

Comparison of Chinese Green Electricity Certificate and International Green Electricity Certificate

Zheng Yin^{1*}

¹North China Power Engineering Co., LTD. of China Power Engineering Consulting Group, Beijing, 100000, China

DOI: [10.36347/sjebm.2023.v10i11.004](https://doi.org/10.36347/sjebm.2023.v10i11.004)

| Received: 07.11.2023 | Accepted: 15.12.2023 | Published: 20.12.2023

*Corresponding author: Zheng Yin

North China Power Engineering Co., LTD. of China Power Engineering Consulting Group, Beijing, 100000, China

Abstract

Review Article

This paper sorts out the trading mechanisms of GECs (Green Electricity Certificate of China) and international Green Electricity Certificate, analyzes the characteristics of relatively mature international Green Electricity Certificate trading mechanism, and compares and analyzes GECs and international Green Electricity Certificate trading mechanism from four aspects: price, issuance scope, trading process and recognition degree. The existing problems of GECs trading mechanism are found, and suggestions are put forward to optimize the GECs trading mechanism from four aspects: increasing the demand for GECs, establishing a collaborative mechanism between GECs and CCER (Chinese Certified Emission Reduction) market, strengthening the traceability of GECs and promoting the international certification of GECs.

Keywords: Green Electricity Certificate Trading Mechanism; CCER; Market Connection of Green Electricity Certificate; Traceability of Green Electricity Certificate.

Copyright © 2023 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution **4.0 International License (CC BY-NC 4.0)** which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

1. INTRODUCTION

As global warming intensifies, responding to climate deterioration has become a common challenge for the international community. As a world power, China has actively responded to climate change and assumed the responsibility of a major country. In recent years, the Party Central Committee has attached great importance to climate governance and pragmatically pushed forward the green transformation. On September 22, 2020, China put forward the solemn commitment of "carbon peak" and "carbon neutral" targets, which demonstrates the style of a great country in environmental governance and is of great significance to global climate governance. At present, many countries have set up dual-carbon targets in line with their own national conditions, promoted the consumption of renewable energy, and assumed the obligation of carbon emission reduction. Improving the utilization rate of renewable energy and promoting the consumption of clean energy is an important link in the process of promoting global energy conservation and emission reduction and achieving the goal of double carbon. Green Electricity Certificate is a certificate for accounting the power generation and use of renewable energy. As a supplementary way to absorb the responsibility weight of renewable energy, it can effectively promote the consumption of renewable energy. Therefore, it is of

great significance to study the trading mechanism of Green Electricity Certificate.

Academic research on Green Electricity Certificate trading mainly focuses on the linkage effect of Green Electricity Certificate market and carbon market [1-4], the problem of multiple counting of Green Electricity Certificate [5, 6], and the optimization of Green Electricity Certificate system [7-10]. For example, scholars such as Sun Xiaorong (2023) analyzed the causal relationship between the Green Electricity Certificate market and carbon market on the investment decision of the distribution network [11], and found that the reward and punishment ladder-type trading mechanism of the Green Electricity Certificate market and the carbon market can improve the efficiency of the investment in distribution network and reduce carbon emissions. Zhang Shuo (2023) and other scholars tracked the source and destination of electricity, constructed the "Electricity-Carbon-Green Electricity Certificate" traceability model to ensure the accuracy of the green electricity data, and put forward policy recommendations on the marketization of the new electric power system from the aspects of policy, pilot, and technology [12]. Zhang Ning (2023) constructed a CGE model and simulation to analyze the economic impact of the implementation of mandatory Green Electricity

Certificate trading, and found that improving the reward and the punishment mechanism can strengthen the binding effect of the renewable energy consumption guarantee mechanism, and safeguard the implementation effect of the Green Electricity Certificate trading mechanism [13].

