

Drivers for Greenness of Green Bonds

An Assessment of the Green Bond Governance in China

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Supervisors

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Abstract

Green bonds are facing prosperity in international and China's bond market, and becoming increasingly important in the overarching aim of financing green projects to reduce environmental impacts. Therefore, the green degree is an important topic.

Based on literature review and interviews, this study defined five key stakeholders in green bond market in China. The regulators are the primary driving force for greenness promotion, while bond issuers are directly related to the implemented green level. Investors can use their investment preference to influence the green degree; auditors play a role in the maintenance and monitoring of green degree; and regional authorities are the direct incentive providers.

Central government provided a clear motivation to promote the green bond market; various incentives from regional authorities were offered to make it more convenient and practical to issue green bonds, however, the incentives were not dependent on the green degree; different agencies set - inconsistent and non-mandatory - requirements for information disclosure, and the implementation did not meet its goal under an incomplete requirement system; the supervision system for green bonds is immature without complete regulation system and auditing market, no specific requirements nor regulations have been set for the qualification of auditors.

This study provided a first review of China's green bond governance system to explore green degree embedded in its governance system. Future researchers may explore the real environmental performance of green bond projects, or potential improvement from the perspectives of bond issuers and investors to draw a full picture of this system.

Keywords: green bonds in China, designed green degree, policy review

Executive Summary

Given the **problems** of environmental issues and funding gaps, green bonds are on the rise in international and China's bond market, and becoming increasingly important in the fund-raising process for green projects to reduce potential environmental impacts. Considering the immature market and policy system of current green bond market in China, it still requires further development and improvement. Therefore, having the aim to be green, the green degree of green bond is an important topic. Not many researches dived into the assessment of designed green degree of green bond system.

Considering current initial stage of green bond market, this study focused on the green level of its governance system to explore the greenness in the root. With the aim to explore the green level of the green bond governance system in China, this thesis raised the main research question as:

What is the green level of China's green bond governance system?

To answer this question, three sub-questions are demanded:

- Who are the key stakeholders in green bond market in China and what are their roles in promoting greenness?
- What drivers and barriers exist in current green bond system in China?
- How can the system be improved in China to better suite the international trend and requirements?

To answer these questions, a stakeholder analysis was conducted to understand their roles in promoting the green level of China's green bond market. the "Motivation – Incentive – Information - Supervision" framework was adapted for policy evaluation, and literature review complemented with interviews was the main source for data collection. Interviews were conducted among scholars in environmental field and financial field, environmental consultant, etc. for a deeper understanding of this topic. The case of green bonds related to clean energy projects was provided as an example to explain and help understand the implementation. It has to be mentioned that since the majority of green bonds in China started after 2016, most of them are still under construction.

Based on literature review and interviews, this study defined five key stakeholders in the green bond market in China, i.e. bond issuers, potential investors, regulators and auditors, and regional authorities. The regulators are the primary driving force for greenness promotion, while bond issuers are directly related to the implemented green level. Investors can use their investment preference towards green projects to influence the green degree of green bond market; auditors play a role in the maintenance and monitoring of green degree; and regional authorities are the direct incentive providers.

Meanwhile, the profitability of a project is still the core consideration factor that determines whether an enterprise wishes to issue green bonds. Under this circumstance, the motivation of issuing green bonds is not directly related to the green degree of the project itself; even if the project itself can produce adequate environmental benefits, without bringing income and profits to the enterprise, the vast majority of enterprises will not invest in such projects. Therefore, the policy makers should improve the policy system to enhance compliance and use financial incentives to influence the cash flow of issuers, so as to promote the green degree of green bond governance system in China.

From four perspectives analyzed in this study, central government provided a clear motivation for local government to promote the development of the green bond market; at provincial and municipal level various incentives were offered depending on the local situation to make it more convenient and practical for enterprises to issue green bonds, however the incentives were not dependent on the green degree of the bonds but rather other non-environmental issues such as bond scale, company's register location, etc.. This cannot provide sufficient promoting mechanism for the green bonds to be greener; different agencies set inconsistent non-mandatory requirements for information disclosure of green bonds, the regulation system for disclosure requirements is incomplete, and while the practice of information disclosure by issuers is not satisfying, additionally, non-compliance did not receive punishment or penalty. Thus the supervision system for green bonds is immature without complete regulation system and functioning and integrated auditing market, no specific requirements nor regulations have been set for the qualification of auditors, which has a negative impact on credibility of third-party certification.

Considering the relatively well-functioning motivation and incentive sections, **recommendations** for further improvement are mainly concentrated on information disclosure and supervision section. The information disclosure system may request hard rules for standardization and soft encouragement for awareness raising, including further clarifying the obligations of listed companies and green bond issuers to disclose environmental information, unifying and refining information disclosure standards and strengthening information disclosure guidelines, also policy makers shall strengthen relevance of environmental information and market, and stimulate the internal driving force of environmental information disclosure. Supervision demands a more detailed and practical regulation system as a guideline for real implementation. Regulators can further standardize the content of third-party certification and evaluation, strengthen the third-party green certification and evaluation of green bond maturity on the quality of green bond information disclosure, and play a better role in supervision and guidance to issuers and investors.

This study provided a first analysis of stakeholders' role in promoting greenness in China's green bond market, and also a first review of China's green bond governance to explore its designed green degree from four perspectives, and a case study of the environmental impacts resulted from clean energy related green bonds was conducted to further understand the potential negative environmental impacts behind current green bond information disclosure system. However, since green bonds in China are relatively new and the majority of funded projects are still under construction, no research has been conducted on the real environmental performance of green bond projects, which can be improved in future researches. Besides, this study mainly focused on the potential improvement from policy makers' perspective, while bond issuers and investors also play important roles in this system, therefore, future study may also explore potential improvement from the perspectives of bond issuers and investors to draw a full picture of this system.

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Abbreviations

Abbreviations for organizations

ADB	Asian Development Bank
CBI	Climate Bond Initiatives
CBRC	China Banking Regulatory Commission
CBR	China Bond Rating Co., Ltd
CCDC	China Central Depository & Clearing Co., Ltd.
CITA	China Interbank Trader Association
CPC	Communist Party of China
CSRC	China Securities Regulatory Commission
DTT	Deloitte

EIB	European Investment Bank
E&Y	Ernst & Young
HSBC	The Hongkong and Shanghai Banking Corporation Limited
ICBC	Industrial and Commercial Bank of China
ICMA	International Capital Market Association
KPMG	Klynveld Peat Marwick Goerdeler
NEA	National Energy Agency
NDRC	National Development and Reform Commission
PWC	Price Waterhouse Coopers

Abbreviations for terminology

CBS	Climate Bond Standard
GBP	Green Bond Principle
GDP	Gross domestic product
EPs	Equator Principles
ESG	Environmental, social and governance
ESIA	Environmental and social impact assessment
LCA	Life-cycle assessment
MW	Megawatt

1 Introduction

According to Jim Yong Kim (2013), the president of the world bank, “Climate change is not just an environmental challenge. It is a fundamental threat to economic development.” Based on estimation, 53 trillion US dollars in additional energy investments are demanded by 2035 to avoid catastrophic climate change (GreenBond, n.d.), which would be a tremendous challenge for governments to shoulder alone as public works.

