
Research on Green Financial Ecology Construction Based on Low Carbon Economy

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Abstract

The green financial ecology is a booster for the advance and transformation of low-carbon economy. And China must base itself on the current international trend of low-carbon economic development, to build a multi-level financial channel, involving top-level design and institutional arrangements in green financial markets, financial institutions, and financial products. Through actively promote the carbon emission market trading and carbon derivative product design, focus on the development of financial institutions' green finance business, actively build green finance market financing and system construction and other paths, and build a green financial ecosystem that adapts to green ecological and low-carbon and green economy. Realizing the interaction and integration of green financial ecology and low-carbon economy transformation is a very meaningful measure and inevitable choice for building a low-carbon and green economy.

Keywords: carbon emission trading, low carbon economy, green finance, regional cooperation

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LOW-CARBON ECONOMY TRANSFORMATION AND POTENTIAL INVESTMENT AND FINANCIAL GAP

According to the latest report released by the UN , If global greenhouse gas emissions continue to grow at current rates, global temperatures are expected to be 1.5 degrees Celsius higher than the pre-industrial level between 2030 and 2052. This has catastrophic consequences. In the current global economic slowdown, the economic and trade situation is complicated, and the financial market turmoil in various countries is intensifying, adjusting the economic structure and vigorously move towards a green economy will test the determination of countries to cope with the complex economic situation and the global climate crisis. The transformation of economic and social sustainable development and the economic model affected by low-carbon economy or micro-environment will be constrained by many factors. The huge and sustained low-carbon economy investment and financing mechanism will determine the development direction and transformation depth of low-carbon and green economy. However, in the case of a certain amount of capital, due to the long-term nature of investment in low-carbon and green economy, the characteristics of public goods and the

opportunity cost, the actual amount of investment or support to the low-carbon economy has quite large gap (Chen et al. 2013). According to a report published by the G20 Green Finance Working Group of China and the UK, the financing gap for the global transition to an environmentally sustainable low-carbon economy by 2030 is expected to exceed \$90 trillion.

In developing countries, there are not only a huge funding gap in the transformation of low-carbon economy, however financing barriers such as the lag of carbon financial market and the lack of carbon financial products (Yuan and Hu 2016). According to research by the World Bank, at present, financing for climate change in developing countries cannot even reach the level of guaranteeing minimum investment, far from meeting the actual demand for investment and financing of low-carbon economy transformation, and developing carbon finance market and carbon financial product. Some of them have just started, and some are even blank. In the future, there will still be considerable room for improvement in the advanced of carbon finance market and carbon finance product development (Liu and Qai 2011). China, as the largest developing country, will achieve the potential targets of low-carbon in the future according to the current economic development trend (Yuan and Hu 2016). The

annual investment amount is about 1 trillion to 2 trillion yuan, accounting for China's total domestic production. The amount of new investment each year is about rmb1,000bn to rmb2,000bn, accounting for about 1%-2% of China's current GDP. The investment and financing gap of all countries in the world, especially the developing countries, to realize the goal of low-carbon economy is prominent. In the future, the realization of low-carbon economic development and low-carbon investment and financing will face greater challenges (Chen et al. 2013).

THE CURRENT CARBON FINANCE DEVELOPMENT PRACTICE BASED ON THE LOW CARBON ECONOMY INVESTMENT AND FINANCING

As a financial trading activity and institutional arrangement aimed at reducing carbon emissions, promoting low-carbon investment and financing, and carbon trading, carbon finance provides an important platform for capital flow, risk transfer and price discovery. Carbon financial products refer to the tool carrier for promoting carbon trading and reducing carbon emissions, and achieving carbon finance development. From the current practice, including the positive response of the government, financial institutions, enterprises and other sectors to the economy and finance products all played an increasingly key role in the low-carbon economy investment and financing mechanism.