GECs trading system is not mature enough compared with the international, with the "Notice on Improving the Full Coverage of Renewable Energy Green Electricity Certificate and Promoting Renewable Energy Power Consumption" (later called the New Deal) issued, it is clear that the Green Electricity Certificate is the only proof of the environmental attributes of renewable energy electricity, and achieve full coverage of the scope of issuance. The original Green Electricity Certificate trading mechanism has been greatly updated, so it is urgent to conduct a review of the existing Green Electricity Certificate trading mechanism. This paper sorts out the trading mechanism of GECs and international Green Electricity Certificate, analyzes the advantages and current situation of the international Green Electricity Certificate trading mechanism, compares it with GECs trading mechanism, analyzes the existing problems, and puts forward suggestions for improving GECs trading mechanism.

2. GECs and international Green Electricity Certificate trading mechanism

2.1 International Green Electricity Certificate Trading Mechanism

Since the 1990s, the international community has actively promoted the practice of environmental rights trading such as Green Electricity Certificate and carbon trading. International Green Electricity Certificate can be divided into two categories: Green Electricity Certificate issued by government agencies and Green Electricity Certificate issued by third-party non-governmental organizations [14]. Among them, Green Electricity Certificate issued by the government includes GO (Guarantees of Origins) of the European Union and RECs (Renewable Energy Certificates) of the United States. Green Electricity Certificate issued by third-party NGOs includes I-REC (International Renewable Energy Certificate) and APX TIGR (Tradable Instruments for Global Renewables).

In terms of price, international Green Electricity Certificate is priced according to the relationship between supply and demand. In terms of the scope of issuance, the international Green Electricity Certificate is applicable to projects such as hydropower, wind power and photovoltaic power generation, among which the GO certificate covers all types of energy, including fossil fuels. I-REC certificate will not be issued to subsidized projects after 2023, and it will only be issued to non-subsidized renewable energy projects like APX TIGR certificate. In terms of transaction process, negotiation is the main way. In order to avoid multiple counting, the on-grid electricity used for international Green Electricity Certificate trading is no longer recognized by other carbon emission reduction mechanisms. EU countries, Norway, Switzerland, Britain and other countries generally adopt the mode of separation of certificates and electricity to promote the cross-border circulation of GO, which has high interoperability and integration. The United States is divided into compulsory quota market and voluntary quota market according to whether the RECs certificate is bound or not. In the compulsory trading market, the trading is mainly through the binding sales mode of the license and electricity or the separation sales mode of the license and electricity. In the voluntary trading market, users can freely choose suppliers. In terms of recognition, GO certificate, RECs certificate and I-REC certificate are all directly recognized by RE100(100% Renewable Electricity), and APX TIGR certificate needs to meet six requirements of RE100 [1] can be recognized. The characteristics of various international Green Electricity Certificate trading mechanisms are shown in Figure 1.

2.2 GECs trading mechanism

As the only evidence of environmental rights and interests, Green Electricity Certificate plays an increasingly prominent role in building a green power environmental value system, promoting the development and utilization of renewable energy and guiding the green consumption of the whole society with the low-carbon transformation of China's energy industry [15]. Since 2017, China has continued to promote the construction of the Green Electricity Certificate trading system. Until 2023, the proposal of the New Deal marked that China entered the stage of full coverage of GECs. The key GECs policies in China are shown in Figure 2.

¹Six requirements of RE 100: accurate power generation data, rights collection, exclusive ownership, exclusive

declaration right, geographical market boundary and limitation of time.

