

Research on Domestic and Foreign Practices of Climate Finance

Abstract

Since the Industrial Revolution, international community has attached great importance to global warming. Agriculture is highly correlated with global warming, thus the promotion of agricultural production activities is an important way to mitigate climate change. Through analysing the domestic and foreign practices of climate finance, this paper aims to make suggestions to agricultural policy finance on climate finance practices, in order to further explore the possibility of agricultural and rural finance in coping with climate change.

The paper defines the climate finance as the floorboard of using financial resources to support all activities relating to mitigate and adapt to climate change, covering green finance and carbon finance and also their extension and development. Based on the definition, the paper summarizes the current situation and highlights from five representative international organizations and nine countries. Combined with the field research in Xiongan New Area, the report concludes five representative cases of climate finance practices in China, including Credit Support Mode, Fund Support Mode, Security Support Mode, Insurance Support Mode and Carbon Emission Trading Support Mode, and also provides representative cases to elaborate each model.

The Agricultural Development Bank of China (hereinafter referred as ‘ADBC’) has continuously been strengthening its support to green economy, low carbon economy and circular economy, providing strong support to national actions in the agricultural and rural areas to mitigate and adapt to climate change. Considering the characteristics of climate finance in China, the overall development of ADBC and the domestic and international experiences, the report provides seven suggestions on the development of climate finance in ADBC, which are as follows respectively, firstly, to strengthen research and planning on climate finance. Secondly, to clarify the basic principles of climate finance development. Thirdly, to set up the scope of support scientifically. Fourthly, to build a diversified support and promotion mechanism. Fifthly, to actively engage in international cooperation on climate finance. Sixthly, to improve management level and team quality. Seventhly, to strive for relevant supporting policies.

1. Background of the Study

1.1 Presentation of the Problem

Fossil fuels, such as oil and coal, have fueled global economic development after the Industrial Revolution. Fossil fuel usage, however, has also led to a significant increase in global greenhouse gas emissions. Human deforestation (including rainforests cutting) acquired resources and space needed for development, but also weakened forests' ability to absorb greenhouse gases. These factors contribute to a continuous increase in greenhouse gas concentrations, leading to global warming. Global warming not only causes extreme weather, but also leads to problems, such as glaciers melting and sea levels rise. In the long run, global warming may inundate and wipe out low-altitude areas, cause animal extinction, and threaten human health.

Agriculture, as the backbone of the national economy, the primary source of food and clothing, and the basis of survival, is highly correlated with the climate change. On the one hand, global climate change will impose irreversible impacts to the ecological environment of all countries. The impact on agriculture will bear the brunt, which will greatly increase the fragility of agricultural production. In some areas, climate change will even bring devastating damage to agricultural production by greatly reducing crop yields and seriously endangering food security. On the other hand, agricultural production also contributes to the climate change through greenhouse gas emissions and accounts for 19-29 percent of total greenhouse gas emissions.¹. Therefore, promoting agricultural production activities is an important way to mitigate climate change.

From the "Kyoto Protocol" signed in 1997 to the "Paris Agreement" jointly signed by 175 countries at United Nations Headquarters in 2016, the international community has reached the consensus on the severity and urgency of the climate change, and the importance of using financial tools to solve climate problems. "Making financial flows in line with low greenhouse gas emissions and climate-adapted development" is one of the three goals of the Paris Agreement. This is not only an initiative for using financial

¹ Making Climate Finance Work in Agriculture, World Bank Group.

resources to address climate issues, but also a clear requirement for financial industry to fulfill social responsibility.

Based on the above considerations, this study, while combing the domestic and foreign practices of climate finance, has provided suggestions on the implementation of climate finance in agricultural policy finance, in order to further explore the possibility of agricultural and rural finance in coping with climate change.

1.2 Definition of climate finance

Climate finance was introduced by the 2009 United Nations Climate Change Conference (The Copenhagen Summit) in negotiations of a financial mechanism to address climate change. Currently, there is no uniform definition for climate finance. The United Nations Framework Convention on Climate Change (UNFCCC) defines climate finance as obtaining local, national or transnational financing from public, private and alternative sources of financing that seeks to support mitigation and adaptation actions that will address climate change, in order to reduce greenhouse gas emissions, mitigate human and ecosystem vulnerability, build resilience to the adverse effects of climate change. The World Bank believes that climate finance includes all resources that promote low carbon and climate resilience development, which supports an enabling environment with adaptation and mitigation capabilities, and encourages the research, development and deployment of new technologies by covering the costs and risks of climate action. The Climate Policy Initiative (CPI)² proposes that climate finance is financial support for adaptation and mitigation activities, including capacity building, research and development, promotion of the transformation for low carbon and climate defense development, and promotion of the flow of funds from developed to developing countries and flows between countries and within countries. Some domestic scholars also have their definitions for climate finance. Chen Xiping³ believes that climate finance is the floorboard of a series of financing and related institutional arrangements implemented by the international community to cope with

² The Landscape of Climate Finance, Climate Policy Initiative, 2011

³ Climate Finance, Lixin Publishing House, 2011

global climate change. Wang Yao⁴ defines climate finance as innovative finance related to climate change, including the use of multi-channel funding sources and diversified innovative tools to promote global low-carbon development and build resilience to climate change. We believe that climate finance is the floorboard of using financial resources to support all activities relating to mitigate and adapt to climate change, covering green finance and carbon finance and also their extension and development, which has strong positive externality, globality and urgency.

1.3 Global climate finance practices

The Paris Agreement maps the future of climate finance and provides opportunities for its development. At present, except for a few countries, most countries in the world have made significant progress towards the targets of the Paris Agreement and have taken joint efforts to combat climate change and protect the ecosystem. For example, the World Bank and the Asian Development Bank have established funds to address the causes and consequences of climate change; large commercial banks such as HSBC and Citibank have taken climate governance as an important component of corporate governance; Swiss Re and Munich Reinsurance are actively promoting catastrophe insurance; institutions such as the Chicago Climate Exchange have started voluntary greenhouse gas reduction and trading system.

In general, there are two major funding sources for climate finance. Developing countries tend to adopt direct government funding, while developed countries tend to adopt a combination of ‘policy finance+market assistance+government implicit guarantee’. There are two main reasons for the difference. First, compared with that in developed countries, policy finance system in developing countries is incomplete and lacks related market support, having relatively limited ability to perform duties. Second, the cost of adopting composite models in developed countries is relatively low. Climate funds do not directly reach the end users, but through various intermediaries. Under some certain situations, these intermediaries can aggregate funds to achieve economies

⁴ Climate Finance, China economic press, 2013

of scale, or mobilize a larger amount co-financing capital by existing funds. Main climate finance media include multilateral financial institutions, bilateral financial institutions, carbon financial institutions, and international capital market. Thereinto, multilateral financial institutions and bilateral financial institutions are important channels to provide international funds, especially international public funds, to the developing countries. Among all the multilateral financial institutions, the World Bank Group plays the most important role in climate finance, while International Finance Corporation has effectively mobilized private sector investment. The two institutions have made joint commitment to put more efforts into combating global climate change. In terms of bilateral financial institutions, bilateral development agencies and bilateral banks provide funds or assistance to address climate change in the form of grants, concessional loans, co-financing, and technical assistance.

1.4 China's actions to cope with climate change

China signed the Kyoto Protocol in May 1998 and approved it in August 2002. As a supplement to the UNFCCC, the Protocol has taken a solid step to reduce the adverse effects of the climate change. At the press conference in 2007, Premier Wen Jiabao pointed out that although the 'Kyoto Protocol' does not set emission limit for developing countries, China, to take a responsible stance, is committed to cut its energy intensity by 20% from 2006 to 2010.⁵ Climate finance faces new development opportunities. Some projects related to greenhouse gas emission reduction have received billions of RMB investment from the Clean Development Mechanism (CDM) of the Kyoto Protocol.⁶

On December 9, 2014, at the 20th United Nations Climate Change Conference (COP20) in Lima, Peru, China stated that it will control its annual carbon dioxide emissions under 10 billion tons in 2016-2020.⁷ In 2016, China signed *the Paris Agreement*, which is

⁵ Huang Chengxun. (2007) Wen Jiabao: China's implementation of the Kyoto Protocol is responsible for the world. Structurehttp://news.sohu.com/20070316/n248774681.shtml

⁶ Lin Hua. (2005). What does the Kyoto Protocol bring to China? [J]. High Technology and Industrialization, 2005, (3): 4-6.

⁷ Wang Xiaoyi. Foreign media: China sets a carbon emission cap of 10 billion tons per year from 2016 to 2020. https://baike.baidu.com/reference/1620452/e383sPKEjPKWIo0Jq4YU9XYdDmtKpHRjPHrdzV_FtSGWh_Jbc_11SPfFGzx_OxfxuM3G9_CYqpSPCSeqQmXHkPjBUL7aMXh_P6dq7Nq_fyaR

the third international treaty on climate change in human history following the 1992 United Nations Framework Convention on Climate Change and the *1997 Kyoto Protocol*. This agreement reflects continuity, fairness, persistence and feasibility. For industries and enterprises in China, *the Paris Agreement* will increase economic cost of the existing projects. Meanwhile, many unqualified competitors and projects will also be kicked out, promoting economic transformation and green and sustainable development in China.

In recent years, Chinese government has been continuously attached great importance to combat climate change and has put forward detailed requirements in the “Eleventh Five-Year Plan”, the “Twelfth Five-Year Plan”, the “Thirteenth Five-Year Plan”, the report at 19th CPC National Congress, and the annual National Conference on Ecological Environmental Protection. Promoting green and low-carbon development is an important component of building ecological civilization and accelerating the progress of economic restructuring in China. Chinese government has been continuously strengthening the cooperation with multilateral institutions, such as the World Bank, Asian Development Bank and United Nations Development Programme (UNDP), and also actively participating in setting up the Green Climate Fund, the Adaptation Fund, the Technology Executive Committee and others under the UNFCCC.

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2. International practices of climate finance

Since the Industrial Revolution, climate issues have increasingly attracted the attention of the international community. In addition to the continued efforts by the international organizations, some countries and regional organizations have also made unremitting efforts in climate finance, and have already achieved remarkable progress. The Climate Policy Initiative (CPI) report (2018) shows that the top three areas with the fastest growth rate and the largest financing amount in global climate finance are China (\$180

⁸ China's 2018 Annual Report on Policies and Actions to Address Climate Change, Ministry of Ecology and Environment of the People's Republic of China

billion), Western Europe (\$107 billion) and the United States (\$56 billion), while Japan, South Korea, Israel are tied for fourth with Latin America (\$26 billion). (see Table 1).

