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A Study on the Construction and Supporting Mechanisms of Tradable Green Certificates Finance System in China

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Abstract: Facing the energy crisis and the requirement of green power, China will implement the Renewable Portfolio Standards (RPS) to promote the development of renewable energy during the period of Twelfth Five-Year Plan. The application prospects of Tradable Green Certificate (TGC) as financial instruments in China will be greatly vast which is a supporting policy of the RPS. This study firstly reviews researches related to the TGC market. Secondly TGC derivatives are designed to explore new financing methods for renewable energy industry. Then, This study constructs the TGC finance market system based on the combination analysis of previous studies and China's development plan of the TGC market. Finally This study puts forward the detailed supporting mechanisms and policies for the TGC finance system making recommendations for the development of renewable energy industry and energy finance in China.

Key words: Renewable energy, tradable green certificate market, finance

INTRODUCTION

In recent years, the security of the world's energy supply faces great challenges due to the instability of oil prices and turmoil rocking the Middle East. In order to relieve the pressure on energy supply and fight against the climate change, many countries have issued various policies to speed up their renewable energy industry development.

On December 15, 2011, the National Energy Administration announced the Twelfth Five-Year Plan (2011-2015) on renewable energy industry development. It indicated that China would endeavor to form the renewable energy industry's scale and basic industry chain to build a competitive renewable energy industry system during the Twelfth Five-Year Plan period. By 2015, the development amount of the non-fossil fuels including wind energy, biomass energy, solar energy and many others would reach 480 million tons of standard coal and the share of non-fossil fuels in primary energy consumption would be increased from the current 7.8% to 11.4%. Meanwhile, China will launch the Renewable Portfolio Standards (RPS) to promote the construction of RPS transaction system. "We shall continue to develop and perfect the renewable energy policies, especially the quota system and trading system." Shi Lishan, deputy director of new energy resource division at national energy administration. The tradable green certificate (TGC) market playing a supporting part of the RPS will have great development potential in the future. Energy prices are affected by many factors and the TGC is no exception. Therefore, the financial TGC market will become a trend of the TGC market considering the purposes of stabilizing

TGC price fluctuation and avoid trading risk. The participation of financial institutions expands the TGC market's capacity, strengthens liquidity and makes the market more transparent than before. In turn, more mature TGC market will attract more enterprises, financial institutions and private investors so that more capital will flow to the renewable energy industry.

Literature review: TGC, as a supporting policy in RPS, has been researched in many literatures. These literatures mainly focus on the barriers to implement TGCs, its market risk and cost effectiveness. Tsao *et al*. (2011) find that there would be policy redundancy in the situation in which two policies-the Renewable Portfolio Standards (RPS) and the emissions trading (C and T)-co-exist in a competitive electricity market. Fristrup (2003) thinks the obstructive elements of implementing TGCs include the establishment of incentive mechanisms, diversified renewable energy power generation technology and excess capacity.

As for the market risk of TGCs, Lemming (2003) analyzes financial risks in a market for Tradable Green Certificates (TGC) from existing renewable producers and potential investors. Andrew Ford *et al*. (2007) calculate

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and simulate the dynamic price of TGC using the data from Europe and America. Eirik Amundsen *et al.* (2006) show that introduction of banking of GCs may reduce price volatility considerably and, furthermore, as expected lead to increased social surplus. Agnolucci (2007) shows that the financial constraint and long-term contracts can guarantee the operation of TGC market.

Many scholars question whether TGCs are cost effective in some aspects. Chen *et al.* (2008) calculate the cost effectiveness of TGCs with 31 states in the U.S. (Nilsson and Sundqvist, 2007) study the cost of TGC in Sweden and find that the implementation of TGCs improves the cost of electricity retail market. Bergek and Jacobsson (2010), assessing the performance of the Swedish TGC system, find that consumer costs and rents under TGC have been substantially higher than expected. And it contributes marginally to technical change. Marchenko (2008) shows that a mechanism of green certificates is not an ideal means for minimizing the impact of energy on the environment. The economic effect turns out to be smaller than the maximum possible one. Aune *et al.* (2012) conclude that trading in green certificates can ensure a cost-effective distribution of renewable energy production, but the national targets prevent a cost-effective distribution of energy consumption.

At present, some scholars mention that developing the forward and futures market of TGC is an effective way to avoid risks. However, they do not describe the TGC finance system in details. This study will, based on previous studies, focus on developing the TGC finance system and designing TGC derivatives to explore new financing methods for renewable energy industries and make recommendations for renewable energy financial legislation and financial policy design.