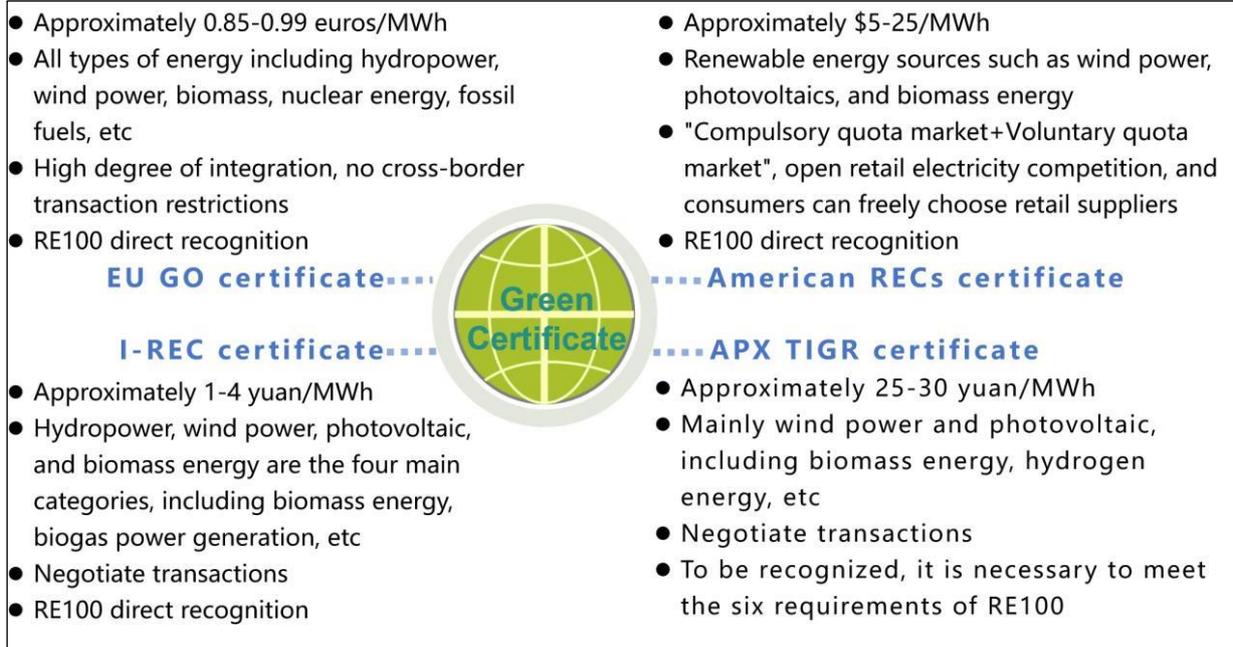


Figure 1: Characteristics of international Green Electricity Certificate trading mechanism