Under this circumstance, green financial system appears, which represents a combination of a series of policies, institutional arrangements and related infrastructure building, using loans, private equity, issuance of bonds and stocks, insurance and other financial services to steer private funds toward green industry (The People's Bank of China, 2016), using market-based instruments to promote environmental protection and enhance sustainable development.

Green bonds, as an essential part of green financial system, refer to bonds raised to support eligible green industrial projects (ICMA, 2018). In most cases, green bonds are marketed as “green” when issued, while issuers are expected to provide projects descriptions at the time of issuance, to ensure segregation of project funds, and provide post-project reporting or verification about how the funds were used. There are several voluntary guidelines used to guarantee the required transparency, accuracy and integrity of information disclosure and reporting such as second opinions, rating agencies review, etc. (ICMA, 2018), among which the two widely accepted are the Green Bond Principles (GBP) and the Climate Bond Standards (CBS), concerning information disclosure in the life cycle of green bonds, from project identification to track and report (CBI, 2017 & ICMA, 2018). The issuance processes of green bonds from an issuer’s perspective can be seen in the following flowchart, from choosing one suitable green bond criteria to reporting after issuance:

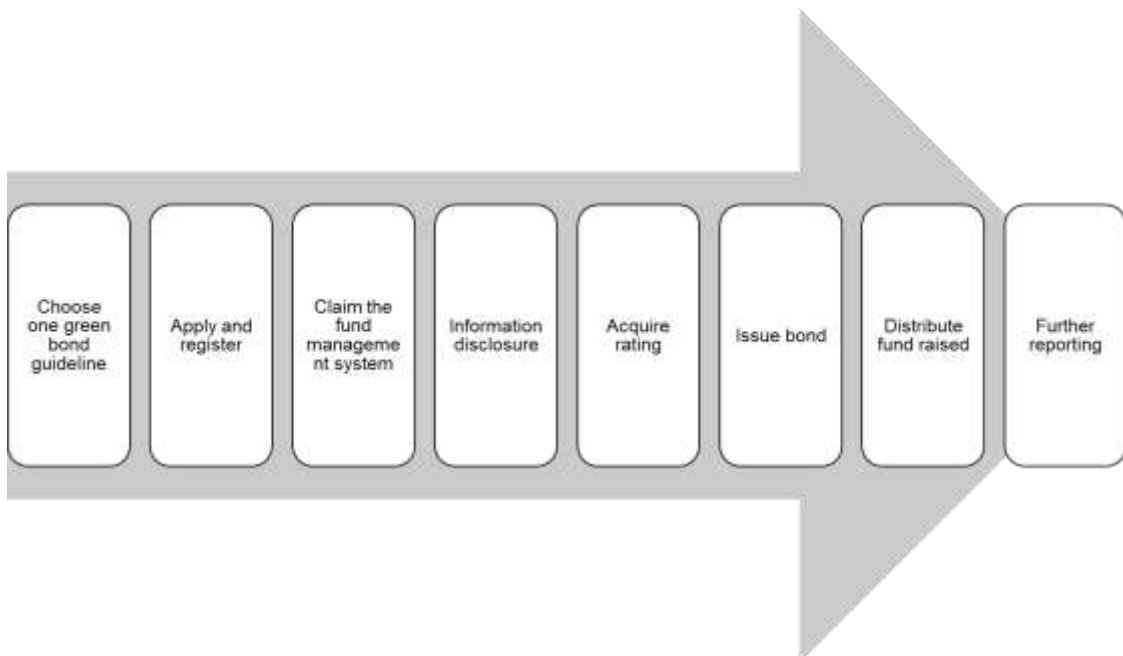


Figure 1-1. Green bond issuance processes

Starting from 2007, the global green bond market is maturing with an increase in issuer countries, bond type, issuer types, ratings and use of proceeds (CBI, 2017). After 2012, the green bond market witnessed its prosperity. In 2016, 81 billion US dollars (USD) green bonds were issued. The market kept growing and its issuing scale reached 155.5 billion USD in 2017, increased by 78% compared to 2016 (CBI, 2018).

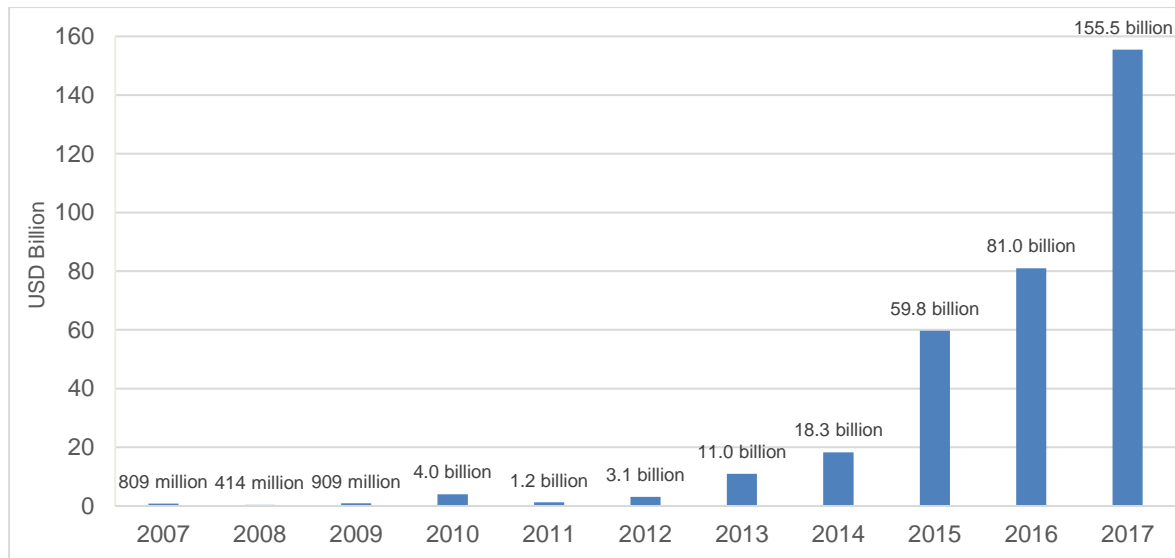


Figure 1-2. The development of global green bond issuance

Source: data compiled from CBI, 2016 & CBI, 2018

According to the estimation from the People's Bank of China (2017), there is an annual demand of around 320 to 640 billion USD for potential solutions to environmental problems and climate change, while the public funds can only meet 15% of the total demand. Therefore, it is critical important to attract non-governmental financing into the green field. As an important participant with the second largest issuance scale in the green bond market, China is paying more attention to its green bond development. The green bonds issued by Chinese issuers grew rapidly in 2016, from around zero to 238 billion CNY (about 36.2 billion USD), accounting for 39% of the global distribution (CBI & CCDC, 2017). In 2017, the green bond issuance in China was 248.6 billion CNY (about 37.1 billion USD), with 62% (154.3 billion CNY) consistent with international green bond definition (CBI, CCDC & HBSC, 2018).