THE DEFINITION AND THE CURRENT SITUATION OF THE FINANCIAL TGC MARKET IN CHINA

The financial TGC market is a new research field which springs from the combination of the traditional financial system and renewable energy industry. Therefore, the financial TGC market refers to a place which involves TGC derivatives transactions,investment and financing activities, credit and other relevant financial intermediaries.

China now has not established the TGC trading market yet which is disadvantageous to its economy development. With the promulgation of China's the renewable energy law in February 2005, China will not rely on traditional energy and mainly depend on renewable energy beyond 2020. Therefore, the next decade might be regarded as the critical period for the application of TGC trading market in Chinese renewable energy project.

THE CONSTRUCTION OF THE FINANCIAL TGC MARKET SYSTEM

Components of the financial TGC market are shown in Fig. 1. Under a stringent regulatory environment, the supply side of TGC, intermediaries and the demand side of TGC contribute to transactions of the financial TGC market.

Transaction subject: Transaction subjects of the financial TGC market in China mainly include compulsory transaction subjects and voluntary transaction subjects. Compulsory transaction subjects refer to Chinese power plants or institutions with quotas in China. And voluntary transaction subjects are areas, organizations and individuals involved in the deal voluntarily. They have characteristics such as voluntary, openness and autonomy.

A lot of deals are done only when transaction subjects play their own roles in the trading market. Thermal power manufacturers with quotas and green power manufacturers who are risk averse, expect to stable production relations and fix the future price of TGC. Futures markets provide them with such a mechanism and place to control and transfer the risk through hedging. Hedging is not to eliminate the risk, but transfer it. And the risk transferred out needs someone to take, the social investors (namely speculators) are the risk bearers in the futures market. Citizens' participation provides a convenient way to hedging for producers and operators. Therefore, speculators are an indispensable part of TGC derivatives transactions as important transaction subject.

Transaction object: Transaction objects of the financial TGC market developed from TGC (Table 1) refer to forward contracts, futures, options, etc. The value of the derivatives depends on underlying price of relevant TGC products. The role of them in the TGC trading market is to manage relevant risk exposure of primary TGC financial products, rather than adjust capital and promote the transformation from saving to investment. These TGC derivatives trading can flow freely like soybean to increase the liquidity of the financial TGC market.

Transactions auxiliary: Transactions auxiliaries are people or institutions that provide services to transaction subjects in TGC market based on the entrustments and contracts. They mainly include banks, funds, exchanges and insurance companies. Different transaction auxiliaries provide the corresponding services according to their own characteristics of the industry, as Table 2 shows.