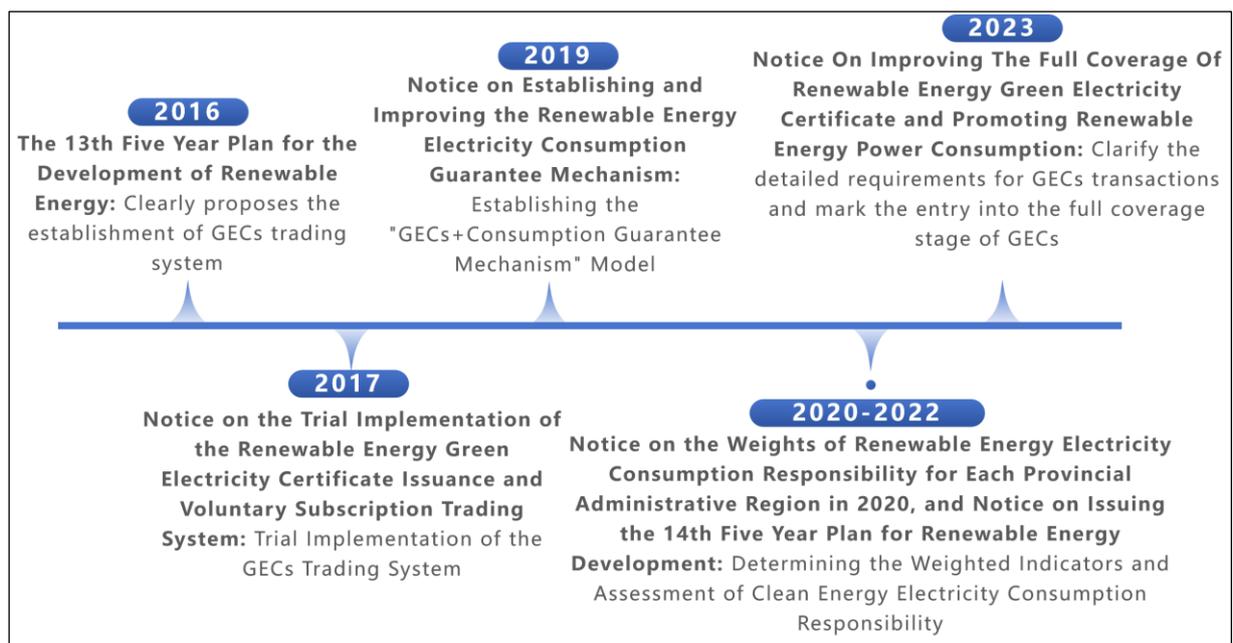


Figure 2: Evolution of key GECs policies

In terms of price, according to the GECs Trading Platform, the average transaction price from January to July 2023 was 42.4 yuan/piece. In terms of the scope of issuance, with the promotion of the policy of full coverage of GECs, the scope of issuance of GECs has expanded from onshore wind power and centralized photovoltaic power generation projects to all renewable energy power generation projects that have been established. In terms of trading process, relying on GECs Trading Platform, Beijing Power Trading Center and Guangzhou Power Trading Center, GECs trading includes three ways: bilateral negotiation, listing and centralized bidding. In terms of recognition, GECs is

only conditionally recognized by RE100 at present, but with the promotion of the policy of full coverage of GECs, the international recognition will be further enhanced.

3. GECs and international Green Electricity Certificate trading mechanism comparison

3.1 GECs and international Green Electricity Certificate price comparison

Compared with the international Green Electricity Certificate, the price of GECs is very expensive, and the price of GECs and international Green Electricity Certificate is as mentioned above. The

high price of GECs is largely due to the low supply of GECs. The New Deal will expand the scope of issuance to all renewable energy power generation projects, and the supply of Green Electricity Certificate will be fully expanded. In the future, with the construction of new energy projects in China, the supply of GECs will exceed the demand, and the price of GECs may further drop, which is expected to activate the GECs market.

3.2 GECs and international Green Electricity Certificate issued by the scope of comparison

Before the release of the New Deal, the scope of GECs issued was only for wind power and photovoltaic projects. Compared with the international Green Electricity Certificate such as I-REC, which has a wide coverage, the application scenarios of GECs are limited, and it is impossible to continue to expand the supply of green electricity and promote the consumption of green electricity. With the release of the New Deal, the scope of GECs has achieved full coverage, which has enhanced the value of new energy projects such as hydropower and biomass power generation, and effectively promoted the development of power generation enterprises.

3.3 GECs and international Green Electricity Certificate transaction process comparison

The perfection of Green Electricity Certificate transaction process will affect the embodiment of Green Electricity Certificate environmental value. Judging from the transaction process, compared with the international Green Electricity Certificate, GECs does not have a perfect system for verification. Due to the imperfection of the verification system, the difficulty in tracing the source of Green Electricity Certificate of power grid companies, and the fact that China's carbon market is still in the accelerated construction stage, there is no mutual exclusion provision in accounting system for GECs trading and carbon emission trading at present, which leads to the problem of multiple calculation of environmental value GECs. Moreover, compared with the property that international Green Electricity Certificate can be traded many times, GECs can only be traded once, which also leads to the lack of vitality in the Green Electricity Certificate market to a great extent.

3.4 GECs and international Green Electricity Certificate recognition degree comparison

At present, international Green Electricity Certificate such as I-REC, APX TIGRs and GO have been widely recognized by the RE100 initiative, while GECs has only been conditionally recognized by RE100. This is because there are still some problems such as multiple counting and unclear environmental uniqueness in GECs. If an enterprise wants to gain international recognition after purchasing the GECs, it needs to fully explain and prove to RE100 that the environmental rights and interests of the electricity corresponding to the GECs have not been repeatedly calculated in the form of CCER and excess consumption, and have not been declared by

others. Although the New Deal for GECs makes it clear that Green Electricity Certificate should not be applied for other certificates with the same attributes in the power field, in the actual operation process, problems such as multiple calculation of environmental value of GECs and unclear attribution of environmental attributes still exist, and the international recognition of GECs is still relatively low.

