an agent of in-grid electric power generation enterprises to participate in regional and national electric power market competition,

and sells surplus electricity quantity to the grid enterprises out of the region, and this mode is mainly used in the temporary electric energy trading and the market competition trading.

The multilateral trading mode and the centralized price bidding mode are adopted in the out-of-regional electric energy trading which gives priority to the former and gives supplement to the latter.

According to the actual demands of the trading, the cycle of the out-of-regional electric energy trading can be divided into the long-term trading (one year or above one year), the middle-term trading (season or month) and the short-term trading (weak or day) and the real-time trading.

(1) Multilateral out-of-regional electric energy trading

The multilateral out-of-regional electric energy trading is organized by the season or the month.

According to the demands of the out-of-regional grid, the electric power trading center negotiates with the out-of-regional grid trading center to confirm the tie line export electricity price and the trading electricity quantity, and then respectively negotiates with various electric power generation enterprises (sets) which want to participate in the out-of-regional electric energy trading and confirm the actual transacted electricity quantity and the transacted on-grid electricity price in the out-of-regional electric energy trading according to the transacted the tie line export electricity price and the trading electricity quantity.

(2) Out-of-regional electric energy centralized price bidding trading

When the multilateral out-of-regional electric energy trading can not fulfill the demands, the electric power trading center will organize the centralized competitive out-of-regional electric energy trading. Aiming at the transacted electricity quantity deficiency of the out-of-regional electric energy trading, the electric power trading center organizes the electric power generation enterprises (sets) with market admittance to unilaterally bid, and the transacted electricity quantity of the electric power generation enterprises (sets) are confirmed by the electric power generation quotation ranking method which takes the lowest electricity purchasing costs as the objective.

4.1.2 Electricity generation rights trading

The electricity generation rights trading means to realize the non-gratuitous assigning and assigned substitutive trading behaviors of electricity quantity among electric generating sets by the market mode. The electricity generation rights trading can be implemented among all electric power generation enterprises with market admittance, and the enterprises of both parties assign part or all electric power generation rights by signing the electric power rights trading agreement to replace the electric power generation enterprises (sets) to complete the electric power generation tasks of the assigned electricity quantity index. The trading center should encourage the high-efficiency and environment-protective sets to replace the low-efficiency and high-pollution sets, and encourage electric generating sets with the water and electricity and other renewable energy sources to replace the coal steam-electric sets.

In the first stage of the Inner Mongolia grid electric power multilateral market, the non-gratuitous transferors of the electric power generation indexes mainly include the small-sized coal steam-electric sets listed in "the Eleventh Five-year Development program" by Inner Mongolia Autonomous Region Government. With the continual development of the multilateral electric power trading market, the electric power generation trading will be extended to the substituted trading of "replacing small-size by large-size, and replacing low energy consumption by high energy consumption" among coal steam-electric sets, the "water-coal replacement" trading between water electricity sets and the coal steam-electric sets, and the electric power generation replacement trading because of the grid blocked.

The multilateral trading mode and the centralized price bidding mode are adopted in the electric power generation trading which gives priority to the former and gives supplement to the latter.

The electric power generation trading is divided into the annual multilateral electric power generation rights trading, the monthly multilateral electric power generation rights trading, and annual centralized price bidding electric power generation rights trading and the monthly centralized price bidding electric power generation rights trading.

(1) Multilateral electric power generation rights trading

The multilateral electric power generation rights trading can be arranged according to following priority, i.e. trading among different electric power generation sets in same one electric power generation plant, trading among different electric power generation plants in same one electric power generation enterprises, and trading among different electric power generation enterprises.

The electricity quantity and price in the electric power generation rights trading are consulted by both parties independently or coordinated by the electric power trading center, and assessed by the grid safety and confirmed. Both dealing parties report the transacted electricity quantity and price to the electric power trading center, and the report contents will be as the balance references after being confirmed.

(2) Centralized price bidding electric power rights trading

The trading price of the centralized price bidding electric power rights is confirmed by the market competition, i.e. the both dealing parties of the electric power generation rights declare the “electricity quantity-price” curve of the purchased and sold electric power rights, and the intersection point between the demand curve and the supply curve is the trading price of the centralized price bidding electric power rights. The minimum electricity quantity of each board lot electric power rights trading will be confirmed according to the actual situation.

4.1.3 Large consumer directly purchasing electricity trading

The electricity purchasing subjects in the large consumer directly purchasing electricity trading are the large-sized industrial electric power consumers with market admittance, and the sales subjects are the electric power generation enterprises (sets) with market admittance. The multilateral trading mode and the centralized price bidding mode are adopted in the large consumer directly purchasing electricity trading which gives priority to the former and gives supplement to the latter.

(1) Multilateral large consumer directly purchasing electricity trading

Under the organization of the electric power trading center, the large consumers and the electric power generation enterprises (sets) negotiate the directly purchasing electricity quantity and the directly purchasing electricity price, and after the electricity quantity and the electricity prices are checked by the grid safety department, three parties including “electric power generation enterprises, grid enterprises and consumers” sign the barter contract together.