Carbon Emission Trading and Carbon Financial Derivatives

At the international level, the carbon trading market is an important source of funding for low-carbon investment and financing (Zou et al. 2011), although after many uncertainties, including the market-based Clean and Development Mechanism (CDM) under the Kyoto Protocol. The Joint Implementation Mechanism (JI), based on the voluntary emission reduction trading market, still plays a good role in the research and development of low carbon emission reduction technologies and project financing. Since the start of the carbon trading market (Weng and He 2018), the carbon emission trading system represented by the European Union Emissions Trading System (EUETS) and the Chicago Climate Exchange (CCX) has been formed (Yuan and Hu 2016). The tools and products based on the carbon trading market are also emerging; the trend of financialization and monetization is increasingly obvious. In fact, carbon emission rights have been derived into a scarce resource with investment value,

have asset attributes and can be traded in the capital market, have corresponding product pricing mechanisms, and have similar characteristics to other financial instruments, to some extent, Carbon emission rights are also referred to as "quasi-financial instruments" or "carbon credits". In addition, the trading volume and transaction amount of carbon emission trading and carbon financial derivatives such as Carbon-forwards, Futures, and Options or Carbon-Swaps based on carbon emission trading even exceed the basic products and become the most important trading tools in the carbon trading market. In the international carbon trading market, the above carbon financial derivatives and tools are used by many enterprises and project institutions to achieve funding sources for low-carbon economic investment and financing, and an important means of hedging the price risk of carbon credit transactions. World Bank (WB) data show that by 2020, the global carbon trading market is expected to exceed 3.5 trillion US dollars, and it is expected that with the global understanding of the climate change crisis and the promotion of climate policy, the future carbon emission rights and The carbon trading market has replaced oil as the biggest trading asset and the biggest trading market of the world (Zhou and Mario 2018).

Bank Carbon Finance Business and Products

The low-carbon economy provides new development space and opportunities for inter-bank institutions to develop carbon financial markets and develop carbon financial products and tools. Bank green financial services or products (Yuan and Hu 2016) have effectively promoted the development of low-carbon investment and financing and low-carbon economy (Chen et al. 2013). The "green credit" and related products related to low-carbon industries and projects based on the "Equator Principles" of developed country banks are currently the common low-carbon economic investment and financing instruments. The Equator Principles is a series of objectives for identifying, assessing and managing project-based environmental and social risks, and establishing a regulatory framework and minimum standards for financial companies to undertake environmental and social responsibility. More than 90 financial institutions in 37 countries, including Citibank, have officially announced the adoption of the Equator Principles and are committed to applying them in their internal environmental and social policies, project financing procedures and standards. For customers who do not comply with the Equator Principles, Project financing or project-related

loans will not be provided. The above principles and standards cover more than 70% of international market financing in emerging markets. A number of low-carbon financial products and services based on the Equator Principles and low-carbon energy conservation and emission reduction standards, such as “green credit” products, carbon asset management tools, indexed carbon trading products and low-carbon financial advisory, to address climate change and promote low carbon Economic development has played an important role. In addition, more than 200 banks in Europe are supporting low-carbon sectors with diversified financial products such as commercial loans, project financing, soft loans, and financing guarantees related to renewable energy, environmental protection, climate change, and transportation. Financial institutions such as the Japan International Cooperation Bank have long helped the government and enterprises to carry out certification emission reduction projects or purchase certification reductions by providing start-up funds and intermediary services within the framework of the Kyoto Protocol. Displacement (CERs) to help Japan control greenhouse gas emissions and achieve greenhouse gas reduction targets.

Other Emerging Carbon Financial Products

Due to the flexibility and innovation of the capital market, foreign direct financial instruments such as equity financing, green bonds, carbon funds, and low-carbon insurance and wealth management products have achieved low-carbon economy investment and financing. Become an emerging means of transformation. The effective means for direct financial market participation in clean energy project investment is to hold equity or debt instruments in low-carbon industries and related enterprises. The usual practice is to conduct equity investment or hold green bonds. The equity investment instruments are mainly equity or stocks. Carbon companies invest funds during the start-up or development period. Before the company goes public, the equity or stock withdrawal investment is transferred to another low-carbon enterprise or project. The debt instruments include designing various green bonds such as convertible bonds and asset-backed securities, which are low-carbon projects. And infrastructure construction provides an important source of long-term funding (Mnguni 2018). Venture capital funds, carbon funds, energy funds and other organizations with different forms of organization are another important tool for participating in low-carbon economy investment and financing and promoting the development of low-carbon economy. Not only have