4. Problem analysis and policy recommendations

4.1 The supply and demand of GECs do not match, increase the demand for GECs

With the New Deal, the supply of GECs will increase steadily in the future. However, the demand of subscribers in the GECs market is relatively low. On the one hand, before the introduction of the New Deal, GECs had a small coverage and limited application, and power users were more willing to choose international Green Electricity Certificate with a wide range of applications; On the other hand, due to the relatively loose setting of the responsibility weight for the consumption of renewable energy in China, the willingness of power users to buy GECs is low.

Therefore, it is necessary to expand the application scenario of GECs, establish a renewable energy consumption mechanism for power users, and scientifically allocate the responsibility and right of renewable energy consumption to users to provide support for the growth of GECs market demand.

4.2 The boundary between GECs and CCER system is unclear, establish the GECs and CCER market coordination mechanism

GECs New Deal system and CCER system still overlap to some extent. Both of them include renewable energy projects such as wind power, photovoltaic power generation and biomass power generation. With the restart of CCER, some power generation enterprises can apply for filing CCER projects or applying for GECs. However, there is no clear boundary between the indirect emission reductions that can be offset by the two.

Therefore, power grid enterprises should actively establish a collaborative mechanism with power generation enterprises, regulatory agencies and other relevant parties, stipulate the carbon emission reduction represented by GECs and CCER respectively, and ensure the smooth connection and interaction between the two markets, so as to end the unclear boundary between Green Electricity Certificate and CCER.

4.3 The GECs has the problem of multiple counting, strengthen the traceability of GECs

The problem of multiple accounting of GECs is serious. Although the New Deal stipulates that the GECs is the only certificate of the environmental attributes of renewable energy, there are still variants of Green Electricity Certificate such as Green Power Transaction Certificates, which will destroy the uniqueness of the

environmental attributes of GECs and cause the risk of multiple calculations of the environmental value of green power.

Therefore, it is necessary to strengthen the traceability of green electricity and GECs, establish a GECs alliance chain covering the whole life cycle of GECs, and efficiently connect third-party platforms such as power grid enterprises and certification bodies. Design a multi-party collaborative mechanism to manage the data flow and storage of GECs transaction information to ensure the authenticity and uniqueness of the data. Establish a healthy and active GECs ecosystem, strengthen traceability reliability, improve issuance accuracy, strengthen transaction security, improve market liquidity, etc., and achieve the goal of standardization and unification.

4.4 The international recognition of GECs is low, promote the International Certification of GECs

At present, the international recognition of GECs is low, which makes power users more inclined to choose international Green Electricity Certificate. Power users buy Green Electricity Certificate mainly to prove that enterprises consume green products, which is the requirement of green consumers to offset carbon emissions in response to climate change, so the credibility of environmental attributes of Green Electricity Certificate is required to be high. At present, the international rules for the recognition of Green Electricity Certificate are very strict, but the environmental attributes of GECs are not clear, and the rules system still needs to be further improved, so it is difficult to be recognized internationally.

Therefore, it is urgent to introduce new policies to accelerate the internationalization certification of GECs. It is necessary to meet the international Green Electricity Certificate market standards, understand the international rules formulated by multinational corporations' action alliance represented by RE100, communicate with international rule makers in depth, and lay a foundation for promoting international mutual recognition of GECs. At the same time, it is necessary to make a special response system for the unclear environmental attributes of GECs to ensure that GECs system meets international standards.

5. CONCLUSION

Achieving the "double carbon goal" is an inherent requirement of China's high-quality development and a solemn commitment to the international community. The GECs trading mechanism is an important part of the clean energy consumption system, and improving the GECs trading mechanism is of great significance for promoting the green transformation of enterprises and optimizing resource allocation. This paper combs the characteristics of GECs and international Green Electricity Certificate trading mechanism, finds the disadvantages of GECs through

comparative analysis, and puts forward some suggestions from the aspects of increasing the demand for GECs, establishing a collaborative mechanism between GECs and CCER market, strengthening the traceability of GECs and promoting the international certification of GECs, so as to provide reference for the development of GECs trading mechanism.