In the first stage of the Inner Mongolia electric power multilateral trading market, the large consumer directly purchasing electricity trading adopts the mode that the electric power trading center openly lists the tradable directly purchasing electricity resources on the electric power trading platform, and multiple large consumers and electricity generation enterprises participate in the trading, and three parties including large consumer, electric power generation enterprises and the Inner Mongolia Electric Power Co., Ltd sign the large consumer directly purchasing trading contract through multiple parties’ (both parties’) negotiation. This mode can be convenient for more large consumers in larger range and electric power generation enterprises to know the trading information and participate in the directly purchasing electricity quantity trading, and it can ensure the implementations of large consumer directly purchasing electricity contract and the healthy and orderly large consumer directly purchasing electricity trading market.

(2) Large consumer directly purchasing electricity centralized price bidding trading

When the large consumer directly purchasing electricity multilateral trading can not fulfill large consumers’ demands or new demands of large consumer directly purchasing electricity are added, the centralized price bidding mode will be adopted.

For the large consumer directly purchasing electricity centralized price bidding trading, in the initial stage, the form that large consumers declare demands of electricity quantity and generation producers unilaterally declare the trading price is adopted, and the large consumer purchasing electricity price will directly link with the on-grid electricity price depreciation extent of the generation producers. With the market oriented construction of the electric power multilateral trading, the form that the power generation enterprise (sets) and large consumers bilaterally quote prices in different periods will be adopted. To uniform the quoted price, contracting parties quote the price on the grid, and the transacted price is the price balanced in the large consumer centralized price bidding market.

4.1.4 Day-ahead simulation trading

The competitive sets participating in the day-ahead market simulation declare price data to the trading center, and the trading center adopts the node marginal electric price method to confirm the electric prices in various periods of the day-ahead market, and simulate clearance and balance.

4.1.5 Assistant service compensation mechanism and simulation trading

In the initial stage of the Inner Mongolia electric power multilateral trading market, assistant services will continually perform the assistant service compensation mechanism confirmed by the present assessment method about the synchronization electric power plant scheduling management of Inner Mongolia Grid, and the total objective is that the decrease and reduction of the electricity quantity are basically balanceable with the encouraging electricity quantity. As the multilateral trading market laws of electric power are continually perfected, the assistant service market simulation operation should be properly started.

4.2 Trading flow

The trading flow is seen in Figure 2.

5. Conclusions

By means of the electric power trading platform, Inner Mongolia Grid could develop the multilateral trading of electric

power, which accords with the national situation, regional situation, and Chinese present correlative policies about administration, financial tax, investment, price and grid management system, the market strategy of “giving priority to the grid electric power balance, and actively developing the out-of-regional (including trans-province, trans-region and trans-nation) electric energy trading of Inner Mongolia Grid”, makes for the harmonious and sustainable development of local economy, environment and electric power industry and could realize the win-win among multiple parties. Therefore, it is necessary and feasible to start the electric power trading market for Inner Mongolia Grid. The electric power market operating mode in the near future was designed primarily in the article, which possesses driving function and practical meanings for the promotion of Inner Mongolia electric power market oriented reform.

References

- Energy Sources Department of Inner Mongolia Development and Reform Commission. (2007). Developing the Wind Power and Improving the Inner Mongolia Electric Power Energy Structure. *Northern Economy*, No.9.
- Fu, Ruibin & Fu, Ruixia. (2004). Analysis of the Macro Environment of the Inner Mongolia Electric Power Industry. *Inner Mongolia Science Technology and Economy*, No.5.
- Huang, Yujun & Ren, Ze. (2007). Analysis, Countermeasures and Advices of Inner Mongolia Electric Power Industry Development Tendency. *Northern Economy*, No.12.
- Li, Hanfang, Tan, Zhongfu & Luan, Fengkui. (2008). Regional Electricity Market Factors and Market Performance Evaluation Model. *Electric Power Automation Equipment*, No.3.
- Zhang, Zhonghui, Yu, Zhimin & Wang, Yu. (2008). Analyze Roughly about the Power Market Pattern and the Operations Model. *Science & Technology Information*, No.2.