the climate been established under the framework of the UN Framework Convention on Climate Change and the Kyoto Protocol. The Adaptation Fund and the Green Climate Fund also provide financing services to achieve low carbon emission reduction targets and economic transformation through the establishment and management of carbon funds also provide an important source of funding for clean energy and low-carbon economic development. In addition, some large foreign insurance companies are also committed to low-carbon investment and providing hedging tools. There are £2 billion to invest in “green project” infrastructure, and insurers in the US and Germany invest more than billions of dollars each year in clean energy and renewable energy projects.

FINANCIAL SUPPORT IS THE BOOSTER OF TRANSFORMATION TO GREEN ECONOMY

“Finance is the core role of modern economy”, we know from the economic history that behind of the emergence of major technological innovation and economic restructuring, financial support is a crucial factor. For this, we collected the related data from 1980 through 2008, use the balance of deposits and loans of financial institutions as the indicators of financial support, use the CO₂ emissions per unit of the GDP as the indicators of low carbon or green economic advancement, through the sequence of stationary and co-integration test to analysis the effectiveness of financial sector support low carbon economy development (Machaba 2017). If there have significant co-integration relationship between the time series, it shows that they have the common trend, and the coordinated variation of the time series constrained by the long-term equilibrium relationship.

Unit Root Test

In order to check the steadiness of the time series and avoid producing fallacy regression, we need to do unit root test on the two time series above. If the non-steady time series' second difference is steady, then the original sequence is the second-order stationary process. Here we use the ADF statistic for unit root test, the lag order number in the inspection process can be determined by the AIC criterion and the test results in the case of second-order lag are given in **Table 1**. According to the test results of **Table 1**, the four time series are the second-order stationary series at the 0.01 level. On this basis, you can continue to test the co-integration relationship between these variables.

Table 1. ADF Test

Time-series	The ADF statistic value	1% Critical value
Balance of deposits and loans M	-4.674832	-3.7667
CO2 emissions per unit of GDP CO2/GDP	-6.130685	-3.7667

Table 2. Johansen Co-integration test

Eigenvalue	Likelihood ratio	5% Critical Value	1% Critical Value	No. of CE(s)
0.279433	9.473404	15.41	20.04	None **
0.049930	1.280481	3.76	6.65	At most 1 *

Co-integration Test

If both series are of the same order, and some kind of linear combination (This combination's coefficient is called co-integration vector) cause the order of time series combination reduce, then said that between these time series has the remarkable co-integration. Because the above time series are second-order, so you can use the Johansen test method to test the co-integration between the two time series, and the test results are given in **Table 2**.

Likelihood ratio test showed that there is only one significant co-integration relationship, take the standardized co-integrating vector (The Standard deviation of the coefficients are in the brackets), get the following co-integration relationship:

$$\frac{CO_2}{GDP} = -1.76e^{-6}M + 0.050537$$

(1.1e⁻⁶)

That show the balance of deposits and loans and the CO2 emissions per unit of GDP have the following long-term relationship: First, with the increasing of balance of deposits and loans or financial support, the CO2 emissions per unit of GDP fell; Second, million for each additional deposit and loan balances, emissions will decline 1.76e⁻⁶ metric tons; Finally, financial sector support low-carbon economy development is effective, and should establish a financial support system to boost low carbon or green economic advance as soon as possible (Chen et al. 2013).

RESEARCH ON THE CONSTRUCTION OF GREEN FINANCIAL ECOSYSTEM BASED ON LOW CARBON ECONOMY

After 40 years of rapid economic development, China has also become the country with the largest carbon emissions. The "high carbonization" is facing increasing pressure from the international community. Under the current economic new status, it is a crucial

period for China to controlling carbon emissions, accelerating the advance of low-carbon or green economy, and accelerating the investment and financing of low-carbon economy. The carbon emission trading market and the supporting role of carbon finance systems such as bank credit and capital markets should be fully utilized.

