

Research on Distributed Energy Trading Patterns in Inner Mongolia Under the new electricity reform

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Abstract. At present, the development of distributed energy in Inner Mongolia is at the forefront of China, and the policies that government issued play an important role on this. However, in the context of the new electricity reform, much more trading mechanism problems of distributed energy appears. Therefore, based on the trading status analysis and development experience in foreign countries, this paper proposed the trading mechanism and implementation suggestions of distributed energy in Inner Mongolia under the new electricity reform. The results is conducive to further completed the management mechanism and ultimately promote the large-scale consumption of distributed energy in Inner Mongolia.

Keywords: electric power system reform; Inner Mongolia Autonomous Region; distributed energy; trading mechanism

1. Introduction

The coordinate development of energy and environment is an important problem in the global energy development. At present, two major contradictions exist in China's energy exploitation and utilization: one is the contradiction between the day-by-day exhaustion of traditional energy and the low utilization efficiency of energy; another is the contradiction of the coal based energy structure and increasing environment pressure [1]. Under such a social background, as a new way of energy utilization, distributed energy can effectively solve the two contradictions with the characteristic of energy-saving, environment protection, economy and reliability. Hence, distributed energy can promote the adjustment and transformation of the energy supply mode, which has a wide range of development and application prospects. At the meanwhile, the policy document "Some Opinions on Further Deepening of the Electric Power System Reform" issued in May 2015 clearly pointed out to raise the proportion of renewable energy supply and distributed energy supply in the electric power system, emphasized taking "local consumption, the surplus transmission to the grid" as the operation mode, and put forward to fully release distributed power market. This undoubtedly promotes the development and trading mechanism formation of distributed energy in China.

Compared to the developed countries, China's distributed energy system is lagging behind, and has many policy problem, market construction problem, economy and technology problem and so on [2]. For example, there's no explicit provisions on the amount of distributed energy that the Power Grid Corp should fully purchase. While other countries have already issued the lots of detail rules, like the connection cost and reserve cost. Therefore, improve the related mechanism of distributed energy system and R&D related technology is a good way to promote the large-scale construction of the distributed energy in China.

This paper will firstly analyze the current situation of the new electric power system reform and distributed energy trading in Inner Mongolia, then learn from the useful experience of foreign distributed energy trading, and finally design the trading mode of distributed energy in Inner Mongolia and propose corresponding policy recommendations to ensure the smooth development of energy transaction. The study of this paper helps to fill the gaps in transaction management mechanism of Inner Mongolia's distributed energy, and ultimately promote the mass consumption of distributed energy in Inner Mongolia.

2. Development Status of Distributed Energy Transaction in Inner Mongolia

Currently, the gas distributed energy in Inner Mongolia already has scale development condition in resources, technology, market and other aspects, but the development speed is still relatively slow. The total reserves of wind energy in Inner Mongolia ranks first in China, and its technical exploitation amount is up to 0.15 billion kilowatts, accounting for half of the general resources [3]. As for distributed photovoltaic power generation, its potential value gradually emerge and the total installed capacity reaches 8 million kilowatts by the end of 2015 [4]. For the biomass generation technology, Inner Mongolia has made significant progress, but the research on the core technology and key equipment is still inadequate.

In the context of the new electric power system reform, more supporting policies have been issued to promote the development of distributed energy, by giving a clear signal for supporting. First, the sixth key task of electric power system reform scheme proposed “ensure the fair access of grid, build new mechanism for distributed energy”, which maps out the strategy of actively develop distributed energy and fully release distributed energy market [5]. Subsequently, the supporting document “orderly release electric power planning” rules that distributed wind power and solar power generation enjoy the priority generation right; the document “promote the reform of electricity sale side” rules that power users with distributed power can be engaged in market oriented electricity sale business, or entrust the sales agency with the business [6]. These policy supporting documents also significantly facilitate the development of distributed energy in Inner Mongolia.

The development of distributed energy in Inner Mongolia is an important measure for promoting the distributed energy in China transition from the initial stage to the large-scale development stage, a necessary means to promote the circular economy development, and an effective way to improve the comprehensive utilization efficiency of energy resource. However, the support promotion policy for Inner Mongolia’s distributed energy is not perfect yet and the power management system is immature neither. Generally speaking, five main problems exist in Inner Mongolia’s distributed energy trading mechanism.

