

Research on the Key Mechanism of Transnational Electric Power Trade

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Abstract: Transnational electric power trade involves different governments, regulatory agencies, power grid enterprises and various market entities, etc. There are many interest subjects and it is difficult to coordinate, so it is necessary to establish a series of effective trade mechanisms. Based on the special properties of electric power commodity, this paper analyzes the key trading mechanism types of transnational electric power trade at the present stage from the physical and non-physical levels, and puts forward corresponding supporting mechanisms considering the needs of multinational interest coordination and docking of different market mechanisms. The purpose is to ensure fair and effective market transactions, thus providing important support and reference for the steady and orderly development of transnational electric power trade.

1. Introduction

Compared with general commodities, electric commodities have the characteristics of real-time balance between production and consumption and are difficult in large-scale storage. Therefore, the orderly development of transnational electric power trade needs the organic cooperation of various related transaction types. Auxiliary service transaction can guarantee the safe and stable operation of power system and the quality of power commodity. In order to realize the market distribution of transnational transmission capacity, it is necessary to carry out transmission rights trading. In addition, the development of electric power financial derivatives trading can provide market participants with a tool to avoid risks and mitigate the empirical risks brought by the price fluctuation of the electric power market.

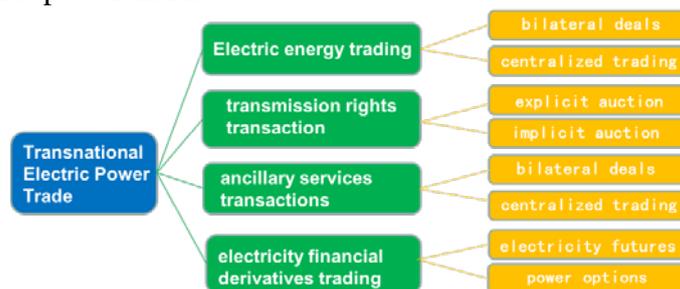


Figure. 1 Type and Mechanism of Transnational Electric Power Trade

2. The Main Transnational Electric Power Trading Mechanism at Present

2.1 Electric energy trading

According to the different transaction modes, there are two main mechanisms for transnational (cross-border) electricity transaction at present: bilateral transaction and centralized transaction. Bilateral transactions mainly refer to the mechanism for the market entities of the two countries involved in cross-border (cross-border) transactions to conduct power transactions through bilateral negotiations and negotiations, mainly focusing on medium and long-term transactions. Centralized trading refers to the unified and centralized trading conducted by power generation enterprises,

power users and power selling companies through trading institutions, generally focusing on short-term trading.

Table 1 Bilateral Trade versus Centralized Trade

	Bilateral Trade	Centralized Trade
Participants	Power grid company agent, power generation enterprise, power user, power selling company, etc	Power generation enterprises, power users, power selling companies, etc
Transaction Cycles	Mainly for medium and long-term transactions, such as many years, annual, half-yearly, quarterly, monthly, etc	Short-term trading, such as days, real-time
Settlement Mechanism	Self-settlement or settlement through trading institutions	Unified settlement of trading institutions
Degree of Marketization	High	Higher
Complexity	More easily	More difficult

In bilateral transactions, the market entities of the two countries reach a transnational purchase and sale agreement through bilateral negotiation. Under the circumstance that the electricity market of the two countries is less open, the power purchase and sale negotiation is generally carried out by the power grid companies of the two countries or the agency market subjects of the vertically integrated power companies, that is called the agency negotiation. The other way is for the two countries' power generation enterprises, power users, power selling companies and other market players to conduct direct consultation and conduct power transactions. Centralized trading refers to the mechanism by which market players in different countries conduct bidding and clearing on a common trading platform to reach cross-border power trading agreements. There are two common modes of market-oriented centralized trading: "joint market" mode and "unified market" mode.