Promote the Emission Trading Mechanism and Increase the Pricing Power of the Carbon Emission Trading Market

The Kyoto Protocol established a carbon emissions trading mechanism in 1997, allowing a country to transfer its excess of emission reduction obligations to other countries that have failed to meet their emission reduction obligations, this led to the creation of a carbon emission trading market, and many countries have successively established carbon emission exchanges based on compulsory or voluntary emission reductions. At present, China is the supplier of the largest CDM project in the carbon emission reduction market. The carbon trading market has great potential for development. Since 2008, it has launched seven carbon trading pilots in seven cities including Tianjin, Shenzhen, Guangzhou, Shanghai and Beijing. Explore the establishment of energy, environmental or carbon emission trading mechanisms and provide related low-carbon financial project services. At the end of 2017, China officially launched the national unified carbon emission market, incorporating more than 3 billion tons of carbon emissions. However, the current carbon trading market still stays in the primary market stage of property rights transactions, and the secondary market transactions are relatively inactive. The industries covered are mainly concentrated in the power, petrochemical and other industries. The pricing mechanism of the carbon trading market is not perfect (Weng and He 2018), and there are problems such as low transaction prices and inconsistencies. And related carbon financial trading products and tools are still in the period of institutional design and R&D, and standard contract transactions such as carbon options, carbon futures and swaps have not yet been design or implement, and the carbon trading market and products play a very limited role. With the deepening of the advance of low-carbon economy and the continuous advancement of structural reforms in the economic supply side, we should maximize the role of resource allocation in the carbon trading market and achieve domestically binding carbon emission reduction targets at the lowest possible cost. Reduce the inclusion of corporate thresholds, expand the scope of trade entities

and industries in the carbon emission market, enrich the trading varieties, improve relevant laws, regulations and systems, accelerate the promulgation of the “Provisional Regulations on the Management of Carbon Emissions Trading” and other related regulations and supporting systems, and further master the carbon emission data of key emission units, and verify greenhouse gas emissions and allocation quotas based on actual conditions and emission reduction targets, strengthen the construction of pricing power, and under the control of the government, the price of carbon trading will be formed by the parties involved in the transaction in consultation and decision further.

Strengthening the Banking Industry's Green Financial Products and Service Support

Banks, as a typical indirect financing-based financial system, have been the most important channel for corporate and social financing in the form of bank loans. Bank loans account for nearly 60% of corporate and social financing. In the condition of low-carbon energy-saving and environmental protection credit, as early as the beginning of 2012, China issued the “Green Credit Guidelines” to clarify the national energy conservation and the emission reduction goal of developing a low-carbon economy (Chen et al. 2013), requiring policy banks, commercial banks and other banking financial institutions to follow the strategy. We will effectively promote green credit business, increase support for green economy and low-carbon economy, and attach importance to the environmental and social performance of the banking industry. However, the low-carbon financial business of domestic banking financial institutions is still limited to limited areas such as low-carbon project financing, green environmental loans, low-carbon wealth management and consulting. Bank carbon finance business and products have certain imbalances compared with international counterparts (Membiela and Vidal 2017). To this end, banking financial institutions should further enhance the initiative and enthusiasm of developing green credit, and implement the relevant requirements of the “Green Credit Guidelines” and “Opinions on Green Credit Work” to formulate clear definition standards for green financial projects. Increase credit grants to green and low-carbon industries and enterprises, give priority to supporting relevant energy conservation and environmental protection emission reduction projects, build credit approval mechanisms and risk control measures that match the risk characteristics of green low-carbon environmental protection enterprises, and establish green financial incentives and assessment

mechanisms. To improve the weight and status of green financial indicators such as green credit in the bank MPA assessment, banking financial institutions should continue to innovate green financial products and services. (Zou et al. 2011),