Table 1: Climate Policy Initiative (CPI) Statistics⁹



By the end of 2018.

2.1 The Practice of International organization on Climate Finance

2.1.1 The World Bank Group

The World Bank Group (hereinafter referred as ‘WBG’) and the International Finance Corporation (hereinafter referred as ‘IFC’), an affiliates of the World Bank, are the most active participants in global climate finance. In 2018, the WBG invested \$20.5 billion in climate actions, reaching the 2020 climate finance targets two years ahead of schedule. In 2018, the International Development Association, which offers concessional loans and grants to the world’s poorest areas, invested \$6.8 billion to support 134 climate finance projects. IFC invested \$3.9 billion, which accounted for 36% of its total investment, in over 140 climate projects covering more than 40 countries. IFC also invested \$4.5 billion in climate-smart agriculture, green buildings,

⁹ Climate Policy Initiative Website-<https://www.climatepolicyinitiative.org/>

smart city, clean energy, and green bonds.

The WBG and the IFC are the world's largest green bond issuers. Since 2010, the IFC's cumulative green and social bond issuance is \$7.6 billion in 13 currencies. The Climate Investment Funds (hereinafter referred as 'CIF') has invested \$8.3 billion in climate action that worked in 72 countries. Currently, as part of a \$775 million partnership through its Clean Technology Fund (hereinafter referred as 'CTF'), CIF is helping India expand its rooftop solar industry. Upon completion of the project, it will generate nearly 500 MW of new rooftop solar capacity, saving almost 2 billion tons of carbon dioxide emissions and providing approximately 50,000 jobs.

With the help of the World Bank, CIF, the African Development Bank, and other partners, Morocco launched the Moroccan Solar Energy Programme that will provide 2 million Moroccans with 580 MW, accounting for one-fourth of Morocco's solar energy target by 2020.

IFC is currently helping Egypt build the world's largest solar installation and financing the construction of 13 solar power plants in Egypt's Benban Solar Park with \$653 million debt package. The 13 solar power plants are expected to generate 752 MW of electricity per year for over 350,000 residents and help avoid 2 million tons of annual greenhouse gas emissions. The project was developed in Egypt's second round of Solar Feed-in-Tariff program and received \$210 million in political risk guarantees by Multilateral Investment Guarantee Agency.

Mozambique and DRC, two African countries with important forest resources, signed landmark agreements with the World Bank to reward social community who makes efforts to reduce carbon emissions by tackling deforestation and forest degradation. These agreement unlock performance-based payments of up to US\$50 million for Mozambique and up to US\$55 million for DRC. The payments will be funded by the Forest Carbon Partnership Facility Carbon Fund, whose Secretariat is hosted inside the World Bank.

In Rwanda, private company Inyenyeri is using carbon finance to mobilize private finance in order to scale up clean cooking and reduce greenhouse gas emissions. It provides rural households with biomass fuel pellets for clean gasifying cookstoves, a

solution that delivers climate, environmental, and health benefits. The program is growing rapidly, with customer base tripled from 2017 to 2019.¹⁰

2.1.2 Asian Development Bank (ADB)

Asian Development Bank (hereinafter referred as ‘ADB’)’s new Strategy 2030 prioritizes tackling climate change, building climate and disaster resilience, and enhancing environmental sustainability. In 2018, ADB invested over US\$3.59 billion in climate finance from its own resources, in addition to raising a total of US\$426 million from external financing. ADB is committed to cumulatively invest US\$80 billion in climate finance between 2019 and 2030, and ensures that by 2030 at least 75% of its projects will address mitigation and adaptation of climate change.¹¹

In the recent years, the Chinese government has made significant progress in improving air quality particularly by introducing new policies, new ambient air quality standards and nationwide action plans. However, China still faces many difficulties and problems in this area. To address the challenge, the Chinese government and ADB reached a lending program of around US\$500 million per year for 2016-2020. During this period, ADB will focus on assisting the Chinese government to strengthen policies and regulatory frameworks, develop financing facilities to unlock investment in needed areas, and leapfrog technologies in key sectors.¹²

The state-owned China National Investment & Guaranty Corporation (hereinafter referred as ‘I&G’) was selected by the government to develop an appropriate facility. In December 2016, ADB approved a loan of €458 million to help I&G set up a Green Financing Platform (hereinafter referred as ‘GFP’), which . With credit enhancement measures, GFP will enable small and medium enterprises to have easier access to loans from commercial banks. State Development and Investment Corporation, which is the controlling state-owned enterprise of I&G, is responsible for overseeing the implementation of GFP.¹³

¹⁰ According to the World Bank website information www.worldbank.org

¹¹ Climate Change Financing at ADB. <https://data.adb.org/dataset/climate-change-financing-ADB>

¹² ADB-Supported “Green Financing Platform” Launched for Better Air Quality in Greater Beijing Area. <https://www.adb.org/news/adb-supported-green-financing-platform-launched-better-air-quality-greater-beijing-area>

¹³ According to Asian Development Bank website information www.adb.org

2.1.3 African Development Bank (AfDB)

Although African countries only account for 5% of the global greenhouse gas emissions, some African countries (such as Sudan, Chad, Uganda, etc.) have experienced 1 to 3 degrees Celsius of climate warming between 1960 and 2009¹⁴. African countries have developed plans and targets for climate resilience and low-carbon economy within their countries, and the Paris Agreement builds a solid foundation to achieve these goals. AfDB has also corporated with various international organizations, such as the Global Growth Partnership (GGP), and has leveraged on their funds and technology to achieve a series of ambitious projects. Created by the African Development Bank, the African Climate Change Fund (ACCF) was established in 2014 and is contributed by the government of Germany, Italy and Belgium with €4.725 million, €4.7 million and €2 million, respectively. To date, the ACCF has invested in eight small grant projects in six African countries for a total of US \$3.3 million, making outstanding contributions to African countries in comabting climate change. The fund supported a renewable energy project in Cape Verde, Senegal, with a total investment of \$495,037.¹⁵

2.1.4 The International Monetary Fund (IMF)

The International Monetary Fund (IMF) was established in 1945 with the goal of ensuring financial stability, promoting international trade and sustainable economic development, and reducing poverty. Since its inception, the IMF has played a prominent role in global economic governance, helping many countries implement industrial restructuring and energy conservation¹⁶. The IMF mainly supports governments in promoting climate finance development through the following four ways.

Firstly, implement energy subsidy reform. IMF influences governments to reduce or eliminate subsidies for petroleum products, improve energy efficiency and reduce overall energy consumption. According to IMF's prediction, an effective energy pricing strategy will reduce global carbon emissions by more than 20% from the emission

¹⁴ Odusola, A., F. & Abidoye., F., O. (2012) Climate Change and Economic Growth in Africa-An Econometric Analysis.

¹⁵ According to AfDB website information <https://www.afdb.org/en>

¹⁶ Karanfil, F. & Omgba, L., D. (2019). Do the IMF's Structural adjustment programs help reduce energy consumption and carbon intensity? Evidence from developing countries. *Structural Change and Economic Dynamics*. 49(2019): 312-323

amount in 2013, reduce the number of deaths from fossil energy pollution by 50%, and increase GDP by 4%¹⁷. Eliminating distortions in the coal market can not only improve the economic performance of countries, but also improve the overall environmental quality.

Secondly, mitigate carbon emissions through carbon taxes. The carbon tax is considered to be the most effective instruments to reduce carbon emissions. While providing sufficient financial support to the government, carbon taxes also facilitates the transformation to a low carbon economy. IMF is developing spreadsheet tools that provide practical guidance for countries to make fiscal decisions. For example, IMF 's economic review for China¹⁸ shows that carbon tax in China will rise from 32.5 yuan per ton in 2017 to 455 yuan per ton in 2030, which will reduce carbon emissions and air pollution from fossil energy by 30% and 33%, respectively, and increase GDP by 3%. The research results provide guidance for policy formulation of carbon emission in China.

Thirdly, build resilience. Through scientific research, IMF helps countries affected by climate change to conduct quantitative research on economic risks and to build resilience to climate risks. For example, in recent years, IMF has been working to help countries that are vulnerable to climate finance, such as Nicaragua, Myanmar, and Zimbabwe, to conduct research on climate change. Studies shows that natural disasters caused by climate change each year bring losses to low-income countries. Such losses account for around 2% of the country's total GDP, four times the impact on larger economies¹⁹. In addition, during the period of devastating Ebola crisis caused by climate change in 2015, IMF provided debt relief to poor countries hit by natural disasters.

Fourthly, promote international action. IMF also facilitate multilateral coordination through its international influence, such as establishing a minimum price of carbon tax,

¹⁷ Parry, L. (2018). 5 Things You Need to Know About the IMF and Climate Change. Retrieved from: <https://blogs.imf.org/2018/06/08/5-things-you-need-to-know-about-the-imf-and-climate-change/>

¹⁸ Parry, I., Shang, B., Wingender, P., Vernon, N., & Narasimhan, T. (2016). Climate Mitigation in China: Which Policies Are Most Effective? Retrieved from: <https://www.imf.org/external/pubs/ft/wp/2016/wp16148.pdf>

¹⁹ Parry, L. (2018). 5 Things You Need to Know About the IMF and Climate Change. Retrieved from: <https://blogs.imf.org/2018/06/08/5-things-you-need-to-know-about-the-imf-and-climate-change/>

effectively promoting the development of climate finance and speeding up the implementation process of the Paris Agreement.

2.1.5 European Union

The European Union (EU) is the birthplace and the leader of low-carbon economy. As early as 2005, the European Union launched the Emissions Trading System (ETS); in 2006, the European Commission officially announced the EU Green Paper on Energy Strategy, which proposed Europe Energy Policy with the goals of sustainability, competitiveness and supply security, and proposed the establishment of internal gas and electricity market, and etc²⁰. In 2008, the EU summit adopted *the Climate Action And Renewable Energy Package* to encourage the scale development of low-carbon energy. In 2009, the EU Council and the European Parliament proposed *The National Renewable Energy Action Plan*, an important tool to ensure investment stability in low-carbon energy sectors, including renewable energy planning in the areas of transportation, power generation and air conditioning. After the financial crisis, the EU launched a 200 billion euro economic recovery plan to make “smart investment” in the skills needed for the future economic development, including improving building energy efficiency and developing low-carbon energy plan such as clean fuel vehicles and green buildings. In addition, The EU has successively released three documents that are regarded as the medium-term roadmap, long-term roadmap and technology roadmap for the EU's low-carbon energy strategy development, namely *the EU Energy 2020: Energy Strategy for Competition, Sustainability and Security* (2010), *the European Strategic Energy Technology Plan* (2010) and *the Road Map To A Competitive Low Carbon Economy in 2050* (2011).