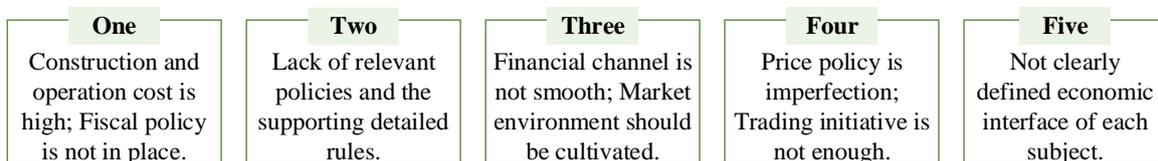


Fig. 1 Main problems of distributed energy trading in Inner Mongolia

3. Study of Distributed Energy’s Trading Model in Inner Mongolia

On-grid of distributed energy is subjected to plenty of objective constraints due to its volatility and intermittent characteristics [7]. Therefore, how to ensure the successfully on-grid and stable transactions of distributed energy becomes an important issue to ensure the healthy operation of the distributed energy market in Inner Mongolia.

3.1 Market Mechanism Design of Distributed Energy in Inner Mongolia

This section made a systematic analysis of the basic elements of market transaction, such as trade subjects, organization mode, market access, market clearing and etc. (as shown in the following table). Then proposed the general market transaction pattern of distributed energy in Inner Mongolia.

Table 1 Basic elements of market transaction of distributed energy in Inner Mongolia

Element	Context
trade subject	Including distributed generation enterprise, grid enterprise, trade center and consumer.
organization mode	Including annual transaction and monthly transaction. Electric power trading center is responsible for the organization of the transaction market, releasing the expected amount of market power and rolling adjustment the amount according to the actual needs.
market access	Market access for distributed generation enterprise: capacity of conventional generator should be less than 20kW; capacity of resource comprehensive utilization unit should be less than 10kW; strict prohibition of owned power plants to enter the market.
market clearing	Including market trade settlement and liquidated settlement. The Inner Mongolia electric power trading center is responsible for this and issue electric quantity balance sheet.
congestion management	The power control center is responsible for the prediction and detection of possible blocking problems, and the necessary congestion management.
Security checking	Based on market transaction results and the planned electric arrangement, the electric power dispatching center carries out the security check and provides the check result.
ancillary services	During the early development of market, execute according to the related policy; timely start auxiliary service transactions based on market construction process.
information disclosure	Electricity trading center is responsible for releasing market information, market members have responsibility and obligation to provide market information timely.

Based on the setting of elements, this paper build market mechanism of distributed energy in Inner Mongolia as followed:

(1) Price mechanism

First, electricity price in bilateral trade is formed by negotiation and price in centralized bidding is formed by market clearing, while planned electricity price is implement in accordance with the relevant provisions. Second, limit each trade production price with a variation of $\pm 20\%$ for avoiding market risks effectively. Finally, each market subject is obligated to pay the transaction fee to compensate construction and operation costs of the trading system.

(2) Balance mechanism

Based on the security check of the transaction results, Inner Mongolia electric power dispatching and trading center is responsible for scheduling electric power dispatch plan in accordance with the contract electricity market and regulated electricity market. Then, all levels of power trading center perform daily scheduling plan in system security conditions, and maintain the real-time balance of power grid according to the power grid operation.

(3) Settlement mechanism

The Power Grid Corp doing the direct settlement of trading. First, Inner Mongolia electric power company clear costs with energy acceptance power grid company, which including fee of transmission & distribution electricity and direct trading. Second, electric power company clear costs of transmission, ancillary services, balance service, direct trading and the national subsidy funds with power generation enterprises.

(4) Regulatory mechanism

Supervision content of competitive electricity market including behavior of power generation enterprises, market access and electricity market order. As for power transmission and distribution company, the supervision is mandatory, and transmission and distribution enterprises should fairly open grid to provide non-discriminatory service. Supervision of the electric power dispatching and trading center should focus on the fairness, openness and transparency.