Building a Green Capital Market Financial Ecology

The capital market is an important platform for resource allocation and transformation, corporate financing and promoting economic development. From traditional credit financing to direct financing in the capital market, it will play a key role in broadening the financing channels of low-carbon and green economy (Chen et al. 2013), reducing the financing costs of low-carbon enterprises, and encouraging low-carbon technology innovation and industrialization. The low-carbon economy will greatly promote the innovation of capital market. Compared with the three-dimensional multi-level capital market low-carbon economy financing system in developed countries, the financing of low-carbon economic capital market in China is still in its initial stage, the low-carbon economy sector has not yet been prominent, and there is still a lot of room for development (Yuan and Hu 2016).

To this end, relevant policies and management departments such as the China Securities Regulatory Commission and the Stock Exchange should improve existing capital market financing standards with low-carbon standards; give priority to supporting all types of low-carbon environmental protection enterprises to go public. Breakthroughs in the listing of low-carbon concept enterprises, cultivating and expanding a number of high-tech and low-carbon concept enterprises, speeding up the reform of the shareholding system and listing counseling, continuously cultivating the reserve resources of low-carbon industries, and improving the listed companies with low carbon emission reduction. Further use the capital market constraint incentive mechanism to promote traditional high energy, high emission, high carbon enterprises to achieve low carbon transformation, and create a “low-carbon sector” for capital market financing.

We should also issue low carbon bond products and increase the scale of low-carbon government and corporate low-carbon bond financing (Chen et al. 2013). The central and local governments should actively finance similar special bonds as “low-carbon national debt”, “climate national debt”, “low-carbon municipal bonds” and “green municipal bonds” to invest heavily in the construction of low-carbon

facilities, new energy development and green buildings (Li et al. 2018), and give priority to the approval of low-carbon enterprises and financial institutions to issue “low-carbon corporate bonds” and “low-carbon financial bonds” and related Medium-term financing bills, short-term financing bills, etc. thus forming a bond market financing system that supports low-carbon economy financing and development. In addition, in restricting other high-emission, high-energy, high-emission enterprises to enter the capital market financing, the “environmental standards” for corporate financing should be established, and mandatory indicators for emissions, pollution and energy consumption should be formulated, in addition to the relevant credit rating mechanism, establish an environmental rating mechanism for various types of financing in the capital market as soon as possible, and prioritize financing for the excellent enterprises, while restricting the listing financing for the poor enterprises, even delisting of listed companies, thus forming a low carbon orientation and environmental constraints for capital market financing.

Accelerate the Development of Financial Instruments Such as Carbon Funds and Carbon Derivatives

In the case of increasing demand for low-carbon economy financing, many countries and international organizations represented by Europe have established carbon sink funds, such as the World Bank Carbon Fund (WBCF) and the European Kyoto Fund (EKF), which are provide important financial support for low-carbon or green economic financing and development (Zou et al. 2011), Carbon Fund, as a hybrid fundraising method, centralizes government, financial institutions, corporate and individual funds to operate, invests in low-carbon industries, low-carbon enterprises, can

effectively promoting the advance and transformation of low-carbon economy (Chen et al. 2013).As an innovative investment and financing mechanism, Carbon Fund will play an irreplaceable role in investment and financing in the future when China accelerates its transformation and development towards a low-carbon economy. The Clean Development Mechanism Fund (CDMF) is the first national-level carbon fund approved by the Chinese government to implement the China National Climate Change Program in 2007. It is responsible for climate finance, fund management and capital utilization, and promotes and supports energy conservation, providing financial support and services in areas such as emission reduction and clean development mechanisms (CDM) has improved China’s ability to cope with climate change. In the future, the CDM fund should gradually transition to the China National Climate Fund, strengthen cooperation with the International Carbon Fund, establish regional carbon funds, etc. Attract international funds and local government funds, further expand financing channels, and through funds in the fund, to support the development and transformation of low-carbon and green economy, promote the research and advancement and industrialization of new low-carbon projects and technologies.

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