2.2 Transmission rights transaction

Cross-border transmission rights transaction is a market-oriented method to allocate the transmission capacity of transnational link lines to market members and deal with the congestion of transnational transmission channels. Currently, there are two main transnational transmission rights transactions. One is explicit auction of transmission capacity, which is mainly applied in the European Union market and similar to Physical Transmission Rights in the United States. The other is the implicit auction of transmission capacity, which is carried out mainly in the Nordic unified electricity market and is similar to financial transmission rights in America.

2.3 Ancillary services transactions

Auxiliary power services refer to auxiliary power products or services provided to maintain safe and stable operation of power system and power quality, which mainly includes primary frequency modulation, automatic generation control (AGC), rotary reserve, non-rotary reserve, reactive power regulation, black start, etc. Because of the close relationship between the power auxiliary service and the characteristics of power industry and the mode of power system dispatch and operation, the definition of its variety varies from country to region. In addition, the auxiliary service market is generally organized by the power dispatching agencies themselves, and there are differences in market rules and bidding methods, so it is difficult to carry out transnational auxiliary service transactions.

2.4 Electricity financial derivatives trading

Electricity financial derivatives refer to financial contracts whose value is determined by the price of underlying financial assets. It usually includes forward contracts, forward futures, short-term futures, options, price difference contracts and so on. Different from electric energy spot or futures trading, transmission rights trading, etc., electric power related financial derivatives trading does not involve the delivery of real resources, but its price changes reflect the fluctuations of electric energy prices in the market. Financial market members can avoid market risks or carry out arbitrage by trading power finance contracts. Since the electric power financial derivatives are traded by means of

financial settlement, there is no influence on the transmission of physical electric energy in the transmission channel. Therefore, electricity financial derivatives trading relies more on financial trading platforms and financial trading institutions (such as Nordic NASDAQ OMX).

3. Related Supporting Mechanism

Since transnational electric power trade involves the coordination and cooperation of interests of multiple countries and subjects, it needs corresponding supporting mechanism support.

First, it needs political mutual trust and multilateral security mechanisms which is an important basis for launching bilateral or multilateral consultations, facilitating the implementation of transactions and ensuring long-term cooperation.

Second, it is necessary to establish mechanisms for investment, trade and transit cooperation which focus on forming relatively uniform rules on investment access, protection of investors' rights and interests, trade barriers, distribution of benefits, land use, environmental protection, ecological compensation, etc.

Third, policy coordination and standards docking mechanism is important because relevant countries can form common goals and directions for important policies such as energy transformation and carbon emission reduction, creating a stable policy environment for investors and various parties.

Fourth, it needs joint regulatory mechanism, in order to coordinate the work of national regulators and work closely with each other to establish competitive, open and secure joint electricity markets.

Fifth, the international financial cooperation mechanism is also necessary to cope with foreign exchange control, currency crisis, interest rate and exchange rate fluctuations and other risks, bring stable returns and expectations for all market players

4. Conclusion

Transnational electric power trade involves many subjects, so it is necessary to establish a systematic and coordinated trade mechanism. At present, cross-border trading mainly includes electric energy trading, auxiliary service trading, power transmission rights trading, electric power financial derivatives trading, etc., so as to coordinate and support transnational electric power flow. The current transnational electric energy trading can help to offset power shortages in neighbouring countries or regions. In addition, the steady development of transnational power trade cannot be separated from important supporting mechanisms, including political mutual trust and multilateral security, investment, trade and transit cooperation, policy coordination and standards docking, joint regulatory and operation, and international financial cooperation mechanism.

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References

- [1] Steven Stoft, *Power System Economics: Designing Markets for Electricity*, US: Wiley-IEEE Press, May 2002.
- [2] Dirk Van Hertem, Mehrdad Ghandhari, and Multi-terminal VSC HVDC for the European supergrid: Obstacles, *Renewable and Sustainable Energy Reviews*.2010 (9).
- [3] Jorge Alcalde-Unzu, Marc Vorsatz, Size approval voting, *Journal of Economic Theory*, 2008 (3).

[4] Boston T., Testimony—FERC Conference on review of wholesale electricity markets (Docket No. AD08-9-000), July 2008