(5) Security mechanism

First, government should strengthen the formulation of supervision and incentive policy, and give the distributed energy related support, such as financial, tax, financial support. Second, specify the rights and responsibilities of market participants, strengthen the construction of the market credit system, as well as timely registration and disclosure fraud management behavior. Third, set the proper investment scheme to prevent the interruption of the capital chain, and make perfect post project evaluation scheme so that subjects can get the result feedback in time.

3.2 The whole frame of distributed energy trading market

Overall, competition should be introduced into the distributed generation and the sale of electricity links to promote distributed energy transaction in Inner Mongolia. And it is necessary to build up the province electricity trading platform, and fully release power generation enterprises' and consumers' independent pricing right by implementing market-oriented trading and mechanism and price mechanism. The whole frame of distributed energy trading market is shown as figure 2.

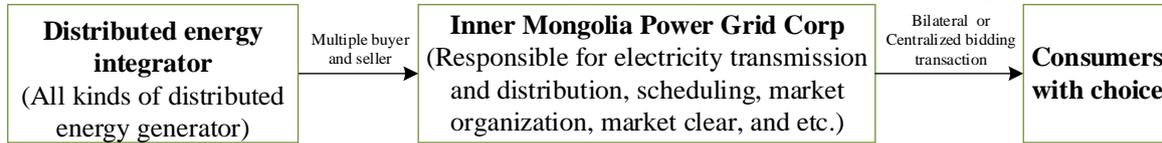


Fig. 2 The whole frame of distribute energy trading market in Inner Mongolia

3.3 New development of distributed energy trade model under the Energy Internet

In July 2015, Chinese State Council issued guiding opinions on action of promoting “Internal Plus”, which takes “Internet + Intelligent energy” as one of the key action areas [8]. In the context of Energy Internet, there are heating, cooling and other forms of energy coupled in energy production, transportation, storage and consumption. On the one hand, as one of the core elements of the Internet, distributed energy generation plays an important role in the energy revolution. On the other hand, distributed generation is an entrance for new market subjects to enter the sale market, and a method to promote the low-carbon development of the electricity power system. Therefore, Energy Internet and distributed energy generation will be on coordinate development in the future, as shown in figure 3.

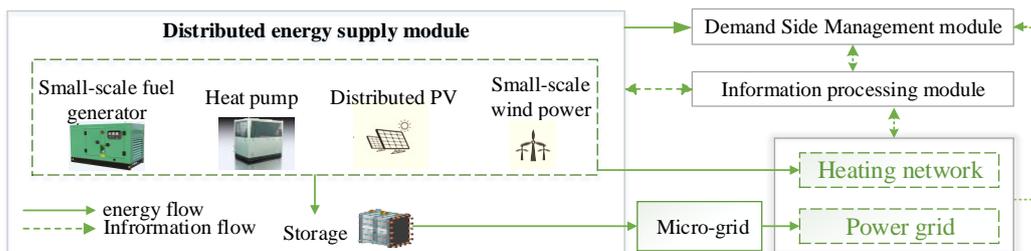


Fig. 3 Energy Internet trading platform with distributed energy generation

It can be seen from the figure, the whole Energy Internet trading platform is basically consist of four modules: distributed energy supply module, demand side management module, system network module and information processing module. Among them, the distributed energy supply module mainly includes distributed photovoltaic power generation, small-scale wind power, heat pump, fuel cell power station, energy storage equipment, etc.

This paper suggest, in the platform, the distributed generation mainly access in the form of micro-grid and using real-time transaction mode to avoid the imbalance of power supply and demand. Also, it is recommended to use unified electricity price settlement method, namely, micro-grid system operators settle the abundant electrical energy in distributed generation with the unified settlement price.

4. Summary

This paper base on the development status and exist problems of distributed energy in Inner Mongolia, proposed basic elements, market mechanism, and the new trend of distributed energy in Inner Mongolia under the context of Energy Internet. Through the research, the paper holds that government need to actively cultivate and open-up the market and establish legal system to ensure the distributed energy development in Inner Mongolia.

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