The present situation, problems and countermeasures of green investment in China

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Abstract. China’s multi-level and multi-channel green investment system currently consists of international financial institutions, government agencies, commercial banks, foundations, securities market and PPP projects. By sorting out and summarizing the investment of relevant social investors in pollution prevention and control, protection and improvement of ecological environment, new energy and related activities, this paper makes an in-depth analysis of the scale of green investment in various channels and the characteristics of capital investment to understand the current situation and problems of green investment in China. At the same time, some countermeasures and suggestions are put forward to solve the problems such as unblocked financing channels, high financing costs, single and inefficient investment mechanism, and insignificant leverage effect of financial funds in the green investment field.

1. Introduction

In recent years, China’s economy has been developing steadily, and the investment in the field of green investment is also on the rise. During the 12th Five Year Plan period, the total output value of China’s energy-saving green investment industry increased from 2 trillion yuan to 4.5 trillion yuan, and the number of people engaged increased from 28 million to more than 30 million [1]. In December 2016, the 13th Five Year Plan for the Development of Energy Saving and Green Investment Industry proposed that the added value of energy-saving and green investment industry should be increased from 2% of GDP to 3% from 2015 to 2020, and 20 energy-saving green investment industry clusters should be built [2], which fully explained that the state should take energy-saving and green investment as an important content to improve the quality of economic development and cultivate new impetus for economic growth.

The definition of green investment at home and abroad can be roughly divided into two kinds: one is the "Cost Theory" [3], which is mainly put forward by the developed countries that have carried out environmental governance earlier. They think the definition of green investment is the cost of environmental protection, that is, the total cost of pollution control and environmental improvement spent by the society to maintain a certain environmental quality [4]. The other is "Investment Theory" [5], which holds that green investment is an important part of fixed asset investment for national economic and social development, and belongs to policy investment [6][7][8].

There is no consistent definition of green investment at home and abroad. Each country has different definitions of green investment according to its own actual situation. Based on the definition
of energy-saving and green investment industry in the 13th Five Year Plan of China, this paper divides
the sub industries that constitute China’s green investment industry, joins in the activities of ecological
green investment [9] and the investment of new energy and clean energy [10], making a statistical
analysis of the capital investment of the relevant investors in pollution prevention and control,
protection and improvement of ecological environment, new energy and related activities, which is
defined as "green investment".

2. Current situation of green investment in China
In this paper, the investment channels in the field of green investment in China are divided into six
channels: international financial institutions, governments, commercial banks, foundations, securities
market and PPP projects. The investment of these six main investors in pollution prevention,
protection and improvement of ecological environment, new energy and related activities in 2014-
2016 is analyzed.

2.1. International financial institutions
International multilateral banks and multilateral climate funds provide a way to transfer international
funds to green investment projects in China [11]. Among them, the Global Environment Facility is the
only one supporting China’s green investment projects, while other multilateral climate funds have not
yet launched activities in China. According to the statistics of the World Bank Database [12], the
number of green investment assistance projects carried out by the World Bank in 2001-2016 totaled
139, with a total commitment of US $12.502 billion. During 2010-2016, the Asian Development Bank
successfully completed 34 green investment projects supported in China, with a total investment of US
$3.394 billion, including clean energy, renewable energy power generation, energy supply and
demand energy conservation projects, which reduced carbon dioxide emissions of about 14.713
million tons [13]. As the most important multilateral climate change fund, the Global Environment
Facility has provided about $1562 million in grant support to 193 Chinese projects by the end of 2016.
According to the relevant data of its project database, from 2014 to 2016, its approved grants for 17
projects related to the field of green investment in China totaled US $144 million, mainly invested in
the environmental governance of water, air and solid waste, as well as the upgrading and
transformation of energy conservation and emission reduction technologies.