Although the importance of green bonds has been emphasized by the government and organizations with the initial design to promote sustainability and mitigate climate change, little attention has been paid to its environmental performance in real practice in China, neither from academic perspective nor from issuers' self-reporting. Current studies had preferential interests in its financial performance and risk characteristics, but argued the projects supported by green bonds were born green and had little environmental risk potential considering its initiatives and design (Buttin, 2017; Jin & Han, 2016). However, some life-cycle assessments (LCAs) suggested equipment production accounted for the majority of environmental impacts during the life-cycle of wind farms (Xu, Pang, Zhang, Poganietz, & Marathe, 2017; Yang et al., 2018) and the construction work was the main pollution source for hydropower stations (Muthiah, 1989; Siddiqui & Dincer, 2017), which were not included in the environmental information disclosure requirements of green bond auditing reports, leading to the greenness uncertainties for green bonds.

Hence, this study focused on understanding the designed greenness of green bonds from policy perspective in China, through current policy related with green bonds and designed environmental impacts of case green bond projects, additional experience from other countries will also be compiled so as to provide information for a government perspective to support further policy making and contribute to a "greener" green bond system. Due to information availability and time limit, corporate bonds were the main focus of case study and were discussed in this thesis.

1.1 Green bond potential in China

The aim of this section is to provide the readers with understanding why it is necessary to evaluate the designed green degree of green bonds in China and why the case of clean energy was provided as an example. This section includes four key reasons, the environmental issues and its adverse economic impacts, green bond situations, the importance of clean energy, and uncertainties in its environmental performance and influence in reality.

1.1.1 Environmental issues in China

China's environmental carrying capacity is at its upper limit with severe pollution for air, water and soil (Vennemo, Aunan, Lindhjem, & Seip, 2009). Research data showed that air quality reached satisfactory level only in 8 out of 74 major cities (Chen, Ebenstein, Greenstone, & Li, 2013), and 75% of drinking water did not meet the requirements of national standards (Zhang, 2012).

The severity of environmental damage in China is heavily resulted from its high resource-dependent industrial, energy and transportation model (Mi, Pan, Yu, & Wei, 2015), which in turn, leads to adverse effects on the financial development. It has been estimated that environmental pollution has led to a 3% loss of national gross domestic product (GDP) in 2004 (SEPA/NBS, 2006) and economic losses resulting from illness related to air pollution were 1.2% of national GDP, which later rose to 3.8 % based on willingness to pay for pollution mitigation (Zhang and Crooks, 2012). Therefore, measures shall be taken to mitigate the pollution and reduce its adverse impacts. In this case, the green bond system was introduced in China to promote environmental protection and sustainable development through market-based instruments.

1.1.2 Importance of clean energy

Clean energy, or sustainable energy, refers to energy consumed at insignificant rates compared to its supply and with manageable effects, especially its environmental impacts (Dincer, 2002), usually including nuclear power and renewable energy such as energy from sunlight, wind, water, tides, waves, and geothermal heat, etc. (Li, Chen & Zheng, 2004).

China has great ambitions for its clean energy development. In the report in 19th National Congress of Communist Party of China (CPC) (CPC, 2017), clean energy is formulated as a priority development strategy, and the government shall “combine economic development, development and utilization of clean energy and environmental protection organically to promote the priority development strategy of clean energy; supports from government research and development and industrialization shall be provided for clean energy.” The percentage of clean energy in total energy consumption increased gradually from 11.2% in 2012 to 16.9% in 2016, concerning hydropower, wind power and nuclear power (NBSC, 2017).

1.1.3 The rise of green finance and green bonds

China is pushing its development transiting toward a sustainable model. The Third Plenary of the 18th Communist Party of China (CPC) Congress in 2013 raised the proposal of establishment of “a systematic and full-fledged institutional system of ecological civilization for eco-environmental protection”, which suggested the adoption of “a market-based mechanism to attract private capital investments into eco-environmental protection” (CPC Congress, 2013). The 13th Five-Year Plan in 2016 set the environmental protection target in air pollution control, water quality recovery, soil quality control, maintenance and improvement of ecological conditions, etc., which requires an annual investment of at least CNY 2 trillion into environmental protection, energy efficiency, clean energy, and clean

transportation from 2016 to 2020 (Force, 2015). This investment is supposed to be obtained through the establishment of a green financial system, of which 85% to 90% is expected from the private sector considering the decline of government expenditure and fiscal revenue (Force, 2015).

Under this circumstance, the green bonds in China has prosperous development with local supportive policies. In 2017, the issuance of green bonds in China has achieved CNY 248.6 billion, with an increase rate of 4.5% compared to 2016 (CBI & CCDC, 2018). However, it has to be pointed out 38 % of the issuance did not match the international standards for green bonds (CBI & CCDC, 2018).

In green bond market in China, clean energy is the largest issuing field, with special focus on hydropower plant construction, clean thermal power technology upgrading, wind farm construction, and innovation in solar panel (CBI & CCDC, 2017 & CBI & CCDC, 2018). Among three main green bond guidelines and categories in China, clean energy is one of the classical categories. In the definition from Green Bond Support Project Directory published by China Financial Institute Green Financial Specialized Committee (2015), supporting categories of projects include energy conservation, pollution prevention and control (pollution control, environmental remediation, coal cleaning), resource conservation and recycling, clean transportation, clean energy, ecological protection and adaptation to climate change. In the classification from China Banking Regulatory Commission (CBRC, 2014), green bond projects include green agriculture, green forestry, industrial energy saving, water saving, environmental protection, solar energy, hydropower, wind energy, green building transformation and other projects are defined as green assets. In the Guidelines for the Issuance of Green Bonds from National Development and Reform Commission (NDRC) (2015), the definition is "Green bonds are mainly used to support the technical transformation of energy saving and emission reduction, green urbanization, clean and efficient utilization of energy, the development and utilization of clean energy, the development of circular economy, water resources conservation and the development and utilization of unconventional water resources, pollution prevention and control, ecological agroforestry, energy saving and environmental protection industry, low carbon industry and ecological text, pilot demonstration, low-carbon pilot demonstration and other green circular low-carbon development projects."