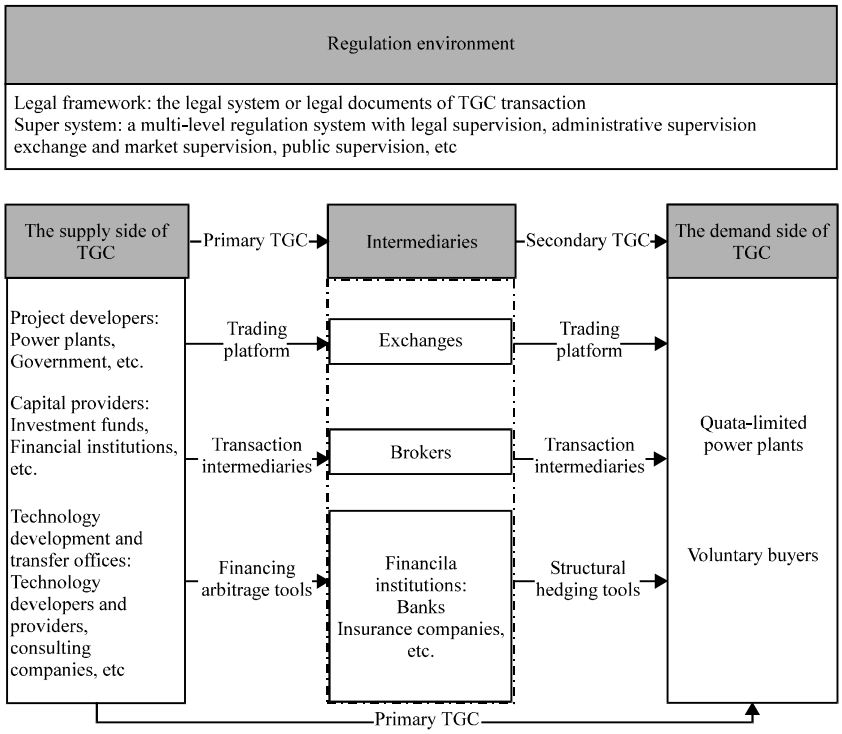

Fig. 1: The participants of the financial TGC market

Table 1: Design and function of tgc financial derivatives

Transaction object	Design	Function
Forward contracts	Both sides of the deal would conduct a transaction of TGC for future by signing TGC forward contracts	Forward contracts can evade the financial risks of the spot transactions in the TGC trading market
Futures	An agreement to take or make delivery of TGC on a particular date which is formulated by futures exchange and dealing in exchange	Participants can place a hedge by taking a TGC futures position opposite to the position held in the spot market and exactly equivalent in value
Options	Options give buyers the right, but not the obligation to buy or sell a specified amount of TGC at a specified price	In theory, options can help us to build up different states of profits and losses to control the investment risk
Others	Other financial instruments mainly include TGC-linked securities, TGC insurances, TGC stocks, swaps, etc	The diversity of financial instruments attracts a lot of capitals, stimulates the transactions, increases the liquidity in the TGC market and raises business and investor confidence in the renewable energy power generation technologies

Table 2: The functions of transactions auxiliaries

Transactions auxiliary	Functions
Bank	• Designing TGC financial products and combining the financing behavior of enterprises or privates with RPS • Making use of its advantages in the areas of information, intermediary and financing to build trading platforms and provide middle agent operations, advisory services and its own business for TGC transactions • Participating in the establishment and management of the TGC fund • Making reference to equator principles, promoting green credit and offering policies inclining to renewable energy power generation project
Fund	• Helping power plants out of the technical, economic and management difficulties in the process of renewable energy development • Investing in the renewable power generation technologies with great market prospect, expanding the market and deepening energy structure reform
Exchange	• Information distribution function, that means exchanges provide a platform for power plants and speculators to release their transactions information • Attestation function, that means exchanges can provide attestation services for purchases, deliveries and registrations of TGC transactions 3. Reserve function, that means power plants and speculators can open transaction accounts in exchanges in order to regulate the supply-demand relationship in the market and maintain the stability of the market • Counseling function, offering consulting services in technology and transaction rules • Capital services function that means exchanges can provide power plants and investment institutions with pledge financing of technologies, stock rights and so on

Table 2: Continue

Transactions auxiliary	Functions
Broker	• Making use of the customers' accounts to trade on exchanges • Helping both sides of the transaction complete the transactions on the over-the-counter market as intermediaries
Security company	• Designing fresh TGC securities • Acting as financial consultant and launching assets management
Insurance company	• Offering new insurance services for the risks involved in the TGC market(such as credit risk, punishment risk) and finding new business opportunities in the growing financial TGC market • Making in system innovation (such as detailing policy and setting floating rate) to avoid adverse selections and moral hazards because of the imperfect condition of TGC transaction system.

Table 3: The comparison of the trading places

Transaction characteristics	Transaction on exchange	Over-the-counter
Trading places	Exchange	Over-the-counter
Contract characteristics	Standardization contracts	Making by negotiations
Manner of delivery	Exchange rules	Mainly cash delivery or decided by negotiations
Bargaining way	Open, centralized price bidding	One-to-one
Clearing form	Daily liquidation	Direct clearing
Basis of credit	Earnest money	Both sides' credit
Performance risk	Exchanges guarantee the performance of contracts	Taking on the risk of default themselves
Legal framework	Specified correlation rules	Legal documents of ISDA
Supervision system	Securities and futures regulatory department	Common contract laws

Trading places: Trading places can be classified into transactions on exchange and over-the-counter in line with different transaction characteristics. Specific comparative analysis is given in Table 3.

SUPPORTING MECHANISMS

The establishment of the trading platform: The price of the TGC and its derivatives are affected by a variety of factors. Therefore timely, accurate and comprehensive information is very important for enterprises to reduce risk and improve profits. An authoritative trading platform is very necessary for TGC trading in China. In consideration of the inequality of regional economy in china, the government should set up several regional trading markets firstly and then form a large national market gradually in the process of building trading platform. Seeing the domestic market, the development of Chinese renewable energy will be very fast in the coming decades, that is to say the TGC market has the great potential in the future. A unified TGC trading platform not only helps government with centralized management but also expands the scope of transaction.