2.2. Government organs
The state budget funds support the investment in the green field through budget investment, subsidies,
transfer payments, tax preferences and other policy tools, actively guiding social capital to invest in
the field of energy conservation and emission reduction. According to the relevant data of 2014-2016
national general public budget expenditure final statement, excluding the expenditure of administrative
affairs in the field of environment and energy, as well as the expenditure of government subsidies and
subsidies, the green investment of the central and local governments in 2014-2016 was 316.926 billion
yuan, 340.524 billion yuan and 400.518 billion yuan respectively. Among them, the financial funds
used for pollution prevention and control accounted for the highest proportion, reaching 34.22%,
38.59% and 36.14% respectively in 2014-2016, followed by energy conservation and utilization.
In 2014-2016, three policy banks, including the National Development Bank, the Export Import Bank
of China and the Agricultural Development Bank of China, accumulated the balance of energy
conservation and emission reduction and low-carbon related loans of 237.619 billion yuan, 282.547
billion yuan and 394.036 billion yuan. Their business scope covers green credit management,
sustainable energy and new energy projects, energy conservation and emission reduction, rural
economic energy conservation green investment projects and low-carbon financial innovation.
As an innovative financial mechanism to support low-carbon development, China Clean Mechanism
Development Fund is the first national level policy fund established by China and developing
countries to deal with climate change. As of the end of 2016, China Clean Mechanism Development
Fund has arranged 1.125 billion yuan of free funds to support 522 grant projects, arranged 14.868
billion yuan of paid loan funds and leveraged 79.268 billion yuan of social funds. The total annual carbon emission reduction (or carbon emission reduction potential) of the loan projects is expected to reach 48.2839 million tons [14].

2.3. Commercial banks
As the center of social credit system, commercial banks play an important role in the field of low-carbon investment. At present, the carbon finance business of domestic commercial banks is mainly green credit, supplemented by intermediary business. In 2016, the green credit balance of 18 major commercial banks was 4398.41 billion yuan, accounting for 5.45% of the total loan balance at the end of the year, with an increase of 22.54% compared with that at the end of 2015. This shows that China’s commercial banks are gradually strengthening their credit support in the green and low-carbon field, and the balance of green credit is growing steadily. However, the proportion of green credit balance to total loan balance of most banks is less than 5%, which indicates that there is still a lot of room for the commercial banks to improve their green credit business.

Table 1. Green credit ranking of commercial banks in 2016 (100 million yuan)

| Ranking | Bank name                                | Nature  | Green credit balance | All loans balance | Green credit ratio |
|---------|------------------------------------------|---------|----------------------|------------------|-------------------|
| 1       | Industrial Bank Co., Ltd.                | Stock system | 4,943.60           | 20,798.14        | 23.77%            |
| 2       | Construction Bank of China Co., Ltd.     | State-owned | 8,892.21           | 117,570.32       | 7.56%             |
| 3       | Industrial and Commercial Bank of China Co., Ltd. | State-owned | 9,785.60           | 130,568.46       | 7.49%             |
| 4       | Bank of Jiangsu Co., Ltd.                | City    | 467.00              | 6,493.80         | 7.19%             |
| 5       | Agricultural Bank of China Co., Ltd.     | State-owned | 6,494.32           | 97,196.39        | 6.68%             |
| 6       | Shanghai Pudong Development Bank Co., Ltd. | Stock system | 1,738.12           | 27,628.06        | 6.29%             |
| 7       | Bank of Communications Co., Ltd.         | Stock system | 2,411.99           | 41,029.59        | 5.88%             |
| 8       | Zheshang Bank Co., Ltd.                  | Stock system | 261.18             | 4,594.93         | 5.68%             |
| 9       | Bank of China Co., Ltd.                  | State-owned | 4,673.42           | 99,733.62        | 4.69%             |
| 10      | China Merchants Bank Co., Ltd.           | Stock system | 1,436.64           | 32,616.81        | 4.40%             |
| 11      | Ping An Bank Co., Ltd.                   | Stock system | 590.34             | 14,758.01        | 4%                |
| 12      | Hua Xia Bank Co., Ltd.                   | Stock system | 453.50             | 12,166.54        | 3.73%             |
| 13      | Bohai Bank Co., Ltd.                     | Stock system | 111.91             | 3,536.82         | 3.16%             |
| 14      | China Everbright Bank Co., Ltd.          | Stock system | 493.76             | 17,952.78        | 2.75%             |
| 15      | China Post Savings Bank Co., Ltd.        | State-owned | 752.31             | 30,106.48        | 2.50%             |
| 16      | China CITIC Bank Co., Ltd.               | Stock system | 254.78             | 28,779.27        | 0.89%             |
| 17      | Guangfa Bank Co., Ltd.                   | Stock system | 85.19              | 9,789.02         | 0.87%             |
| 18      | China Minsheng Bank Co., Ltd.            | Stock system | 138.23             | 24,615.86        | 0.56%             |
|         | **Total**                                |          | 43,984.10          | 719,934.90       | 5.45%             |
2.4. **Foundations**