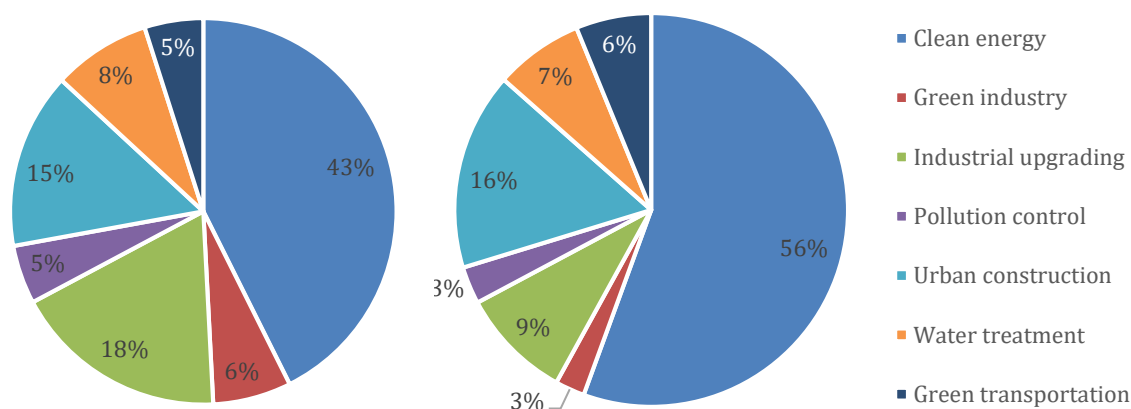


Figure 1-3. Composition of green bond projects in China in 2017 (Left: Project quantity; Right: Money involved)

Source: CBI & CCDC, 2017

Excluding 26 financial green bonds projects issued for further investment, from 2016 to 2017, there are 26 out of 61 corporate green bonds directly related with clean energy, concerning hydropower, wind energy, solar energy and clean thermal energy, which accounts for around 56% of the investment amount (CBI & CCDC, 2017 & CBI & CCDC, 2018). In terms of both project numbers and the money involved, clean energy is the dominant aspect with specific focus. Due to the time and access limit, this study only focused on the environmental performance of energy related projects, grid construction projects were excluded.

1.1.4 Uncertainties in the performance

However, behind this prosperity, problems are existing. First of all, green bond definition in China is not fully consistent with international standards, including mainly three categories (EIB & GFCFSB, 2017):

1. Transformation of existing fossil fuel power stations;
2. Clean utilization of coal; and
3. Grid infrastructure linking renewable energy and fossil fuel energy.

According to the analysis of CBI & CCDC, in 2016, 33% of green bonds issued in China did not meet the definitions of internal green bonds (CBI & CCDC, 2017), while the percentage increased to 38% in 2017 (CBI & CCDC, 2018).

It has also been criticized if green bonds can contribute to environmental protection as promised, which leads to the accusation of greenwashing, and therefore, potentially higher transaction costs. Shishlov, Morel & Cochran (2016) mentioned two challenges in environmental integrity, i.e. how to define “greenness” which depends on the objective of green bonds, and the reliability of information, linking to monitoring and evaluation processes. Other issues such as the disclosure level of environmental impacts and adaptive in process were also raised in the performance of green bonds (Queen, 2016). Additionally, as long-term investment projects, there are doubts if current environmental standards or requirements for green bonds can meet the advance of technology in the long run (Jin & Han, 2016).

Since China is expanding its green finance market into international level, it is critical to find the “common language” in green finance standards to ensure the successful implementation of targeted projects, especially when it comes to environmental impacts of sponsored projects. Besides, considering China’s commitment in carbon emission reduction and environmental protection, the green degree in design of vigorously support projects must be guaranteed. However, considering the green bond market in China is still in its initial stage, the market construction and the policy and regulation system are still immature and shall be improved and developed to meet the requirements for green degree in international market for further recognition.

1.2 Research objectives

Considering current initial stage of green bond market, this study focused on the green level of its governance system to explore the greenness in the root. Therefore, this thesis project aims to understand the green level of China’s green bond governance system in China, through relevant stakeholder analysis and a review of current green bond governance system and designed environmental impacts of green bond projects, additional experience from other countries will also be compiled so as to provide information for a government perspective to support further policy making and contribute to a green bond system with higher green degree. Therefore, the research question of this study is:

What is the green level of China's green bond governance system?

To answer this question, three sub-questions are demanded:

- Who are the key stakeholders in green bond market in China and what are their roles in promoting greenness?
- What drivers exist in current green bond system in China and what are their shortcomings?
- How can the system be improved in China to better suit the international trend and requirements?

1.3 Limitation and scope

This study has a specific focus on the governance system and relevant environmental performance of green bonds focusing on clean energy in China. A stakeholder analysis was conducted. Relevant policies published between 2012 to 2018 were collected and evaluated according to the “Motivation – Incentive – Information - Supervision” evaluation framework. Corporate green bond projects in clean energy field issued in 2016 and 2017 were compiled to analyze their designed environmental impacts. Since the majority of green bond projects in China are still under construction, their designed environmental benefits instead of practical performance were compiled and studied. Financial green bonds were not included in this study considering the accessibility to their proceeds track.

Even though this study tried to cover all types of clean energy projects for more adequate comparisons for clean energy variety, only several wind farms and hydropower plants had environmental information disclosure in their auditing reports for green bond issuance, which further limited the scope of this study.

Due to the language barrier, Chinese policies referred to in this study were mainly translated into English by the author, which may lead to inaccuracy during the translation process.

1.4 Audience

The main audience for this study includes policy makers with the desire to improve the environmental protection efficiency of green bonds and potential green bond issuers with the desire to improve the designed greenness of their bonds. Other potential audience can be institutional investors who are aware of the environmental footprint of their investment and want to mitigate the environmental risks during investment process.

This study may attract NGOs as background information for potential environmental performance of green bonds; it can also provide a policy review for green financial system in Chinese context for people who are interested in the green financial system in China.

1.5 Disposition

Chapter 1 presents the current situation for green bonds in China and why it is interesting and necessary to study the designed greenness of green bonds. Research scope and limitations were identified, followed by intended audience and thesis outline.

In Chapter 2, methods used in this study were introduced, including analytical framework for green bond policies, methods for information collection and data analysis.

Chapter 3 contains the findings of this study, mainly concerning the stakeholder analysis, and China's green bond governance system review, designed environmental performance of issued green bonds.

In chapter 4, main findings are discussed in the context of previous studies and potential external experience for further improvement.

Chapter 5 concludes with reflections on the thesis procedure, final remarks regarding research questions, and recommendations for potential audience and further research.

2 Methodology

For this study, a stakeholder analysis was conducted and the “Motivation – Incentive – Information - Supervision” framework was adapted for governance assessment, and literature review was the main source for data collection. Interviews were conducted among scholars and practitioners in environmental field and financial field, environmental consultant, etc. for a deeper understanding of this topic in practice.