Table 1. Grading construction objectives of the electric power multilateral trading market of Inner Mongolia Grid

	The first phase (2008.6-2010)	The second phase (2011-2015)	The third phase (2016)
Market model	The finite electricity competition market including part sets and part large consumers	Part electricity day-ahead auction market and assistant service market	Wholesale competition market, retail competition market and financial electricity market
Main characters	Major multilateral (bilateral) trading, and assistant auction trading	Expanding the proportion of the competition electricity The day-ahead market price becomes into the important economic signal Gradually implementing the apex-vale electricity price Establishing scientific and reasonable electricity transportation and distribution price mechanism and promoting the electric energy trading trans-provincial, trans-regional and trans-national Enriching and perfecting the season trade	The bilateral quoted price is implemented in the day-ahead market Adopting flexible and high-efficient trading mechanism Financial electricity trading
Market subject	Inner Mongolia Electric Power (Group) Co., LTD Power generation enterprises (sets) with market admittance Large consumers with market admittance	Extending the power generation enterprises with market admittance and large consumers purchasing electricity directly	Power generation enterprises (sets) with market admittance, retail dealers and electric power users
Trading type	Out-regional electric energy trading Power generating rights trading Directly purchasing electricity trading by large consumers Day-ahead market and assistant service market simulation operating Real-time balances and distribution according to the demands	Properly starting the day-ahead market Establishing assistant service market Real-time market simulation and operation	Starting the real-time market Developing the financial electricity products trading

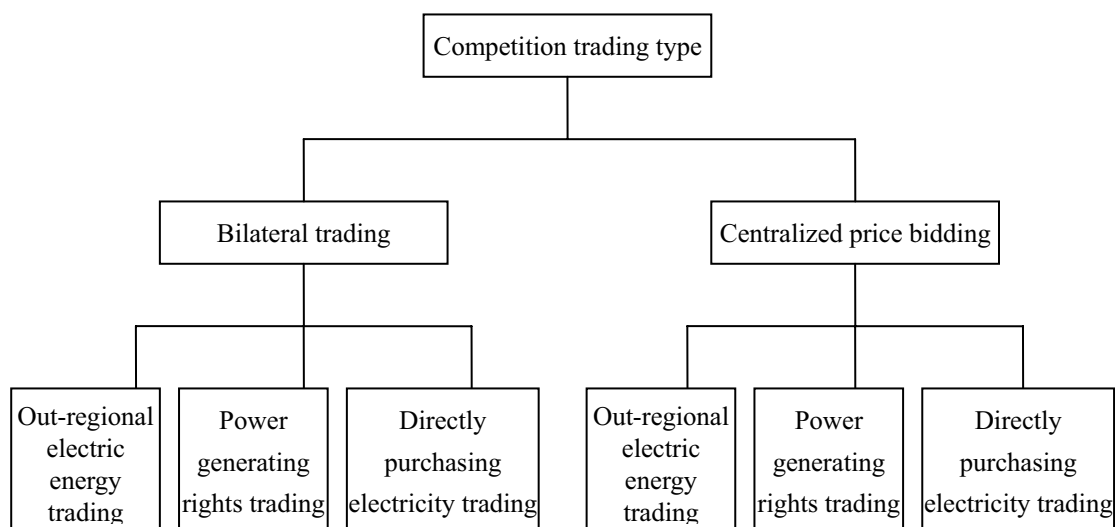


Figure 1. Electric Power Multilateral Trading Structure of Inner Mongolia Grid

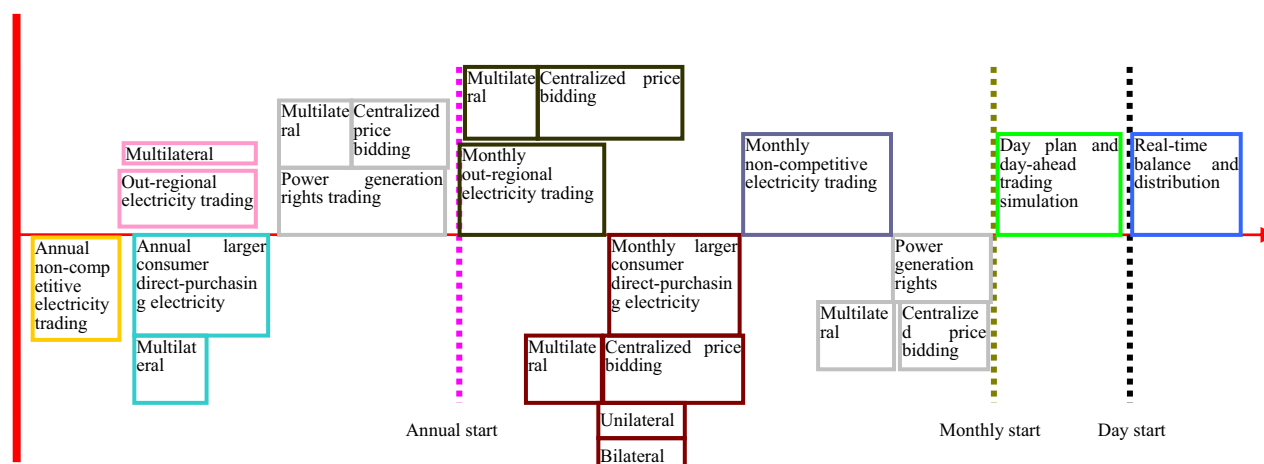


Figure 2. Electric Power Multilateral Trading Time Sequence of Inner Mongolia Grid