From 2014 to 2016, the total investment of the foundation in the field of low carbon was 357 million yuan, 329 million yuan and 263 million yuan respectively, of which the proportion of public funds was 95.88%, 93.89% and 94.34% respectively. At present, there are four national public funds in China that put green investment into the main purpose of funds, and another 19 local public funds are also involved in the field of green investment, which mainly includes low-carbon publicity, low-carbon technology, low-carbon education and afforestation. Afforestation "carbon neutralization" is the main low-carbon project of local foundations, accounting for more than 80% of the total investment of local public funds in low-carbon field.

2.5. **Stock market**

Although the proportion of capital investment in the securities market is small, it rises rapidly and has great potential. From 2014 to 2016, listed companies invested about 43.049 billion yuan, 50.954 billion yuan and 63.935 billion yuan in green and low-carbon fields through IPO, additional issuance of shares, allotment or issuance of convertible corporate bonds in the primary market. It invested mainly in five directions: energy conservation and efficiency improvement, renewable and clean energy, ecological protection and environmental governance, resource recycling and utilization and green investment services.

### Table 2. Overall use of raised funds in low carbon field of listed companies

| Investment direction | Definition | Proportion |
|----------------------|------------|------------|
| **Energy conservation and efficiency improvement** | Production and technology upgrading of energy-saving equipment and materials, green transportation, new energy vehicles, energy efficiency improvement of traditional energy, etc. | 52.77% 37.20% 56.08% |
| **Renewable and clean energy** | Construction and investment of clean energy comprehensive utilization projects such as solar energy, water energy, wind energy, nuclear energy, etc. | 34.23% 49.94% 37.25% |
| **Ecological protection and environmental governance** | All kinds of manufacturing enterprises serving new energy power generation need new materials, special equipment manufacturing, spare parts, etc. in clean energy power generation | 2.71% 9.34% 4.17% |
| **Resource recycling and utilization** | Investment in the whole industrial chain of new energy vehicle design, battery, material, power system, etc. | 8.54% 2.22% 0.07% |
| **Green investment services** | Ecological restoration, urban greening, sewage treatment, resource recycling, etc. | 1.75% 1.29% 2.43% |

As for private equity and venture investment, from 2014 to 2016, there were 237 cases, 484 Cases and 307 cases of investment disclosure in green and low-carbon industries, with financing amount of 11.853 billion yuan, 18.915 billion yuan and 20.792 billion yuan respectively. The investment mainly focused on green investment and new energy. By the end of 2016, China’s green bonds had issued a total of 209.519 billion yuan, with 83 issued. The main issuers were mainly in the financial industry, accounting for 33.73% of the total green bonds. From the perspective of the nature of green bond issuers, China’s local governments and state-owned enterprises accounted for 49% of the total green bond issuers, making them the most important green bond issuers.

2.6. **PPP projects**

As of the end of 2016, among the two batches of more than 2000 PPP projects recommended by the National Development and Reform Commission, there were 563 projects involving green investment, with a total investment of 222.036 billion yuan [15]. The investment amount of green
investment projects signed and implemented in 2015-2016 was about 176.21 billion yuan and 411.7 billion yuan respectively, mainly involving sewage treatment, ecological construction, environmental protection, water conservancy construction, renewable energy and other fields with the role of promoting green and low-carbon economic structure. PPP mode broadens the source of funds, alleviates the pressure of government financial expenditure, and introduces the professional technology and advanced management experience of the private sector in the field of green and low carbon while introducing social capital.

2.7. Summary
At present, the World Bank, Asian Development Bank and other international financial institutions, government, banking, social funds, private venture capital and listed companies in the green investment industry constitute a multi-level and multi-channel green investment system. From 2014 to 2016, China’s green investment increased from 1062.411 billion yuan to 2250.778 billion yuan. Among them, policy finance accounts for 52.61%, 37.81% and 35.39% of the total investment, but it always occupies an important position. Commercial banks’ investment is increasingly becoming an important channel for green and low-carbon capital sources, accounting for 41.25%, 41.85% and 35.94% respectively. Due to the profit-seeking nature of enterprises, the share of securities market is not high. In addition, the investment of international financial institutions and social funds also play a complementary role.