2.1 Analytical framework: Motivation – Incentive – Information - Supervision

To understand the policy framework in China, it is important to know the relationship between central government and regional authorities. The Motivation – Incentive – Information framework was first advanced by Tang & Chen in 2017 to understand and analyze the role and interaction between central government and municipalities and implementation of environmental policies in China. According to the research of Tang & Chen (2017), due to principal-agent relationship between central government and municipalities, the existing environmental policies in China still mainly adopt a command-control oriented environmental indicator policy, resulting in information asymmetry and incentive compatibility as the core issues. Therefore, the implementation of environmental policies is mainly influenced by three key factors, i.e. motivation, incentive, and information.

In Tang & Chen’s framework, central government provides incentives for municipalities in order to obtain consistency in motivations for environmental policy practice. Information communicated between central government and municipalities works as the basis for higher authorities to make decisions and a medium for coordinating and guiding subordinates' behaviors (Tang & Chen, 2017). The mechanism of the framework can be seen in Figure 2-1.

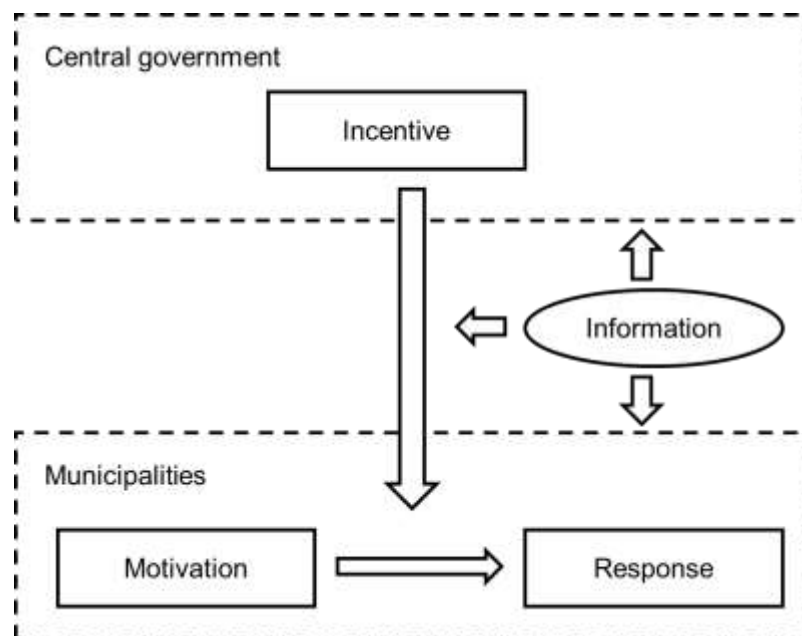


Figure 2-1. Mechanism of Motivation – Incentive – Information Framework

Source: Tang & Chen, 2017

In this thesis, one player, the green bond issuers or companies was added into the framework to modify the system better suited the case of green bonds, and one function was introduced

into the system. In this case, central government provides consistent motivation to municipalities directly through strategy plans and performance evaluation system, while incentives were mainly given from municipalities to green bond issuing companies. Information is disclosed from all sectors to each other and also to the public. The market also plays an important role, but still stays in a immature statue currently. In a nutsell and in the context of this study, this modified framework is used understand the designed green degree and potential effect and efficiency of green bond policy system in China (see in Figure 2-2).

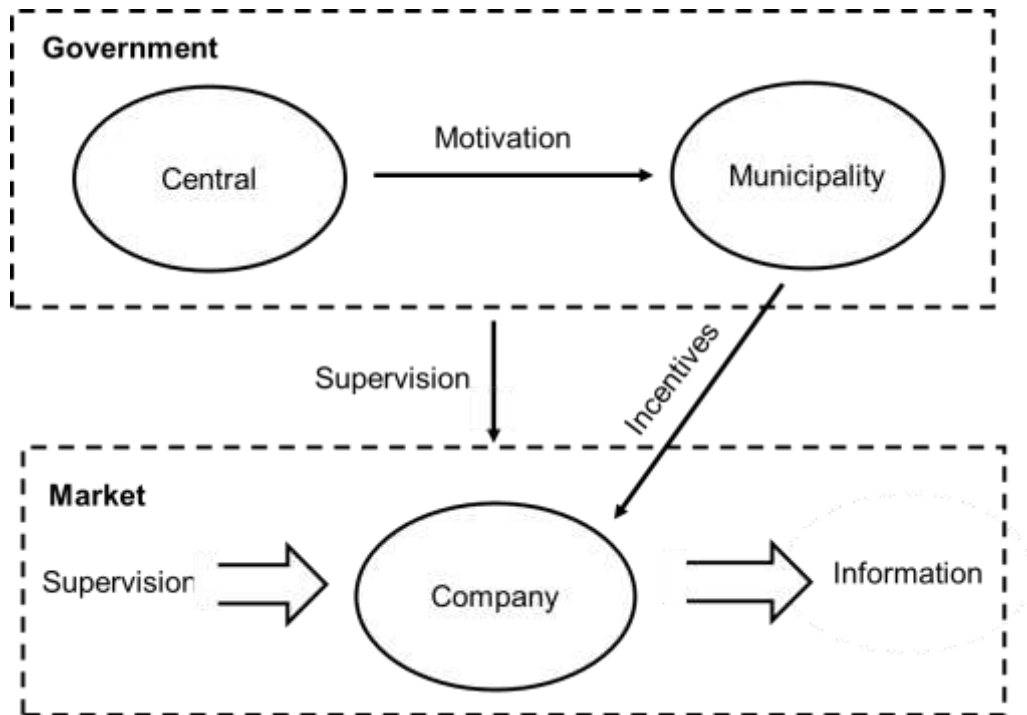


Figure 2-2. Mechanism of adapted Motivation – Incentive – Information & Supervision Framework

2.2 Methods for information collection

Data collected for this study mainly concern policy documents and regulations related to green financial system and green bonds and designed environmental impacts of green bond projects, which were both retrieved from literature review. Interviews were conducted for further discussion of the topic.

Governance documents

In the beginning for green finance and green bonds related policy searching, strategy planning documents such as 13th Five-year plan, green bond annual reports, green bond white paper (the need for a common language in Green Finance: Towards a standard-neutral taxonomy for the environmental use of proceeds) and other key documents related with green bonds in China were read, and other policies or projects mentioned in above documents were retrieved as potential information sources.

Key words in mandarin including “绿色金融 (green finance)”, “绿色债券 (green bonds)”, “气候债券 (climate bonds)”, “清洁能源(clean energy)” were used for further searching in government websites (<http://www.gov.cn/>) and general searching engine such as baidu.com and bing.com. Other policies or supportive projects mentioned in previous studies were also added to the policy list.

In total, 51 policies and regulations related to green financial system and green bonds in China are selected and reviewed to understand the designed greenness from political perspective, including 7 development plans and strategies from national level, 14 guidelines for green financial system and 28 detailed regulations from local government.