EU leads the world in promoting carbon emissions trading and has already formulated the European Union Emission Trading Scheme. In accordance with the rules promulgated by the Commission, EU Member States set a cap on emissions for their own countries, determine industries and enterprises that are incorporated into the emission trading system, and allocate to these enterprises a certain number of emission

²⁰ The main contents of the EU's Green Paper on Energy Strategy, Retrieved from <https://www.docin.com/p-908050488.html>

permits - European Emission Units (EUAs). The European Union extensively promotes the carbon tax system. Firstly, The tax rate increases gradually. During the experimental stage, lower carbon tax rates are charged, and then are gradually increased to the expected level. Secondly, differential tax rates are charged. Different tax rates are charged according to the amount of carbon emissions and products' carbon content from different industries and departments²¹.

Professional financial organizations are the major investors of climate finance. EU member states have established a number of national carbon funds. Following *The Equator Principles*, commercial banks promote green credit, and provide financing services for low-carbon industry in terms of technology research and development, project cultivation and industry development. The EU carry out climate finance and promote low-carbon economy through different channels, such as national initiatives (funds and investment plans, etc.), guidance tools of public funds, green investment banks, public-private partnership (PPP), government guarantees and etc.²². In addition, EU countries have access to the Cohesion Fund, a financial instrument for implementing EU regional policies (known as cohesion policies). These funds are used for environmental, transportation and low-carbon energy projects in EU countries. The budget for the period of 2014-2020 shows that €351.8 billion were earmarked for the Cohesion Fund, accounting for about one third of the total EU budget.

2.2 The Practice Of Representative Countries On Climate Finance

2.2.1 United Kingdom

In 2012, the United Kingdom Department of Energy and Climate Change announced *The Energy Act*. The act proposed that the UK will invest heavily to support the development of low-carbon electricity, nuclear power, renewable energy and universal carbon capture and storage technology are the top priority. In the same year, the UK government invested £ 3 billion to establish the Green Investment Bank (hereinafter

²¹ Relevant policies and institutional arrangements for low-carbon economic development in EU countries.<http://www.docin.com/p-1720319435.html>

²² Yao Wang, Xin Wang (2013), Innovation of urban low-carbon financing tools in OECD countries and its implications for China. *International Finance Study*(8):36-37

referred as ‘GIB’). GIB is the world’s first government-owned investment bank that is dedicated to the greening of the economy. At present, the bank has supported approximately 100 green infrastructure projects in the UK, and raised more than £ 10 billion for green projects between 2013 and 2016. In 2015-2016, there were 30 new investment projects, with a total transaction value of £ 3.7 billion, income of £ 58 million, pre-tax profit of £ 9.9 million, and return on investment of 10%. By 2016, in terms of commitment by sector, offshore wind accounted for 60%, waste and bioenergy accounted for 23%, energy efficiency accounted for 11%, and onshore renewables accounted for the remaining 6%; in terms of commitment by product, unlevered equity accounted for 43%, levered equity accounted for 7%, debt accounted for 19%, fund accounted for 27%, and the remaining 4% existed in the form of managed account. In addition, for every pound it invests, the GIB attracts another three pounds from third-party capital.

The original intention of the GIB was to accelerate investment in green energy projects and transition to a green economy, rather than become a long-term owner of the project. In February 2016, the bank set up a subsidiary called Green Purposes Company to safeguard the ownership transfer of the GIB from the government to the private sector. To strengthen the support for low-carbon projects, the UK government sold the GIB to Macquarie, the world's largest infrastructure investor, for around £ 2.3 billion in August 2017. After the transaction, all taxpayer capitals (including the startup cost) and profits invested in the bank since its inception have been returned. According to Macquarie, GIB will remain its green objectives, brand, skills and experience. GIB has committed to invest at least 3 billion pounds over the next three years to support the green economy and continue to be one of the primary vehicles of renewable energy investment in the UK and Europe. In addition, Macquarie is committed to promoting the UK Climate Investment Plan, under which the GIB and the government will invest 200 million in pilot joint ventures, which aims at investing in renewable energy and energy efficiency projects in developing countries.²³

²³ Green Investment Bank annual report and accounts 2015-2016. Retrieved from: <https://www.gov.uk/government/organisations/uk-green-investment-bank>

2.2.2 Germany

Germany has put low-carbon economy as a key topic in its future development strategic plan. In June 2009, the Federal Ministry of Environment in Germany issued a strategic document emphasizing that low-carbon technology is the stabilizer of the German economy and also the key to future German economic revitalization. At the same time, Germany has the most complete legal system on low-carbon economy. Since the 1970s, the German government has established and developed a series of low-carbon economic laws. In 1971, Germany published the first comprehensive Environmental Programme. In 1972, Germany revised and passed *the Basic Law for the Federal Republic of Germany*, which gave the government more power in establishing environmental policy. In the same year, Germany enacted *the Waste Treatment Act*, which was amended to the *Waste Avoidance and Waste Management Act* in 1986. In 1996, Germany put forward a new Law on Circular Economy and Waste Management, and in 2002, *the Energy Saving Act*, which raised the level of reduction of fossil energy and waste disposal to the ideological level of developing a new economy, and established a complete legal system. In 2004, the German government issued National Sustainable Development Strategy Report, which specially formulated the "Fuel Strategy - Alternative Fuel and Innovation Driving Mode". Germany's "fuel strategy" aims to reduce fossil energy consumption and achieve greenhouse gas emission reduction. In the same year, *the Renewable Energy Act* was passed. The German government adopted and amended *the Renewable Energy Act* in 2004 and 2008, which guaranteed the status of renewable energy and made it develop rapidly.²⁴ Germany started preparations for emissions trading in 2002 and set up a special emissions trading office and has formed a relatively complete legal system and management system. Before implementation, Germany conducted a survey on machinery and equipment of all enterprises and used the results as the basis for emission rights. After being issued the emission permit, enterprises must purchase the emissions amount through the trading department, if their carbon emissions exceed the limit amount. Otherwise, they will be fined.

²⁴ Germany: the country with the most comprehensive legislation for low carbon economy, Retrieved from www.coalchem.org.cn

Germany encourages the development of green enterprises. Green energy enterprises creates €25 billion annual output and more than 250,000 jobs. One out of every three solar panels and one out of every two wind turbines in the world comes from Germany.

²⁵The Kreditanstalt Fuer Wiederaufbau (KfW) actively fulfills green development and is regarded to one of the most socially responsible national policy bank that grows with the federal government. Sustainable development is one of KfW's main business objectives. In 2018, KfW's environmental and climate protection project amounted to €30.3 billion, accounting for 40% of its total business volume. KfW finances the development of renewable energies, such as solar power, wind power, hydropower, and invests €10 million in environmental protection projects. Meanwhile, KfW also provides up to three years of non-repayment period. KfW and the German Federal Ministry of Economy have set up a special energy-saving fund for enterprises to receive professional energy-saving guidance and take energy-saving measures. At the same time, KfW provides low interest rates for loans to small and medium-sized enterprises to support enterprises to improve energy efficiency and reduce fixed costs. KfW signed *the Principle of Responsible Investment (PRI)* and has been actively investing in Green Bonds on a global scale since April 2015, which makes KfW more than the green bonds issuer. In May 2017, its portfolio had a target trading volume of €2 billion²⁶.

2.2.3 Japan

In 2006, The Ministry of Economy, Trade and Industry of Japan replanned the energy industry and promulgated the *New National Energy Strategy*, which specified six featured fields as the focus for new energy strategy, including diversification of energy consumption, reduction on oil dependence, and development of energy-saving technologies. In 2007, Japan issued the White Paper of the *21st Century Environmental Nation Strategy*, which clearly pointed out that Japan should overcome the environmental crisis and achieve sustainable social and economic development. Japan attached great importance to low-carbon development in 2008. In March 2008, the

²⁵ The annual output for new energy companies are over 25 billion euros. Gongdi Huan <http://finance.sina.com.cn/stock/t/20090814/02356615061.shtml?from=wap>

²⁶ KfW Official Website. Retrieved from: <https://www.kfw.de/kfw.de-2.html>

Ministry of Economy, Trade and Industry of Japan formulated and released the "Energy Innovative Technology Plan", specifying 21 innovative major technologies in the energy industry and the development roadmap of these technologies by 2050. In May, the Japanese government began to implement *the Low Carbon Technology Plan* to promote means and measures for technology innovation in environment and energy industry. In June, Yasuo Fukuda put forward a series of new measures to mitigate global warming, and *the Fukuda Blueprint* formed the formal symbol of Japan's low carbon strategy. Japan actively promotes multilateral or bilateral international cooperation plans with developed and developing countries, and promotes the infrastructure and result sharing of cutting-edge research.²⁷

At present, Japan has constructed a pyramid-shaped legal system for energy industry that is guided by the *Basic Energy Law*, centered by legislations in coal, oil, natural gas, electricity, rationalization of energy utilization, new energy utilization, atomic energy, etc, and supplemented by relevant departmental order for enforcement of the act.²⁸ Japan's energy legislation is complete and is timely amended according to the changes in domestic and international environment. In October 2008, Japan formally implemented the Domestic Emissions Trading System. According to the regulations, domestic enterprises can set their own total emission targets. If enterprises can keep their emissions under the emission targets, they can sell the remaining part as emission rights, while those enterprises that fail to meet the emission targets must buy permits from others.

Japan is committed to climate financing, energy conservation and emission reduction through increasing budget, PPP projects and securities funds. The fiscal policy is one of the important policies in promoting carbon emission reduction in Japan. In 2000, the Japanese government invested US\$622 million in research and development for energy-saving technology, ranking first among all the member countries of the International Energy Agency (IEA). Agency for Natural Resources and Energy in

²⁷ The Enlightenment of Japan's Low Carbon Economy on China's Development of Energy Saving Industry, Contemporary Economic Management. Retrieved from :<http://news.bjx.com.cn/html/20140226/493104.shtml>

²⁸ Haisong Chen, Japan's Energy Legislation and Implementation, Foreign Issues Research, No. 2, 2009: 23-26

Japan spends more than 40% of its total budget in energy conservation and emission reduction every year. In the budget for fiscal year 2009, the budget for the R&D of environmental energy technology was made separately and amounted to 10 billion yen. In the budget for fiscal year 2010, a new budget with the amount of 2.5 billion yen was added for the R&D of cutting-edge low-carbon technologies. In addition, to promote emission reduction, Japan has subsidized in many ways. For example, Agency for Natural Resources and Energy in Japan will distribute more than 50% of the special budget funds for energy conservation and emission reduction through subsidies, which are mainly used to subsidize households and enterprises for purchasing energy-saving equipment. Companies can get subsidies for purchasing advanced energy equipments with the amount equal to 1/3 of the price²⁹.