The construction of strict supervision system: An efficient and orderly financial market can not operate without strict supervision. The supervision means the following parts. Firstly, the government should supervise every single deal to ensure the authenticity of transactions and compliance. Secondly, the market participants should be supervised in order to prevent someone, who makes use of information asymmetry, policy inadequacy or market power from profiteering in the market. Thirdly, in order to avoid systemic market risk, the regulation of the whole market is very necessary to carry out. Fourthly, separate operation and separate supervision in financial industry are taken for a long time in China which cause regulatory inefficiency, different regulatory standards, overlap and so on. Therefore, the government needs to build a multi-level regulation system with legal supervision, administrative supervision, exchange and market supervision, public supervision, etc.

The formulation of specialized transaction system and laws on TGC: The legislation is as important as the market on the issue of TGC transaction. Markets provide incentives and the legislation guarantees the boundary. In order to ensure the legitimacy and authority, TGC transactions must have the corresponding legal protection. So the state must publish corresponding laws and regulations to promote the development of TGC transaction. The Chinese government can also learn from other countries in the extent of TGC transactions, laws and regulations on TGC or other energy derivatives and so on. TGC transaction regulations and laws can be modified and updated depending upon the actual operating conditions which will play a positive pushing role in reality in that way.

POLICIES

The financial supporting policies: The financial supporting policies address the financial institutes' initiatives. Finance supports the development of energy industry which is an important content of energy finance system. It needs relevant financial policies matched in practice such as the design of TGC derivatives and the operation of professional energy financial institutes. A

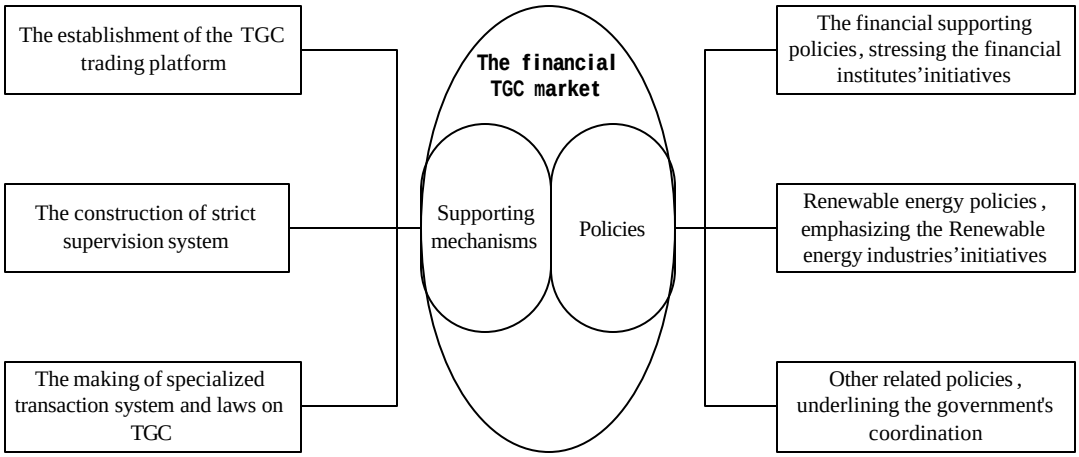

Fig. 2: Supporting mechanisms and policies

series of financial policies issued by government departments on TGC derivatives are the significant backup force and guaranty for the development of TGC market. Policy energy financial institutes can be set up to provide convenience for power plants.

Renewable energy policies: Renewable energy policies emphasize the renewable energy industries' initiatives. The aim of the financial policies on TGC is to provide services for the development of renewable energy and make profits at the same time. Therefore, renewable energy development policies point out the development direction of the related financial policies to a certain extent. As the development of renewable energy would go though stages of research, development and promotion, different policies should be taken in different development stages on the purpose of supporting the development of renewable energy.

Other related policies: In addition to national macro-finance policies and renewable energy policy, a number of micro-policies are also needed to jointly promote the development of financial TGC markets. These policies emphasizing on the government's coordination mainly contain tax policy, subsidy policy, guarantee policy, preferential policy on venture capital and investment policies.

CONCLUSION

The establishment of the financial TGC market plays an important role in the development of renewable energy. In This study, the transaction subjects, transaction objects, transactions auxiliaries and trading places of the financial TGC market are systematically introduced which can make reference for the design of TGC derivatives and new financing ways for renewable energy in the future. Then we make a particular analysis on designing supporting mechanisms from the three aspects, that is, the trading platform, strict supervision system and specialized transaction system and laws on TGC (Fig. 2). In the end, we provide some suggestion towards relevant policies of promoting TGC development, namely the financial supporting policies, renewable energy policies and other related policies. The well-functioning of the financial TGC market calls for the joint efforts of participates, government and departments. The great operation of the financial TGC market will enormously boost the development of renewable energy industry in China which infuses fresh blood into the development of energy finance in China.

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