Designed environmental impacts of green bond projects

Projects list was from green bond market annual reports (CBI, 2016 & CBI, 2017), selection criteria including:

- Clean energy related projects (hydropower, solar energy, wind power, biomass, waste incineration) were first selected
- Clean thermal power qualified by Chinese green bond projects such as natural gas, integration projects of small thermal power plants were excluded due to the inconsistency with international standards
- Issuance reports and annual auditing reports were read. Projects without estimated / actual environmental performance disclosure were excluded.

Selection process of target projects can be seen in the flow chart in Figure 2-3.

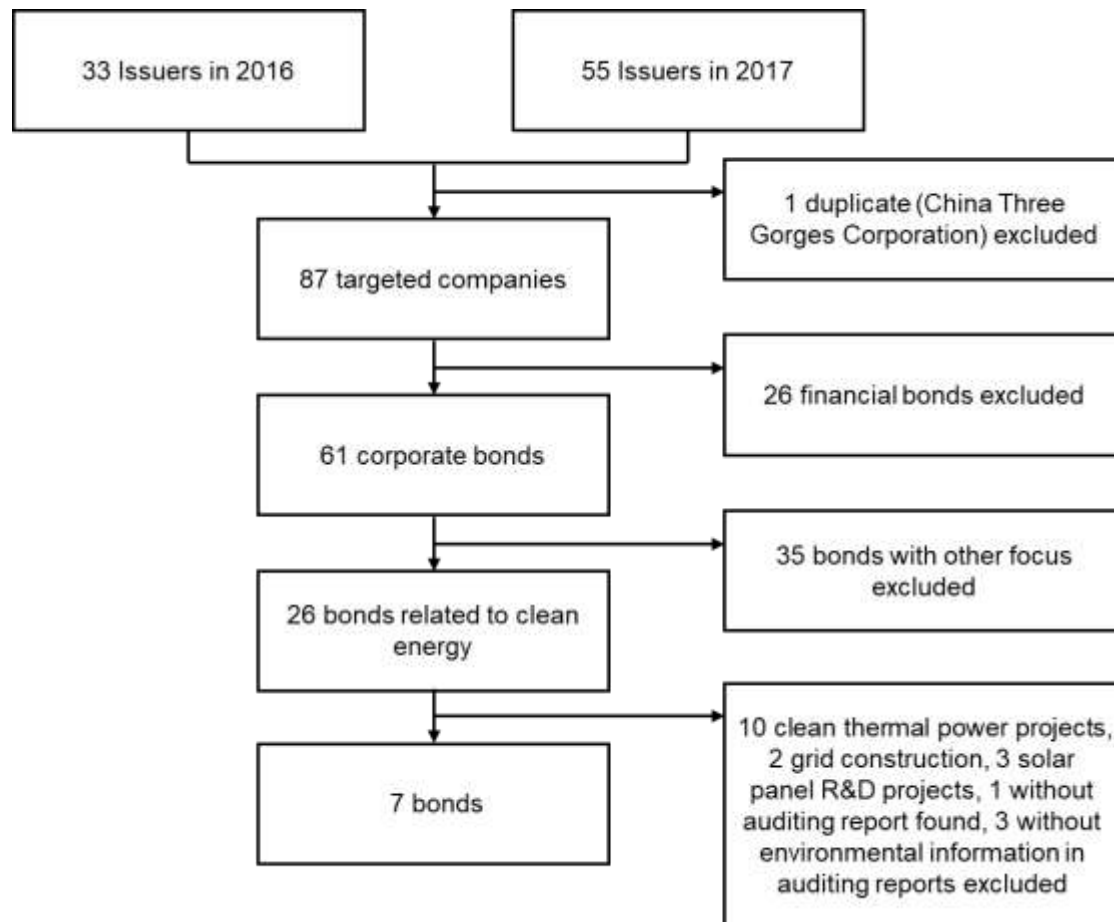


Figure 2-3. Flow chart of bond selection

Interviews

7 semi-structured interviews were conducted during the thesis developing process, in the early stage of thesis development, interviewers helped the author obtain basic understanding of the topic and develop the research design, and suggested potential information sources. In the

latter stage of the thesis, interviewers provided insights from their background, supporting the author to deeply discussed the topic. Interviewers in this study included scholars in environmental field and financial field, environmental consultant, etc. and interviews were conducted through meetings, phone calls, e-mails and WeChat talks.

Interview questions were adjusted based on interviewees' background and contents of conversations, mainly based on:

- Who are the important stakeholders in this system?
- What type and how much is the environmental concern reflected in green bond related governance system?
- When making investment decisions, how do investors prioritize the environmental impacts of relevant projects?
- What are the evaluation criteria for environmental impact assessment of green bonds? Any ideas why impacts during construction and end-of-life stages are excluded?
- What is the plan for the reporting and monitoring of green bonds from the perspectives of both government and issuers?
- What is the greenness of green bonds in your understanding?
- Do you have any suggestions how can the transparency and greenness of green bonds be improved?

The interview list can be seen in Table 2-1, interviewees were listed according to alphabetical order by their surnames.

Table 2-1. Interview list

Name	Title	Organization	Interview Date
Cai, Yu	LEED AP	AntRock Energy China	03/08/2018
Cai, Jianan	Postgraduate	Fudan University	20/06/2018
Huang, Xiangyue	Investment manager	Shanghai China Investment Co., Ltd	02/06/2018
Sun, Mingxing	Postdoctoral Researcher	Tsinghua University	08/06/2018
Sun, Yiting	China sustainable financial project director; Deputy Secretary General of the International Finance Forum (IFF); Director of the green development center	WWF; IFF	05/08/2018
Yu, Huajun	PhD. Candidate	Fudan University	08/06/2018
Zhang, Zhengyang	Head of Marketing Dept at ICBC Amsterdam	ICBC	10/06/2018

2.3 Methods for data analysis

Considering the information disclosure in green bond auditing reports, 4 common pollution reduction indicators disclosed in prospectuses were retrieved for comparing the environmental

performance in different green bond projects, i.e. CO₂, dust, SO₂, and NO_x. For direct comparison between different projects, projects were categorized by energy source (wind power, hydro power), and pollution reduction per kWh electricity generated and pollution reduction per CNY per year were provided.

3 Findings

There are mainly three processes concerning the promotion of greenness of green bond market, including technical design, implementation and maintenance overtime. Considered that the majority of Chinese green bond projects started in 2016 or and have not been completed yet, the governance system designed is used to study the implementation and maintenance of green bond projects to replace the real practice.

It has been pointed out that sustainability is one of the most significant trends in financial market for decades (Clark, Feiner & Viehs, 2015). Institutional investors are trying to steer capital toward companies and projects that can provide solutions to major social and environmental challenges, however, it can be difficult to achieve expected impacts at scale (Menou & Nishikawa, 2016). Additionally, not enough attention has been paid to the environmental performance of green bonds, rather, information disclosure still puts more emphasizes on the financial statue of targeted companies or projects.