Japan fully utilizes and actively innovates the model of Public Private Partnership (PPP) to promote low-carbon economic development. In 2013, Japan revised the *Private Finance Initiative Act* to allow the establishment of a 10 billion yen PPP infrastructure fund to assist projects with high market risk, including aging infrastructure, disaster prevention, climate mitigation and so on. After assessing the cost of financing for different waste incineration power plants, Yokosui City of Japan has chosen the design-build-operation (DBO) PPP mode. Through bidding, it has signed 20 years' operation contracts and management contracts with the private consortium, with the amount of 8.267 billion yen and 7.07 billion yen, respectively. The municipal government used "special bonds of municipal consolidation" to raise funds for the construction of power plants. The national government undertook around 70% of the capital and interest of the bonds, and set up subsidy program for such circular economy investment. More than three-quarters of capital expenditure on projects is ultimately paid directly or indirectly by the national government. The DBO model has now become a standard model for such projects in Japan. Japan's low-carbon environmental protection PPP projects, such as public energy facilities, water resources, and waste to energy conversion, have attracted large amount of money.

²⁹ The Enlightenment of Japan's Low Carbon Economy on China's Development of Energy Saving Industry, Contemporary Economic Management. Retrieved from :<http://news.bjx.com.cn/html/20140226/493104.shtml>

The Tokyo Stock Exchange has launched infrastructure fund market for listing funds focused on renewable energy and franchise projects. The industry has attracted more than 140 trillion yen in government pension investment funds from insurance companies and investment managers. In 2003, The Green Fund was established to facilitate the financing of clean energy projects and address the challenges of high up-front capital costs for development and construction stages of the projects. Managed by the Green Finance Organization (GFO), the fund is capitalized by the revenue of tax for Climate Change Mitigation, a tax levied on fossil fuel consumption since 2012. The Green Fund is committed to attracting further capital from private sources through equity and mezzanine investments. Equity investments are limited to less than 50% of the total amount; a sub-fund can also be created to aggregate equity investments from GFO and other sponsors before project funds are available. Since inception in 2013 and through March 2017, GFO has, through the Green Fund, invested 110 million US dollars in projects with a total value of more than 900 million US dollars, achieving a private source leverage ratio of over 10:1. The projects are expected to reduce nearly 1 million tons of carbon dioxide every year.

2.2.4 USA

Several U.S. governments have adopted negative internationally and positive domestically low-carbon strategies; they refuse to sign the protocol or assume the responsibility of reducing emissions in international society while developing low-carbon economy and technology in the U.S.. In March 2001, the U.S. Government represented by Bush unilaterally retreated from the Kyoto Protocol. However, the U.S. is well aware of the important role of low-carbon technology in future world competition. In June 2002, the U.S. Environmental Protection Agency released the Climate Change Report 2002. Through legislation, the U.S. has set up many economic incentives clauses to encourage ordinary consumers and small and medium-sized enterprises to implement low-carbon development. The Obama administration has put forward many ideas to achieve a double win of climate protection and economic development, and has played a big role in clean energy cooperation. However, the 4% emission reduction target greatly limited the effectiveness of Copenhagen Accord. The

Republican government, led by Trump, was unwilling to assume responsibility for greenhouse gas emissions reduction. It rejected *U.S. Clean Energy Security Act* introduced by the Obama administration in 2009, cancelled the Climate Change Action and retreated from the Paris Agreement. However, under circumstances of stable policies, technological progress, mature markets and consensus reached by the international community, the low-carbon energy in the U.S. will continue to develop.

The U.S. enacted many laws to deal with climate change, The Power Plant and Industrial Fuel Use Act and the Public Utilities Management Policy Act were passed in 1978; the Clean Air Act was implemented in 1990; the Energy Policy Act was promulgated in 1992; the Energy Policy Act was passed in 2005, involving incentives of government up to \$14.5 billion; and in July 2007, the U.S. Senate proposed the Low Carbon Economy Act. On June 26, 2009, the House of Representatives passed the first bill in the history of the US to limit greenhouse gas emissions, the Clean Energy Security Act of the US. In February 2009, the US formally introduced the American Recovery and Reinvestment Act, with a total investment of 787 billion USD, mainly for the development and utilization of new energy, including high efficiency batteries, smart grids, carbon storage, renewable energy (wind and solar energy) and so on³⁰.

Compared with the wobble of the federal government's attitude, state governments in the U.S. are more motivated to reduce emissions. At present, more than 40 states have implemented greenhouse gas emission reduction regulations, and more than 20 states have introduced policies and measures to encourage the development of renewable resources. According to the International Institute for Sustainable Development (IISD), the U.S. has adopted a number of low-carbon incentives, including guarantees for green loans and tax relief for green bonds, to promote low-carbon economic development.

The voluntary reduction of carbon emissions market is growing rapidly in the United States. In 2003, the Chicago Climate Exchange (CCX), which independent of government agencies began operations, the cap-and-trade system they established is voluntary take part in but legally binding. The U.S. Regional Greenhouse Gas

³⁰ Trump is difficult to resist green low carbon transformation of energy. Retrieved from: http://www.sohu.com/a/132088540_418320

Voluntary Reduction Program (RGGI) began operations in 2008, for regulating thermal power generating units with a capacity of more than 250,000 kilowatts. In the United States, the diversification of carbon institutions, such as traders, investment and financing institutions, third-party registration agencies, and the diversification of carbon market trading products, such as spot, futures, and options, contribute to the development and maturity of the U.S. carbon market.

Governments also encourage private or non-profit organizations to provide green residential facilities for low-income families through various preferential policies. The Energy Efficiency and Renewable Energy Office of the U.S. Department of Energy has launched a variety of green incentives. The Office has established a “Public Welfare Fund Program” to provide funding for developers, consumers, technology developers, and even state and local governments, to promote the demonstration projects of renewable energy and new technologies Green Guarantee Housing construction development. At present, public welfare funds have been established in 25 states, reaching \$1.2 billion in 2015. Controlling carbon dioxide emissions to achieve carbon offsets trading has developed rapidly in the green indemnificatory housing construction industry. According to statistics from the “Point Carbon” consulting company, there are currently 600 emission reduction projects operated by hundreds of construction companies in the United States.

The U.S. government actively promotes the development of green building industry. There are two main sources of funding: First is Government’s financial allocation for the “Low-income Housing Tax Rebate Policy” program, the federal government allocates tax deduction ceilings to states each year. The construction developer of the Green Guarantee Housing can receive a direct deduction of income tax every year for 10 years. The developer could sell the income tax deduction amount to the investment institution, such as banks, for financing. Second is Green Fund for Energy Saving Public Welfare. Federal Housing and Urban Development Department is responsible for the start-up funding for the Green Guarantee Housing Project, and they provides public housing trading funds and public housing capital funds each year. The trading fund is used for management, operation, daily maintenance and other expenses on

public housing projects; public housing capital funds are used to improve public housing conditions, including development, refurbishment, and demolishing of damaged homes. The fund can be combined with the “Low Income Residential Tax Rebate Policy” program, energy trust etc, so that the total financial subsidies covers the vast majority of the total cost of the project³¹.

The U.S. commercial banks have achieved remarkable results in climate finance practices. In October 2002, Citibank led the Dutch bank, Barclays Bank, and West Germany Bank to reach a consensus and drafted a voluntary financial industry benchmark for environmental and social risk management in project financing, these four banks became founding members of the Equator Principles. 2007-2013, Citibank directly invests US\$50 billion in global climate governance projects. In 2008, the Bank of America and other financial institutions work together to develop carbon principles in collaboration with public facility customers and environmental organizations. The carbon principle is recognized as the best investment decision standard for evaluating new power plant construction projects and analyzing long-term carbon costs. JPMorgan Chase has established a global environmental and social risk management team consisting of experienced experts.

In addition, during the period 2011-2014, green banks such as Connecticut Green Bank, New York Green Bank, Green Energy Market Securitization Agency(Hawaii Green Infrastructure Authority), New Jersey Energy Restoration Bank, or energy financial institutions were established to promote climate financing. New York Green Bank's main sources of funding are Carbon Emissions Trading System revenue, Utilities Surcharge, Renewable Portfolio Standards and Energy-Efficiency Regulations, etc. In contrast to the New York Green Bank, besides the above sources of funding, the Connecticut Green Bank's funding sources include loans; Green Energy Market Securitization Agency(Hawaii Green Infrastructure Authority) 's funding sources include Bond issuance; New Jersey Energy Restoration Bank receives funding from the National Government

³¹ Dr. John Grace (2019). Sustainable Development of Green Affordable housing in the United States (iii) -- GAH financing support system in the United States. China building metal structure, (3):40-41

2.2.5 India

India is more vulnerable to climate change than many other countries, especially in agricultural production and food security. India is ranked as the seventh most vulnerable country to climate change in the 2018 Global Climate Risk Index. Most of India's agricultural production is dominated by small farmers, agricultural and rural infrastructure is relatively weak and highly dependent on climate. Then the Indian government has been actively involved in addressing global climate change and signed the Kyoto Protocol to the United Nations Framework Convention on Climate Change. In 2030, it plans to reduce its carbon dioxide emission intensity by 33% to 35% in 2005, and plans to expand its total renewable energy capacity to 175 GW by 2022.

India issued the "11th Five-Year Plan for New Energy and Renewable Energy" in April 2008, and joined the National Action Plan for Climate Change in June of the same year, officially launching Mumbai's Carbon credit futures trading, which related to the Chicago carbon trading market. Since 2010, in order to reduce carbon emissions and encourage people to use clean energy, the Indian government has begun to levy coal use tax and impose a strict "renewable energy trading system." At the 23rd Meeting of the Parties in Bonn, Germany, in November 2017, the Government of India actively demonstrated its support for the development of people's livelihood through climate finance and the implementation of rural climate change strategies.