3. The main problems of green investment in China

3.1. Single financing channel, the investment system needs to be improved
At present, the scale of international capital investment in China is very small. Many international multilateral and bilateral financial institutions have not continued to cooperate with China in the past two years or even some have not. Although the investment scale of policy banks and foundations is not small, there is a single investment channel and a lack of cooperation mechanism. The development of carbon finance business in commercial banks is relatively passive, and the products are lack of innovation. The scale of social funds is small, and the transparency of charitable donation system and fund use needs to be improved. In the securities market, private venture capital’s IPO exit resistance is large, and low-carbon industry stock market is sluggish. Laws, regulations and regulatory system of green bonds still need to be improved.

3.2. Indirect financing is dominant, high cost of financing
Compared with the previous two years, the proportion of direct financing of low-carbon industry in China has increased significantly, but it still accounts for only 15.47% of the total financing in 2016, while the proportion of direct financing of enterprises in developed countries accounts for more than 50%. Indirect financing, mainly bank loans, plays a leading role, but private enterprises and small-scale renewable energy enterprises are difficult to get financial support from banks. The structural imbalance of domestic financial market makes the proportion of indirect financing much higher than that of direct financing.

3.3. Low efficiency in financing mechanism
China’s green investment is still dominated by government policy finance and commercial banks, with the total investment amount accounting for 61.92% in 2016.China relies too much on the investment and financing system of the government and banks, which makes it difficult for other investors to enter the configuration pattern of energy-saving green investment, resulting in the lack of market competition mechanism and low investment efficiency in this field.
3.4. The leverage effect of financial funds is not obvious

The ratio of financial funds to social funds is defined as the leverage ratio of financial funds, which means the increase of social investment in energy conservation and emission reduction caused by each additional unit of financial investment, which reflects the multiplier effect of financial funds [16]. It is estimated that from 2014 to 2016, the leverage ratio of financial funds and social funds invested in the field of climate change in China was 0.79, 0.90 and 0.93 respectively, with an obvious upward trend but a relatively low proportion, and the government funds have not yet significantly leveraged the investment of social capital. In contrast, CDM funds and PPP projects have a better effect on leveraging social funds.

4. Suggestions

4.1. Improve the guarantee mechanism, broaden financing channels

We need to improve green investment standards and regulatory mechanisms, encourage financial institutions to participate in environmental risk assessment and management processes, and establish a sound green investment risk early warning and monitoring mechanism. To give full play to the platform and window functions of various outcome fairs, and guide the gathering of various high-quality green industry projects, funds, technologies, talents and other elements. Accelerate the establishment of cross departmental information sharing mechanism, clarify the scope of information sharing and feedback channels, and promote collaborative management. Establish a green investor network, and encourage multiple institutions and investors to participate in the green investor network.

4.2. Make full use of credit financing, improve the efficiency of green financing

To encourage innovation in credit product services, develop green credit management systems, open up fast approval channels for green credit, and explore continuous innovation in carbon emission rights, emission rights, energy-saving pledge financing loans and other non-mortgage credit products [17]. On the basis of summing up the pilot experience of green credit asset securitization business in the early stage, by further expanding the scope of participating institutions, standardizing the selection of green credit basic assets, exploring efficient and low-cost mortgage and pledge right change registration methods, improving the market liquidity of green credit asset securitization, and strengthening the relevant information disclosure management. Support the high-quality stock assets with stable cash flow in the green industry to carry out securitization business. Encourage the innovation of asset securitization business of PPP project, and explore efficient and low-cost mortgage and pledge right change registration methods.

4.3. Explore PPP model of environmental protection, widely introduce social capital

The establishment of PPP green industry fund is an important means to promote the development of green industry funds. The government should continue to give full play to the guidance and amplification effect of financial funds, attract all kinds of powerful institutional investors and long-term and stable social capital to set up green industry development investment funds, and invest in enterprises and projects in the fields of environmental protection, energy conservation, clean energy, green transportation and green building. The development of PPP model needs perfect system to ensure the good operation of long-term partnership. The government should speed up the establishment of legal system of PPP model, improve the transparency of PPP projects, and establish information disclosure system, so as to promote and regulate the development of PPP. We need to build an efficient regulatory system, improve the information sharing mechanism, build a professional PPP consulting service agency, and establish a special project management agency to promote the institutionalization, standardization and specialization of the PPP model.
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