According to the results of interviews and literature review, the core value for green bonds is still a financial instrument for making profits. Therefore, risk can still be regarded as the key concern for investors, including risks regarding financial security and environmental benefit. Under this circumstance, requirements were raised by the green bond market from financial and environmental perspectives to guarantee the stability of payback and limit negative environmental impacts.

In this paper, an introduction to the green bond market concerning the development history and demand for green degree was provided, the designed green degree in current policies and existing green bond projects in China were reviewed, also researches and experience from other countries were compiled to provide potential recommendations for further improvement.

3.1 Green bonds market

3.1.1 International green bond market

In 2007, the European Investment Bank (EIB) issued its first green bond, which showed the beginning of green bonds, in the meanwhile, the green financial system was keeping expanding. After 2012, the green bond market witnessed its prosperity. In 2016, 81 billion US dollars (USD) green bonds were issued. The market kept growing and its issuing scale reached 155.5 billion USD in 2017, increased by 78% compared to 2016 (CBI, 2018).

Investment and financing of green bond projects are mainly used to improve the global environment, cope with climate change and improve energy efficiency, among which the climate bonds are concerned with how green bonds respond to climate change (CBI, 2018). The reason why climate change is emphasized is that risk points of financial institutions in developed countries are mainly the future climate dynamics and corresponding technological adjustments, since the industrialization process of these countries is earlier than that of developing countries, and the environmental pollution problem, as a contradiction in the early stage of industrialization, has been basically solved, and has been rid of the dependence on coal (Source from interview). Therefore, green principles and standards were widely adopted in the evaluation for possible funding projects to set restrictions for issuers to enhance the green degree of green bonds.

Additionally, due to the increasing awareness of sustainability and social responsibility, the environmental, social and governance (ESG) risks were integrated into the consideration of

institutional investors to operate in accordance to their value, which can be considered as another driver to promote the greenness of green bond market.

Green standards and green principles: requirements for issuers

Currently, there is no standardized requirements for green certification in China’s green bond market, while the main certification standards of green bonds in the international market are Green Bond Principles (GBP) and Climate Bond Standard (CBS).

Green Bond Principles (GBP)

GBP is the first green bond voluntary guideline accepted by market participants in the international market. It was launched in 2014 by the International Capital Market Association (ICMA) in conjunction with a number of financial institutions, and was revised in June 2017. GBP lists the industry categories of green bond projects and provides guidance for issuers before and after bond issuance.

GBP considers that green bond projects should clearly provide environmental benefits, and lists a broad range of projects designed to address issues such as climate change, degradation of natural resources, loss of biodiversity and pollution control, including but not limited to renewable energy, energy efficiency, pollutant reduction and control, and sustainable management of natural biological resources, clean transportation, sustainable water treatment, climate change adaptation, and ecologically efficient products, production technologies and processes (ICMA, 2017).

GBP provides a framework of guidance for issuers from four aspects: the use of raised funds and the scope of application projects, project evaluation and selection, follow-up management of raised funds and information disclosure (ICMA, 2017). It also recommends issuers to use external certification to ensure that bonds issued meet the definition and requirements of green bonds (ICMA, 2017). Detailed requirements can be seen in Table 3-2.

Table 3-1. GBP requirements for issuers

Framework	Requirements for issuers
Use of raised funds and the scope	<ol style="list-style-type: none"> 1. Use of funds: the use of funds must be made clear, including specific projects and the proportion of inputs; 2. Targeted projects: meet GBP category requirements;
Project evaluation and selection	<ol style="list-style-type: none"> 1. Project decision-making: Disclosing the process of project evaluation, listing the criteria for project compliance and environmental benefit objectives; 2. Business standards: an auxiliary introduction to the issuer's overall business capability and performance in the past are required;
Follow-up management of raised funds	<ol style="list-style-type: none"> 1. Compliance: Manage fund raised with a sub-account, or ensure that funds raised are invested in green bond projects through a formal internal process and that the overall flow of funds is traceable; 2. Flow of funds: Regular disclosure of the details of funds used and short-term investment purposes for unused funds;
Information disclosure	<ol style="list-style-type: none"> 1. Contents: In addition to the details of the funds, the list of investment projects (project cost information, capital quota and environmental benefits) should be disclosed at least annually. 2. Methods: Qualitative and quantitative descriptions of expected environmental benefits (e.g. emission reduction, number of beneficiaries) are suggested to be

	<p>used, and methods and basis for quantitative analysis are required.</p> <p>3. Framework: GBP provides a template for green bond impact reports jointly submitted by a number of international financial institutions active in the green bond market; it also encourages industry leaders to establish and disclose templates;</p>
External certification (recommended)	<p>1. Consultant review or second party opinions: professional advice on environmental sustainability from advisory bodies to review projects;</p> <p>2. Verification: independent auditing or green bond process auditing of internal fund tracking process and fund allocation;</p> <p>3. Certification: Green bonds can be certificated by an assessment standard, which defines criteria, and alignment with such criteria is tested by qualified third parties/certifiers.</p> <p>4. Rating: Green Bonds or its framework rated by qualified third parties, such as specialised research providers or rating agencies.</p>

Source: ICMA, 2017

Climate Bonds Standard (CBS)

Climate bonds generally refer to bonds that finance projects/assets to help achieve a “low-carbon economy”. On the basis of fully considering the compatibility with GBP, an NGO named Climate Bonds Initiative (CBI) developed CBS and a matching CBS green certification to provide a “green certification” process for unified market identification, in order to help investors and intermediary agencies assess the authenticity of climate mitigation and climate adaptation bonds.

Similar to GBP, CBS outlines a broad range of projects/assets appropriate for achieving a "low-carbon economy", including energy (especially clean energy, renewable energy and energy management and storage), low-carbon construction, industry (including energy efficiency, cogeneration, waste power generation, etc.), waste, pollution control and storage, low-carbon transport, information technology and communications, low-carbon infrastructure, agriculture and forestry, and climate change adaptation (CBI, 2017).

According to the bond issuance process, CBS green certification is mainly divided into pre-issuance certification, post-issuance certification and periodic certification, corresponding to relevant CBS requirements, which are described in Table 3-3.

Table 3-2. CBS requirements for certification

Stage	Certification Requirements
Pre-issuance	This stage mainly evaluates and certifies whether the bond project meets the category criteria and whether the issuer's internal control process is in place, including information disclosure for the selection and decision-making of the project, the establishment of the internal control system of the fund-raising, the behavior of "ensuring reasonable activities" to the issuer before issuing, the bond information and the fund-raising plan.
Post-issuance certification	After issuing bonds, issuers need to submit the certification application again within two years. This stage mainly evaluates and certifies whether the issuer's internal control, capital use and information disclosure meet the post-issuance requirements after the issuance of bonds, including whether the issuer maintains the project adaptation and decision-making process, how the issuer's internal control system is implemented and how the fund is raised, and specific information disclosure such as details and environmental benefits of projects.