Base on the Climate Investment Fund data, India has a huge climate financing requirement of more than \$1 trillion between 2015 and 2030. National Bank for Agriculture and Rural Development (NABARD) as a policy bank has taken a series of measures in addressing the challenges posed by climate change, particularly in the areas of agriculture and rural livelihoods, and NABARD has made great efforts to integrate all national and international organizations to provide financial support and intellectual support for the Indian government to address climate change. **Firstly**, according to the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), by December 2022, NABARD was accredited by the Board of Directors to be responsible for three important funding arrangements as a National Enforcement Entity (NIE). **Secondly**, more than 28% of NABARD's projects are related to climate

finance, such as NABARD's forestry, agriculture, animal husbandry, land development, small-scale irrigation, biogas digesters, rural energy management (water pump replacement, high voltage direct current, etc.). These projects have renewable energy, energy efficiency and carbon dioxide emission reduction characteristics. In addition, NABARD's projects such as agricultural mechanization, collaborative teamwork, warehousing and market construction have a certain relationship with climate change adaptation. **Thirdly**, NABARD has signed an Accreditation Master Agreement (AMA) with the Global Climate Fund to facilitate the operation of financing arrangements between NABARD and the Global Climate Fund. Currently, NABARD can use the financial resources of the Global Climate Fund to promote climate adaptation development in India. **Fourthly**, NABARD pioneered the establishment of the Climate Change Centre at the Banker Rural Development Institute (Lucknow) to create a "state-of-the-art climate change training centre" that provides climate change adaptation strategies, climate finance training, advising services and policy advocacy to all climate change participants; improving the ability of the whole society to cope with climate change, and focusing on guiding climate financing. The training centre was funded by the German Agency for International Cooperation (GIZ) and established the Climate Change Knowledge Pavilion at the Banker Rural Development Institute (Lucknow) Climate Change Centre.

2.2.6 Climate finance practice in other countries

Brazil has developed a path to build sustainable development banks through a combination of voluntary and coercive methods. The voluntary green agreement reached by the Brazilian Banking Federation was adopted by the top five state-owned banks in Brazil in 2008 and subsequently adopted by commercial banks in 2009. In 2014, the Central Bank of Brazil (BCB) issued a mandatory decision 4327 on social and environmental responsibility for financial institutions. A 2013 study estimated that 11% of the Brazilian banking system's loans flow to "new energy" and low-carbon agriculture fields.

Indonesia Financial Services Authority launched a sustainable financial roadmap in December 2014. The roadmap encourages the financial industry to contribute in two

ways, including supporting countries' commitment to climate change and transition to low-carbon economy. Indonesia is designing a protection policy that will provide practical guidance for Indonesia to build a green financial system.

In April 2016, the Mexican Banking Association (ABM) officially signed the “Sustainability Agreement” to launch a voluntary industry approach that is consistent with national development strategies and the government climate change targets for the next 15 years. The Sustainability Agreement provide guidance on risk management and sustainable lending for the financial system.

Turkish sustainable banks follow a market-oriented method in accordance with national and international principles 。 In 2014, the Turkish Banking Association issued a voluntary banking sustainability guideline to the banking sector, which was jointly prepared by the Turkish Banking Association's Sustainable Growth Working Group and 18 other banks.

3. The development of climate finance in China

3.1 China's policies, mechanisms and effects in addressing climate change

The Chinese government attaches great importance to addressing climate change. Internationally, China unswervingly promotes the comprehensive and effective implementation of the UNFCCC and the Paris Agreement, unswervingly promotes the multilateral system in the field of climate change, and fully promotes the implementation of the Paris Agreement by the member states of the world for 2020. In the future, global cooperation will lay a good foundation for addressing climate change. Domestically, China adopted a strategy of equal emphasis on mitigation and adaption. In March 2018, the Chinese government transferred the role of climate change to the newly formed Ministry of Ecology and Environment, further enhanced the synergy between climate change and environmental pollution prevention, and strengthened the comprehensively environmental protection.

In May 2018, President Xi Jinping emphasized at the National Environmental

Protection Conference that it is necessary to implement a national strategy to actively address climate change, promote and guide the establishment of a fair, rational, cooperative and win-win global climate governance system, showing the character of a great power of responsible and promoting a community with a shared future for mankind. In August 2018, the State Council adjusted the units and personnel of the leading group on climate change and energy conservation and emission reduction. The leading group is headed by the Premier of the State Council, and the members include almost all ministries. Through this coordinating body, in the future work to address climate change, we will make better use of multi-sectoral synergies, achieve high-quality national long-term goals in the field of climate change.

In recent years, the Chinese government has made positive progress in mitigating climate change, adapting to climate change, improving institutional mechanisms, strengthening ability building, and raising social awareness.

In the field of agricultural production, China continues to implement the action of “Zero Fertilizer and Zero Use of Pesticides by 2020”.

By the end of 2017, China's fertilizer utilization rate on rice, corn and wheat crops was 37.8%, an increase of 2.6 percentage points over 2015, and the use of chemical fertilizers and pesticides achieved zero growth ahead of schedule.

The greenhouse gas emissions of livestock and poultry were controlled, the comprehensive utilization rate of livestock and poultry manure reached 70%, and the comprehensive utilization rate of straw in the country exceeded 82%. The rural biogas construction continued to be actively supported, and the transformation and upgrading of rural biogas was promoted. The number of household biogas in the country reached 41 million. The annual output of biogas reaches 14.083 billion cubic meters.

In the field of forest increase, China has actively promoted the protection of natural forest resources, returning farmland to forests and grasslands, sand control, comprehensive control of rocky desertification, construction of forestry key systems in the Three North and Yangtze River basins, and innovation to promote. Planting trees and carrying out large-scale land greening activities.

By the end of 2017, China had completed a total afforestation area of 7,680,700 hectares

(115 million mu) and completed a forest-raising area of 8,856,400 hectares (133 million mu), making it the country with the largest increase in global forest resources during the same period;

The area of natural forest management and protection has been increased by 200 million mu, and the consumption of forest resources has been reduced by 34 million cubic meters annually. In the field of increasing grassland carbon sinks, China has actively strengthened the construction of grassland ecological protection, implemented major grassland ecological restoration projects such as pastureland rehabilitation (returning pastureland to farmland) and grassland management in southwest karst areas, and improving grassland ecological environment.

By the end of 2017, the state had invested 18.76 billion yuan as a supplementary fund for grassland ecological protection. The funds were used to implement the grazing prohibited area of 1.206 billion mu and the grass and livestock was 2.605 billion mu. In 2017, the national grassland comprehensive vegetation coverage reached to 55.3%, an increase of 0.7 percentage points over the previous year; the total output of natural fresh grass was 1.065 billion tons, an increase of 2.53% over the previous year. China has actively strengthened the prevention and control of desertification. In 2017, the Beijing-Tianjin sand control and rocky desertification comprehensive treatment project protected a forest area of 460,600 hectares, completed the sand area control project of 0.67 million hectares, and controlled the rocky desertification land of 3,300 square kilometers.

According to the latest monitoring results, both national desertification and desertification area are reduced, and not only the vegetation coverage, but carbon sink capacity in the sand area is increased.

At the same time, China has actively carried out the protection of wetlands. In 2017, China achieved 300,000 mu of returning farmland to wetlands; started the certification of international wetland cities, and nominate 6 candidate cities to the Convention on Wetlands of International Importance Especially as Waterfowl Habitat newly designated 8 Wetlands for inclusion in a list of Wetlands of International Importance with a total of 57; The number of national wetland parks was increased by 65, and the

total number of wetland parks nationwide reached 8,98; the national wetland protection rate increased to 49.03%, and the ecological status of wetlands improved significantly. According to data released by the Ministry of Ecology and Environment, in 2017, China's carbon intensity decreased by about 46% compared with 2005, and exceeded the 2020 carbon emission target. The rapid growth of carbon emissions has been controlled; non-fossil energy accounts for 13.8% of primary energy consumption, and the task of afforestation and forest protection continues to advance, and the country's ability to adapt to climate change continues to increase.

3.2 China's financial policy to address climate issues

China's outstanding achievements in addressing climate change, reducing carbon intensity and increasing forest stock volume are inseparable from the support and synergy of the financial system. In accordance with the strategic arrangements and policy requirements of the national response to climate change, various relevant functional departments have issued a series of policy measures to strengthen financial support to address climate change.

Firstly, in July 2007, the People's Bank of China, the National Environmental Protection Agency and the China Banking and Insurance Regulatory Commission jointly issued the "Opinions on Implementing Environmental Protection Policies and Regulations to Prevent Credit Risks". The opinion requires banks to classify loans according to national industrial policies; Credit support is not allowed for projects that fail Environmental Impact Assessment or environmental facility acceptance; Strictly restrict working capital loans to enterprises that violate pollution discharge.

Secondly, in Nov.2007,the China Banking and Insurance Regulatory Commission issued "Guidance on energy saving and emission reduction credit", the Guidance requires all banking institutions must fully understand the importance of financial services in energy conservation and environmental protection; enhancing social responsibility, consciously improve and strengthen financial services in the field of energy conservation and environmental protection, reasonable control of total credit, optimize credit structure, promoting the coordination and sustainable development of

economy and finance. Further clarify the new requirements of “Three supports”, “Three non-supports” and “One Innovation”. Three supports means banking institutions should support energy conservation and emission reduction projects listed as national priorities; support energy saving and emission reduction projects supported by finance and taxation; enterprises and projects in areas with significant energy conservation and emission reductions are given priority support under the same conditions. Three non-supports means banking institutions do not support new projects listed in the national industrial policy restrictions and elimination categories, Enterprises and projects with prominent energy consumption and pollution problems and inadequate rectification are not supported, projects classified as backward capacity are not supported. One Innovation means encouraging banks to develop credit innovation for energy conservation and emission reduction.

Thirdly, the China Banking and Insurance Regulatory Commission (CBIRC) has successively issued documents including the *Notification on Issuing Green Credit Guide*, *Opinions on Green Credit*, *Notification on Delivering Green Credit Statistical Tables*, and *Regulations of Banking Financial Institutions for Green Credit Assessment* since 2012, establishing a set of relatively sophisticated green credit system³². As the programmatic document for Chinese financial institutions to carry out green credit, the *Green Credit Guide* stipulates specific requirements on the scope, organization management, policy system and capacity building, process management, internal control management and information disclosure, and supervision and inspection.