REFERENCE

1. Li, J., Luo X., & Zhu, X. (2023). Wind fire storage joint peak shaving control strategy based on Green Electricity Certificate carbon trading mechanism [J]. *Electric Power Construction*, 44(07), 11-20.
2. Li, Y., Wang, W., & Kou, Y. (2023). Considering the Economic Operation of Green Electricity Certificate Carbon Joint Trading and Demand Response Integrated Energy System [J]. *Acta Energiæ Solaris Sinica*, 44(11), 538-546.
3. Jinliang, Z., & Ziyi, L. (2023). Low carbon economic dispatch model for a virtual power plant connected to carbon capture system considering Green Electricity Certificate carbon trading mechanism [J]. *Sustainable Energy Technologies and Assessments*, 60103575.
4. Dewen, L., Zhao, L., & Jinghui, Q. (2023). Low carbon patch of multi district integrated energy systems considering carbon emission trading and Green Electricity Certificate trading [J]. *Renewable Energy*, 218.
5. Li, W., Liang, C., & Dong, X. (2023). Analysis of the Impact of Green Electricity and Green Electricity Certificate Trading on Carbon Emission Factors in Electricity [J]. *Value Engineering*, 42(32), 13-15.
6. Leng, Y. (2023). Exploration of Issues Related to the Connection between Green Electricity Consumption and Carbon Market [J]. *China Electric Power Enterprise Management*, (22), 35-36.
7. Zou, H., Zhang, J., & Wei, Y. (2023). Exploration of the Market Collaborative Linkage Mechanism of Electricity market, carbon market, and Green Electricity Certificate market [J]. *Environmental Economy*, (19), 48-53.
8. Zhang, Z. (2023). Inspiration of International Experience on the Internationalization of China's Green Electricity Certificate [J]. *China Electric Power Enterprise Management*, (25), 68-71.
9. Haobo, R., & Honghai, K. (2023). A cooperative model of photovoltaic and electrical to hydrogen including Green Electricity Certificate trading under the conditional value at risk [J]. *Global Energy Interconnection*, 6(4), 403-417.
10. Mi, L., Jinshan, H., & Dunaan, L. (2019). Research on Green Electricity Certificate Trading Mechanism of Renewable Energy [J]. *IOP Conference Series: Earth and Environmental Science*, 242(2), 022036 (5pp).
11. Sun, X., You, Y., & Pan, X. (2023). Dynamic Evaluation of Investment Benefits in Distribution Networks Considering Carbon Market and Green

-
- Electricity Certificate Market [J/OL]. *Electric Power Automation Equipment*, 1-13. [2023-12-08] <https://doi.org/10.16081/j.epae.202311025>.
12. Zhang, S., Xiao, Y., & Li, Y. (2023). Key blockchain technologies for the coordinated operation of the electricity carbon Green Electricity Certificate market in the new power system [J]. *Electric Power Construction*, 44(11), 1-12.
 13. Zhang, N., Pang, J., & Wang, Q. (2023). Simulation of renewable energy Green Electricity Certificate trading mechanism based on CGE model and its economic impact [J]. *China Population Resources and Environment*, 33(02), 51-62.
 14. Shang, N., Chen, Z., & Leng, Y. (2023). Mechanism and Key Technologies for Mutual Recognition of Typical Environmental Rights and Interests Products under the Background of the Carbon Electricity Market [J/OL]. *Proceedings of the CSEE*: 1-19 [2023-12-08]. <http://kns.cnki.net/kcms/detail/11.2107.tm.20230316.1116.006.html>.
 15. Zhu, B., & Ou, J. (2023). The normative construction of China's Green Electricity Certificate trading system under the "dual carbon" goal [J]. *Journal of Jiangsu University (Social Science Edition)*, 25(05), 29-45.