Fourthly, in August 2016, the People’s Bank of China, Ministry of Finance, NDRC, Ministry of Ecology and Environment, CBIRC, and CSRC jointly issued the *Opinions on the Establishment of Green Finance System* as the top level design for establishing China’s green finance system, explicitly specifying that the establishment and improvement of green financial system need the support from the policies, laws and regulations related to banking, finance, and environmental protection as well as appropriate incentive and restraint mechanism to solve environmental externality issues.

³² Guo Feng (2018), *Green Finance Research Report*, Rural Financial Development Institute of Agricultural Development Bank of China.

Fifthly, in 2017 the People’s Bank of China, CBIRC, CSRC, and Standardization Administration jointly released the *Construction and Development Planning for the Financial Industry Standardization System (2016-2020)*, emphasizing green finance as the priority of the financial industry standardization, establishing the standards for green financial products such as green bonds, green industry funds, and catastrophe risk securitization, and researching exchange and sharing standards for financial information and statistical data so as to support the supervision and assessment for the application of green financial funds.

On December 11, 2018, “China Pavilion” held a forum named “China’s Climate Investment and Financing” during the 2018 UN Climate Change Conference held at Poland-based Katowice, introducing China’s role in giving full play to the leverage and support from investment and financing for climate campaigns and demonstrating the significance of financial system support and synergism for such climate campaign progresses. So far, China’s Ministry of Ecology and Environment and relevant functional departments have been actively carrying out climate investment and financing to enhance China’s financial system and climate change and introduce more funds to cope with climate changes by innovating the financial mechanisms and business such as low carbon credit, carbon finance, climate bonds, climate insurance, and climate funds.

Feature: Xiong’an New Area – A City of Green Finance

Xiong’an New Area was established to take all Beijing’s functions which unrelated to its status as national capital. Since its establishment in April 2017 according to the policies of Chinese, government, it has been sparing no efforts to become a smart city, a digital city and a green city based on the overall requirement of “establishing scientific and rational construction plan, proposing new era cityscape planning, creating beautiful natural and ecological environment, developing premium high-tech industries, providing high-quality shared public services, making convenient and efficient traffic networks, building up green and smart city, establishing modern urban security system, and ensuring effective planning implementation”. According to the overall planning,

the ratio of green and water space will reach a level above 70% and the area of green forests will reach about 666.66km². The *Planning for the Ecological Environment Management and Protection of Baiyangdian (2018 - 2035)*, issued in 2019, has made comprehensive planning and overall design in terms of ecospace building, ecological water utilization guarantee, comprehensive protection and pollution prevention of river basin, water pollution control, ecological restoration, ecological protection and utilization, and ecological environment management innovations so as to make the area a place with low carbon and green ecosystem. In accordance with the *Green Finance Planning Report of Xiong'an New Area*, published by an authoritative research institution, the total green investment required by Xiong'an for the upcoming five years will be as high as RMB 1,000 billion. Currently, various financial institutions have made plans and competed to settle in the area to facilitate the development here. These institutions include policy-based financial institutions such as the Agricultural Development Bank of China, China Development Bank as well as commercial banks including ICBC, ABC, BOC, CCB, China CITIC Bank, China Everbright Bank, and Bank of Beijing; three security companies including Essence Securities and Changjiang Securities and 14 insurance companies including China Life, Sunshine Insurance, and PICC Pension have settled in the area, forming a diversified financial network with various and multiple services.

3.3 Typical Cases of Domestic Climate Finance

According to the estimation made by the National Center for Climate Change Strategy and International Cooperation (NCSC)³³, China's total funds for addressing climate changes reach to RMB 2,400 billion annually. However, the annual average financing gap is still as high as RMB 1,300 billion by comparing with RMB 3,700 billion, the annual funds required for climate changes during 2019 – 2030, and the gap will be solved through financial measures. The main measure of supporting climate change is

³³ The National Center for Climate Change Strategy and International Cooperation (NCSC) is not only a department-level unit directly under the Ministry of Ecology and Environment but also a national strategy research institute and a window for international cooperation and exchanges for China to cope with climate changes.

green finance for all finance institutions. The green credit scale of China's 21 major banks³⁴ had exceeded RMB 9,000 billion last year.

3.3.1 Credit support modes

Based on the risks and characteristics of climate financing, various financial institutions have been making innovations and improving guarantee modes by “enhancing the risk prevention and control ability for credit assets” and “obtaining external risk compensations” to control risks and solve the dilemma of high risks due to a little collateral for climate financing

Case 1: Green innovation investment project of Bank of Jiangsu

The Bank of Jiangsu has established the “green innovation investment” project jointly with China Clean Development Mechanism Fund and the Department of Finance of Jiangsu Province. The phase-one investment scale is about RMB 10 billion for supporting the industrial activities in favor of generating benefits for coping with climate changes in the province, including the projects such as renewable energy sources, new energy, energy conservation and emission reduction products, centralized heating, combined heat and power generation (CHP), and utilization of waste heat and pressure. Based on the project arrangement, the Clean Development Mechanism Fund (CDMF) will allocate preferential funds, the Department of Finance of Jiangsu Province will provide financial discounts, and the Bank of Jiangsu will perform market-oriented operation and assume project risks by means of credit (ordinary loans).

The project is a typical bank-government cooperation risk compensation fund mode. The CDMF provides equity capital as internal credit enhancement support, the Government of Jiangsu Province provides discounts to reduce financial pressure and lower the credit risks of any single project, and the Bank of Jiangsu assists enterprises to perform fund management well by providing professional financial services. The three parties cooperate to enhance green industry development.

³⁴ The 21 banks are China Development Bank, Export-Import Bank of China, Agricultural Development Bank of China, Industrial and Commercial Bank of China, Agricultural Bank of China, Bank of China, China Construction Bank, Bank of Communications, China CITIC Bank, China Everbright Bank, Huaxia Bank, Guangdong Development Bank, Ping An Bank, China Merchants Bank, Shanghai Pudong Development Bank, Industrial Bank, China Minsheng Bank, Hengfeng Bank, China Zheshang Bank, China Bohai Bank, and Postal Savings Bank of China.

Case 2: CDM subsidized loan of Bank of Beijing

The Inner Mongolia-based Chahanmiao Phase I 49.5MW wind power project is a UN CDM Executive Council registered clean energy power project. The Bank of Beijing made the income from CDM transaction and power generation as the sources for repayment, providing a loan of RMB 300 million for the project to purchase wind power generators. After the project is put into operation, the annual emission reduction of greenhouse gas, such as carbon dioxide, is about 86,900 tons. The project also received corresponding subsidy.

Compared with the risk compensation fund mode of Case 1, this mode is relatively weak in risk compensation. This loan mode mainly relies on CDM income as the source of interest payment, but it has no explicit pledge. However, in most registered CDM projects, the borrowers are large state-owned enterprises with good credit and government support, the actual risks of these projects are relatively low.

Case 3: Carbon emission quota pledge loan of Industrial Bank

In 2014, Hubei Provincial departments, such as Development and Reform Commission, issued 4 million tons of carbon emission quotas to Hubei Yihua Group and its subsidiaries. The market value of the quotas was worth RMB 80 million. Industrial Bank Wuhan Branch, Hubei Provincial Development and Reform Commission and China Hubei Emission Exchange designed and processed the operation procedures related to carbon quota pledge loan mode, designed the carbon quota asset risk management and value assessment model, and evaluated the values of pledged goods. As a result, Yihua Group obtained a loan of RMB 40 million from Industrial Bank by pledging its carbon emission quotas.

It can be found that, carbon quota is an intangible asset because of government subsidy, and its own value can be realized through carbon trading. There are many similarities between carbon quota pledge loans and the three major futures exchanges' standard warehouse receipt pledge loans in terms of business process and risk features. The main risks are the price risk and the wrong-way risk of pledged goods (carbon quota). Carbon quota price generally has positive correlation with macro economic growth rate and negative correlation with industrial enterprise default rate; the higher the default rate is,

the lower the value of the pledged goods will be. Carbon quota loan mode requires excellent management ability of pledged goods.

Case 4: Timber mortgage loan of Bank of Guiyang

The plantation of yellow sandalwood is one of pillar industries for Guizhou-based Luodian County. In order to solve the issue of credit risks for traditional forestry, the county conducted single tree immovable property registration for *Dalbergia odorifera* and Guizhou Qianlang Commodity Trading Center (associated company for planters) established the trading platform. After making the down payment for purchasing standing forest at the center, a timber buyer may apply for “Easy green credit” at the Bank of Guiyang by pledging the property right of the purchased standing forest products.

The project and conventional forest tenure pledge loans have several differences. The borrower of conventional loans is usually a single enterprise, and the pledge is the whole forest farm with higher risk concentration. The borrowers of the mortgage loan are usually several customers, and the pledges are relatively disperse trees with lower risk concentration. The relationship between the two kinds of loans is similar to that between real estate enterprise loan and housing mortgage loan. By enhancing the credit support for the buyer of woods, the buyer may make earlier payment, alleviating the cash flow pressure of the woods planter. In addition, the risks of conventional business concentrated in the planter can be dispersed by several buyers, reducing the bank’s own risks.

The above four cases represent four typical innovation guarantee modes in the field of climate financing. The dependency on government credit support weakens gradually and the credit scale reduces gradually, while the management difficulty and the interest rate pricing increase step by step.

3.3.2 Fund supporting modes

The number of asset management companies specializing in low carbon projects has been increasing since 2009. Many industrial investment funds or private equity investment funds attach great importance to the business opportunity in the low carbon field. At the same time, various international commercial banks have carried out

diversified fund businesses and innovative products related to climate financing, after identifying the opportunities in climate finance. For example, some commercial banks have established carbon funds to invest directly or indirectly in emission reduction projects and developed carbon emission reduction and carbon trading businesses, such as carbon emission reduction upgrading, carbon trading collection and payment, index-based carbon trading products, and specialized intermediary services. By the end of 2016, 265 green funds has been registered with the Asset Management Association of China, and 121 of which were established in 2016. Among all the registered green funds, green industry funds and clean energy industry funds account for 83% and 51% respectively. ³⁵

Currently, most green industry projects in China are still in the initial development stage and have higher risks than traditional well-established industries, having a big gap with the requirements of financing channels. Green industry funds maintain the overall profit of the asset pools by diversifying equity investment and mezzanine investment and used the high yields from successful projects as risk compensation . Bankss provide financial support for green industries by extending overall credit (including the provision of leverage funds or the subscription of preferred fund in the form of loans) to industry funds.

Case 1: Clean Development Mechanism Fund (CDMF)

As the first national-level fund to cope with climate changes in China and developing countries, CDMF is an important achievement in China for the international cooperation of climate change . Since its official operation in 2010, the fund has been carrying out various businesses through grants and paid use,. **First**, grants can support activities that enhance the capacity building to cope with climate changes and improve general public awareness of climate changes. By December 31, 2015, a cumulative of 1.125 billion RMB grants had been paid to support 552 projects, involving researches for coping with climate changes and low carbon development policy, capacity building and publicity at national and regional level, including carbon market mechanism

³⁵ Liu Qian and Cui Ying (2018), 2017 China Climate Financing Report, China Financial Publishing House

research and pilots. **Second**, paid uses can support industrial activities to positively impact climate change. Based on the development directions of emerging strategic industries encouraged and supported by China, the paid uses of CDMF prioritize those low carbon projects with extensive application prospects, representative industries, and high technical maturity. CDMF encourages and supports the development and application of low carbon technology, improves the marketization and industrialization of low carbon technology, and promotes local economic restructuring and upgrading. Moreover, CDMF also facilitates the development of emerging industries. So far, 210 projects, from 25 provinces (including municipalities and autonomous regions), have been approved. Total loans account to RMB 13.036 billion, and RMB 64.043 billion have been used as social funds³⁶.

Case 2: Comprehensive industry fund with government background (Government guidance fund)

The mode is mainly used for supporting capital-intensive green enterprises with certain market basis and profitability, such as various renewable energy power generation companies, new energy automobiles enterprises, and sewage treatment firms. The Yangtze River Industry Fund of Hubei Province is a typical representative of such mode. As a leverage fund, it has an initial scale of RMB 200 billion. RMB 40 billion is invested by Hubei Provincial Government as inferior equities, and the rest RMB 160 billion is contributed by 40 companies, including China Development Bank Capital and ICBC Credit Suisse, as preferred shares.

Case 3: Credit extension for industry funds with special enterprise background

As an innovative agricultural investment and financing platform funded by Beijing Municipal Government and established by Beijing Capital Group, Beijing Agricultural Investment Co., Ltd specializes in investment and operates several funds. Its parent company, Beijing Capital Group, is a large state-owned enterprise affiliated to the State-owned Assets Supervision and Administration Commission of People's Government of Beijing Municipality, and its main businesses are environmental protection and water

³⁶ Source of data: Official website of CDMF <http://www.cdmfund.org/zh/gywm/index.jhtml>

industries. ADBC Beijing Branch signed a strategic cooperation agreement with Beijing Agricultural Investment Co., Ltd in 2018. The bank and the company carried out strategic investment cooperation by relying on the key construction fund of ADBC. The maximum RMB 10 billion credit extension is provided for the capital demands, such as domestic and foreign currency loans, discounts, trade financing, bank acceptances bills, letters of credit, and letters of guarantee.

3.3.3 Security support modes

On February 28, 2008, the *Opinion on Enhancing the Environmental Protection Supervision of Listed Companies* was issued by the Ministry of Ecology and Environment of the People's Republic of China, marking the establishment of China's green security system³⁷. According to the remarks made by the President of the Securities Association of China, Chen Gongyan,, at the inauguration ceremony of SAC Green Securities Committee & China Green Securities Summit Forum, green securities are the most potential green financing mode among China's current financial system. It's significant to increase the proportion of direct financing in green finance, boost the ability of green finance for serving the real economy, and improve sustainable economic development by developing green securities.

In recent years, Chinese bond market has issued a series of reform measures, and the policy environment has been increasingly tolerant, which provides a driving forces for the development of climate finance. The rapid development of international green bonds provides many references and experiences for developing Chinese climate bonds (climate bonds are green bonds certified by the Climate Bonds Initiative³⁸) As the largest issuer of green bonds worldwide, China issued green bonds as high as RMB 248.314 billion in 2017, accounting for 32% of all the bonds issued globally³⁹. The People's Bank of China took the lead in issuing green financial bonds in the inter-bank bond market in December 2015. The development of Chinese green bonds and climate bonds has presents diversification of issuers and investors because various financial

³⁷ Ma Xianfeng and Wang Junxian (2016) Enhancing the Establishment of Green Securities System Providing Services for Ecological Civilization Construction <http://www.csrc.gov.cn/pub/newsite/yjzx/yjbg/201602/P020160203526185782550.pdf>

³⁸ Li Lan, When Chinese-Funded Banks Encounter "Climate Bonds" [N], Financial News, Nov 27th, 2017

³⁹ Liu Qian and Cui Ying (2018), 2017 China Climate Financing Report, China Financial Publishing House

institutions, non-financial institutions, and overseas institutions are allowed to issue climate bonds in the bond market for raising funds. Nevertheless,, the mode of “issuance by corporations and underwriting by banks” also exists in China’s current green financial bond market.

Case: Combination of carbon asset and bond rate

In May 2014, CGNPC issued the China’s first green bond. When determining the nominal interest rate of the bond, the carbon emission reduction benefits from five wind power generation projects were innovatively converted to corresponding bond yields. As a result, the coupon rate was determined with the way “fixed rate + floating rate” by combining carbon assets and bond rate. Shanghai Pudong Development Bank and China Development Bank were the main underwriters and co-underwriters of the green bonds. The bonds were sold to inter-bank market institutional investors, and the shares sold were trusted as per the regulations of China Central Depository & Clearing Co., Ltd. Finally both the registered and issued scale of the green bond reached to RMB 1 billion⁴⁰. As the first green bonds of China, CGNPC green bond guided the shift of China’s green enterprises from indirect financing to direct financing to a certain extent.

3.3.4 Insurance support modes

Climate insurance is not only the most important risk mitigation tool but also an enormous opportunity for insurance institutions. Besides providing insurance products for the climate change field, insurance institutions can provide professional risk contingency plans and countermeasures for demanders by using their expertise in risk assessment, risk pricing, and risk aversion and management, so as to reduces losses and avoid risks. In order to adapt to the climate changes, many insurance institutions worldwide have changed from passively coping with the risk of climate changes to actively playing the role of mitigation institution of climate financial risk.

China’s insurance industry is a late starter in the climate finance field. Currently, the Chinese projects related to climate insurance mainly focus on catastrophe insurance, agricultural insurance, weather and climate insurance, and low carbon property

⁴⁰ Yang Sheng, Analysis on the Application of China’s Innovative Green Financial Products – Take CGNPC Green Bond as An Example [D], Guangzhou: South China University of Technology, 2016

insurance, etc. So far, the major insurance companies that provide climate insurance include People's Insurance Company of China, China United Property Insurance Company, and professional agricultural insurance companies. In addition, insurance companies can add infrastructure investment projects into their investment portfolios as institutional investors. For example, the asset portfolios of CPIC Asset Management Company involve renewable energy source projects such as hydropower and wind power.

As a type of insurance of spreading risks and reducing the risk loss of the disaster victims, catastrophe insurance uses the insurance premium paid by the policyholders as the compensation fund. When the disaster occurs, it evaluates the damage of the insured object and compensate for it after the disaster. The type of catastrophe insurance can effectively solve the shortcomings of current financial allocation, great financial pressure of administrative guidance on disaster relief, low level of post-disaster rescue, and incomplete of disaster relief system. Insurance companies will strengthen risk management through contract design, risk assessment, etc., so as to timely compensate for disaster losses and improve the efficiency of disaster relief⁴¹. In 2016, Swiss Re-insurance Company, as a technical consultant and the only reinsurance company, helped the Heilongjiang Provincial Department of Finance to investigate and design China's first agricultural catastrophe index insurance. Based on the principle of index insurance, the insurance provided RMB 2.324 billion of catastrophe insurance for 28 national-level poverty-stricken counties in Heilongjiang Province for the causes of flood, excessive rainfall, drought and low temperature. Since its establishment, the catastrophe insurance has paid for more than 400% compensation to several poor counties in 2016 and 2017.⁴² The insurance has expanded the scale of disaster relief funds, promoted the optimal allocation of disaster relief resources, and solved the problem of financial funds in disaster relief.

⁴¹ He Zhiyang and Pang Yawei, Development and Risk Control of China's Climate Disaster Insurance, *Journal of Finance and Economics*, 2015, 73-76

⁴² He Xinglong, Chen Han (2017), Design of Agricultural Catastrophe Index Guarantee Scheme in the Era of Big Data -- Taking Heilongjiang Agricultural Financial Catastrophe Index Insurance Project as an Example [J]. *Financial Expo*.(12):58-59

3.3.5 Carbon emission trading support mode

It is an important institutional innovation to make full use of the market mechanism to control greenhouse gas emissions by establishing a national carbon emissions trading market. Establishing the market mobilizes market enthusiasm, increases investment vitality and promotes the development of carbon trading market.⁴³ Since 2011, China has initialized pilot markets for carbon emission trading in seven provinces and cities. Through the pilot work, relevant experience will be explored to lay the foundation for establishing a unified national carbon emission trading market in China. Pilot carbon markets have come into operation in succession since June 2013. By the end of November 2018, the cumulative trading volume of the seven pilot emissions trading platform had reached 270 million metric tons of carbon dioxide, and the accumulative total trading had exceeded 6 billion yuan. The seven pilot emissions trading market covered electricity, steel, cement and other industries as well as almost three thousands of key carbon emissions companies, and both carbon emissions and carbon intensity had been decreased. The carbon market did control the emissions of greenhouse gas and contribute to green and low-carbon development of the regions.^{44,45}

According to China's current *Interim Measures for the Carbon Emissions Trading Management*, the trading products in the early stage of carbon emission are carbon emission right quota and national certification of voluntary emission reduction (CCER) (see table 2).⁴⁶ Shenzhen Carbon Emissions Trading Pilot Market was officially launched as China's first carbon market on June 18, 2013, and Shenzhen Energy Group Co., Ltd successfully completed China's first carbon emission rights trading with China National Petroleum Corporation and Hanergy Holding Group respectively. As buyers of the carbon quota, China National Petroleum Corporation and Hanergy Holding Group bought 10,000 tons of quota from Shenzhen Energy Group Co.,Ltd 's eastern

43 HeXun Analysis on the Status Quo and Effectiveness of the Development of China's Carbon Emissions Trading Market [DB/OL]. Source: <http://www.tanpaifang.com/tanjiaoyi/2018/0807/62194.html>

44 China news network, China's Policies and Actions for Addressing Climate Change (2018) introduced by the State Council Information Office, source: http://www.gov.cn/xinwen/2018-11/26/content_5343360.htm

45 Department of Climate Change, ministry of ecology and environment (2018), progress of China's carbon emission trading market construction and consideration of next steps, environmental protection.15(006):13-14

46 King & Wood, China's Carbon Emissions Trading Products, Model, Market and Carbon Financial Derivatives – A Ten-point Discussion. Source: <http://www.tanpaifang.com/tanguwen/2019/0103/62745.html>

power station at RMB 28 and RMB 30 per ton respectively. Today, the seven pilot carbon trading schemes have been in operation for years, and plans for a national carbon trading market were launched in December 2017.

Table 2: types of current carbon emission trading in China

	Mandator y	Classification	Laws and Regulations	Basic Mechanism
Allocation of carbon emission quota	mandatory	Total quota control quantity trade	<i>Interim Measures for the Carbon Emissions Trading Management</i>	The national development and reform commission determines the total emission quota of provinces, autonomous regions and municipalities directly under the central government. The provincial development and reform commission allocates the carbon emission quota to carbon emission companies. Each regional exchange sets its own rules.
Certification of voluntary emission reduction (CCER)	voluntary	Project emission reduction trade	<i>Interim Measures for the Administration of Greenhouse Gas Voluntary Emission Reduction Trading</i>	<ol style="list-style-type: none"> 1. Projects shall be approved by the certification agency and be filed with the National Development and Reform Commission before regard as voluntary emission reduction projects. 2. After generating the emission reduction, the project shall be verified by the certification institution and then filed with the National Development and Reform Commission. 3. The voluntary emission reduction filed with the NDRC is known as "Chieses Certified Emission Reduction CCER".

4. The practice and consideration of Agricultural Development Bank of China in the field of climate finance

4.1 Overview of climate finance supported by ADBC

Like other domestic financial institutions in China, the Agricultural Development Bank of China (ADBC) supports the development of green finance to address climate change. Based on the relevant requirements of the China Banking and Insurance Regulatory Commission and the People's Bank of China, ADBC has established the Green Credit Guidelines and relevant policies in recent years. Driven by innovation and resources, ADBC has built sound motivation and restriction mechanism and has continuously been strengthening the support to green economy, low carbon economy and circular economy, providing strong support for national actions in the agricultural and rural areas to mitigate and adapt to climate change.

With the strong support by the Climate Bonds Initiative, the Center for International Climate and Environment Research in Oslo and the International Institute for Sustainable Development, ADBC established *The Framework of Green and Sustainable Bonds* in October 2018, under which it successfully issued its first green bonds in the overseas market in November 2018. At present, ADBC has signed a Memorandum of Understanding with the Climate Bond Initiative and two sides will carry out joint research on green agriculture standards that conform with both the international standards and Chinese situation and agricultural strategies, so as to promote green agriculture projects and brands, and to facilitate the green transition of China's and the world's economy. By the end of 2018, ADBC had issued a total of 20 billion RMB green finance bonds, which were earmarked to support green credit projects.

According to the definition of "green loans" by the China Banking and Insurance Regulatory Commission, the green loans in ADBC is mainly used for supporting rural living environment development, supporting rural transportation construction, supporting green agriculture and forestry resource development, supporting renewable energy and clean energy projects, as well as supporting energy-efficient and green

building and etc. By the end of 2018, green loans of ADBC had supported 1952 projects and amounted to 244.852 billion RMB, accounting for 4.81% of all loans. In terms of environmental and social benefits, these green loans has saved 2.476 million tons of carbon dioxide, 24,000 tons of sulfur dioxide, 16,000 tons of nitrogen oxide and 114 million tons of water, and has supported 453,800 hectares of afforestation, 200,000 hectares of water conservation, water ecology, groundwater protection and restoration, 32,500 kilometers of water system improvement, 1297 reservoir gates reinforcement that protected 440 million people, and 1794 sewage treatment plants and waste disposal stations that helped 35.1416 million farmers gain access to safety drinking water.

Meanwhile, ADBC has become one of the first signatories of the Green Investment Principles for the Belt and Road and has committed to follow the principles during related investment and operation and to help domestic agricultural enterprises and projects participate in the Belt and Road green investment. ADBC has incorporated the concept of green, low-carbon and circular sustainable development into the whole process of the Belt and Road construction, building the image of “green bank” at home and abroad.

4.2 Thinking on climate finance in ADBC

So far, ADBC has made important contributions in support of climate action. However, due to various restrictions, ADBC still faces some problems, such as insufficient research and planning, unclear scope, single support approaches, insufficient external cooperation and supporting policies. Considering the characteristics of climate finance in China, the overall development of ADBC and the domestic and foreign experience, we have made some suggestions on the development of climate finance in ADBC.

4.2.1 To strengthen research and planning on climate finance

There is a global consensus on combating climate change and the Chinese government pays great attention to and actively put forward various climate actions. Climate finance is a key innovation and support area for the business development of both domestic and foreign financial institutions. Considering the strong positive externalities of climate finance, the agricultural sector plays a key role to address climate change. ADBC is a

policy-based financial institution dedicated to provide financial services to agricultural in rural areas. We believe that climate finance can be actively pursued as an important aspect of financial supply-side structural reform. Drawing on the practice of National Bank for Agriculture and Rural Development of India, ADBC can designate specialized agencies to make continuous and in-depth research on climate finance, in order to provide suggestions to the national financial support for climate action and ultimately lead to a series of more favorable national policies to ADBC. Meanwhile, ADBC can make strategic planning on climate finance to provide top-level design and mechanism to ensure the smooth development of climate finance.

4.2.2 To clarify the basic principles of climate finance development

The climate finance business of ADBC should be based on the principle of proactive, steady and prioritized manner. Proactive means that serving climate project financing is ADBC's bounden mission as a policy bank, and it is also the "blue ocean" area of ADBC's business development. Steady progress means that climate finance requires a high level of financial specialization, so ADBC should choose some branches with high management ability to carry out business pilot. Actively cooperate with other advanced financial institutions to learn and accumulate experience, data and models from each other, and gradually promoting advanced experience throughout ADBC's whole banking system. Priority means that ADBC's climate finance business and projects should follow the green industry development plan formulated by the local government. In this progress, it is our responsibility as a policy bank that strengthen the cooperation with local governments, conducting high-end docking and guiding overall marketing so as to actively support governmental green industry fund and energy conservation and reconstruction fund.

4.2.3 To set up the scope of support scientifically

At present, the climate finance business of ADBC is limited and guided by the China Banking and Insurance Regulatory Commission, which is not in line with the actual business development and is not conducive to the further business development of climate finance. We believe that, on the one hand, current credit products can be sorted out in detail according to the characteristics of climate finance. Businesses that should

be included in the category of climate finance shall classified as policy businesses. On the other hand, ADBC should actively reflect the opinions and suggestions to the Ministry of Finance, the China Banking and Insurance Regulatory Commission, and the People's Bank of China etc. ADBC should strive to take more responsibilities and play a greater role in the state financial support for climate change. For example, the plan of Xiong'an New Area mentioned five major industries, including "a new generation of information technology industry, the modern life science and biotechnology industry, new material industry, high-end modern service industry, the green ecological agriculture" are proposed as the leading industries of the new area. Five major industries represent the goal of national industrial upgrading and developing, and some of them belong to the category of climate finance. Therefore, ADBC should actively carry out research on climate finance relevant industries and get comparative technological advantages for serving national mitigation of climate change.

4.2.4 To build a diversified support and promotion mechanism

At present, the main ways for ADBC to support climate finance are green credit and green bonds. However, ADBC could carry out the climate finance mode innovation according to the trend of climate financial development and ADBC's business development strategy. For providing a diversified business development support, ADBC should integrate its business, including climate credit, climate bonds, climate funds, climate insurance and carbon finance. It is foreseeable that this mode will provide a comprehensive financial support for the national climate change mitigation. Moreover, the head office of ADBC should support and encourage climate finance business promotion in terms of fund transfer pricing system and performance assessment system, and provide preferential fund pricing for green projects by establishing a green FTP pricing mechanism. It is also vital for the head office of ADBC to give preference in performance assessment and encourage branches to carry out relevant business.

4.2.5 To actively engage in international cooperation on climate finance

Now, international institutions such as the World Bank, the International Monetary Fund, the European Union and other international organizations have given substantial

financial and technical support for the development of climate finance, and lots of developed countries' financial institutions, have created many developed climate financial products. China strongly advocates climate finance, and various financial institutions are actively developing corresponding financial products. ADBC can establish in-depth communication channels with relevant international organizations and foreign financial institutions with developed climate finance business, and carry out climate finance business with their financial and technical support. At the same time, ADBC should consider signing a strategic cooperation agreement with the Ministry of Ecology and Environment to jointly plan the fields, methods and products of ADBC to support national addressing climate change action, and actively seek the support of the Ministry of Finance to carry out relevant business with the clean development mechanism fund (CDMF).

4.2.6 To improve management level and team quality

As for the climate finance business, ADBC should give full play to the advantages of head office and every branch banks to coordinate and promote the development of climate finance business. ADBC should take the initiative to strengthen cooperation with governments, and seize the development opportunities of the government to set up industrial investment funds and green financing project database. ADBC should timely follow up the project progress. The typically innovative branch banks should take the advantage of developed financial environment, actively carry out cooperation with other financial institutions, strengthen the development of employees and teams, and strive to be the "pilot bank" for business innovation, so as to provide experience and technical support for the development of our bank's climate finance business.

4.2.7 To strive for relevant supporting policies

Climate finance business has the characteristics of strong positive externality. However, there are also problems exist such as large risks and low benefits, which makes it difficult to carry out such business without internal and external policy support. In order to encourage the development of relevant business, ADBC should actively strive for national policy support. In terms of financing policies, it is necessary to strive for national support to reduce the capital cost of climate finance projects by reducing taxes

on green bonds and arranging PSL funds. Through consultation with the People's Bank of China and its branches (the central branch of the People's Bank of Guiyang has carried out this business), ADBC will fully use the the green credit assets by means of green credit mortgage refinance. In the field of financing, it is necessary for ADBC to seek state support to carry out investment activities in green projects within its business scope, allow ADBC to participate in the establishment and operation of industrial investment funds that meet policy requirements, and make a bigger contribution to climate finance.

For ADBC, it is clear that business innovation should be encouraged, climate finance business pilot should be carried out in branches with high management level, and higher risk preference should also be given. Besides, ADBC should also actively cooperate with other financial institutions and strengthen the development of employees and management system to gradually establish professional business department in each provincial branch. The last but not least, ADBC shall actively cooperate with other climate industry fund, and establish its own climate industry fund.

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