Periodic	All “certified climate bonds” must provide annual reports to the market and investors during their maturity to disclose whether the issuers and bonds continue to meet CBI requirements for bond issuance. Bond verification and guarantee work do not need to be carried out every year.
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Source: CBI, 2017

During the pre-issuance and post-issuance certification phases, the issuer submits to the CBI the Climate Bond Information Sheet and the CBI-approved third-party institution's report on guarantees that the bond and bond issuers meet the pre-issuance/post-issuance requirements of the CBS Committee for review. If approved before issuance, the Committee will provide “green certification before issuance”; if approved after issuance, the committee will confirm the bond as a “certified climate bond” (CBI, 2017).

Comparisons between green principles

Generally speaking, the unified authoritative “green certification” plays an important role in standardizing the operation of the green financial market and solving the problem of information symmetry between the supplier and the demander.

However, since the principles and standards discussed above are voluntary guidelines, there is no mandatory request for the greenness of the whole green bond market. For example, although the issuers may indicate in the relevant report that it is consistent with GBP to regulate the operation process and information disclose, the “voluntary” feature and “recommended” third-party auditing make it impossible for investors to decide whether the issuer actually complies with the criteria, or even whether it is a “green” issuer, thus unable to solve the problem of information symmetry non-compliance between the supplier and the demander of funds.

In addition, the green bond label certificated by CBS certification provides investors with an easily identifiable signal to solve the information asymmetry, and is increasingly recognized by investors. However, CBS only provides the certification of whether it is “green” and does not distinguish the degree of green. From the coverage of bond categories, CBS certification emphasized more on achieving "low-carbon economy" and climate change mitigation as the outline, ignoring other parts such as energy restructuring, economic transformation and pollution control and treatment.

On the other hand, although these standards or principles are widely adopted in international green bond market, considering the environmental issues in China are not limited to climate change, and the limitations of these green standards, these green standards are not entirely applicable to China. China's green financial market should formulate green standards which are in line with China's actual situation and are accepted and accepted by all financial markets and participants, introduce unified authoritative green regulatory standards, carry out green standard certification and issue unified green certification marks.

Green investment criteria: awareness from investors

Green bonds provided an opportunity for fixed income investors to both achieve their primary investment objectives as making profits and create positive environmental impacts (VanEck, 2017). Besides the green requirements for issuers, the demand for green degree were also raised from the investor’s side in the international green bond market. The ESG indicators are the key evaluation criteria for investors to assess the greenness and social responsibility of potential funding projects. Among ESG criteria, the environmental criteria usually concern essential environmental issues related to the company’s operation and income,

including energy use, resource consumption, waste and pollution, etc., which are adjusted according to company's type and local conditions.

In the US, the total value of ESG funds exceeded 2.5 trillion USD by the end of 2016, meanwhile, there were more than 1,000 funds incorporating ESG criteria into their investment decisions (Investopedia, n.d.). Meanwhile in Sweden, environmental consulting companies for institutional investors such as GES International AB. were looking for evaluation criteria to ensure the reduce of material consumption and waste generation for their investment (Arvidsson-Kvissberg et al., 2018).

Under this circumstance, it is becoming increasingly important for China to adjust its green bond market to meet the requirements for issuers and desires from investors for better adaption to the international green bond market and attraction for foreign investment.

3.1.2 Green bond market in China

The issuance of China's green bonds began at the end of 2015, when the Agricultural Bank of China started to issue green bonds in London (CBI & CCDC, 2017). In December 2015, the people's Bank of China published an announcement of green financial bonds in the inter-bank bond market (the largest bond market in China) (People's Bank of China, 2015); a few weeks later, the NDRC also published Guidelines for the issuance of green bonds (NDRC, 2015), which represented the initial formation of the green bond system in China.

The labelled green bonds in China started from 2016, while the green bonds issued by China Three Gorges Corporate Group were certified by CBI and became the first certified Chinese issuer in 2017 (CBI & CCDI, 2018). Over the past two years, the green bond market in China expected its prosperity and a more standardized system and the investment environment of green bonds is continuously optimized. On the one hand, China has been actively promoting and popularizing the concept of green investment and responsible investment, cultivating green investment culture, encouraging various institutions to invest in green bonds, cultivating green bond professional investors, and optimizing the investment environment of green bonds. On the other hand, the Green Finance Committee has been actively cooperating with international green institutions to establish a set of green financial standards recognized at both domestic and international level to attract capitals from local and foreign market.

Besides, the willingness to issue green bonds continues to increase. In recent years, the issuance of green bonds has become an important means to promote the innovation and development of green industry. With the continuous strengthening of the support for green industry, the efforts of the government to protect the ecological environment are increasing. All local governments support the promotion of green bonds issued by enterprises, which will encourage enterprises to issue green bonds actively. Meanwhile, with the further improvement of the green bond market system, the issuance of green bonds is more standardized, the cost advantage of green bond issuance and the impact on the reputation will further increase the willingness of potential green issuers to issue green bonds.

Although the green bond market has witnessed its prosperity, not enough attention has been paid to its designed green degree. The following stakeholder analysis provided a brief introduction to the key stakeholders in this system and how they are related to promotion of green degree in green bond market.

Stakeholders in Green Bond System

There are five key stakeholders related to green bonds in China, including issuers, investors, regulators and auditors, and regional authorities.

Issuers

The vast majority of bonds issued in China come from policy banks and the central government while most corporate bonds are short-term and are issued by entities with a solid indirect government guarantee to increase its credibility (CBI et al, 2015). The following case study in Section 3.3 has a specific focus on green corporate bonds for better traceability of fund use.

Issuers are the immediate beneficiaries in the bond-raise process who get direct fund support for its operation or expansion. Therefore, issuers are not only one of the essential stakeholders in green bond market, but also a key actor and a link with other actors in the projects funded by green bonds, such as project designers, vendors, construction teams, operators, etc., who are the critical drivers of greenness in the technical design, implementation/operation and maintenance process. It is assumed that the issuers' willingness to greenness will be directly reflected in the projects.

Investors

Investors are the ones who invest their money into certain projects expecting for further return. For those with preference towards bonds, they have the tendency to look forwards to relatively low but stable profits. There are different investor groups in different domestic bond markets. The vast majority of investments in the market come from domestic investors because of the regulations. In the dominant interbank market, domestic institutional investors account for the majority (CBI et al, 2015). The market is not open to individual investors; therefore, institutional investors are the dominant investing group in green bond market.

According to observation from interviews and literature reviews, the initial objective of investors in the bond market is to obtain stable and secure payback and it is still the same in the green bond market, which means the greenness of potential funding projects would not be an essential concern; rather, the environmental issues would be considered only when it is related to the cash flow of the potential funding projects and/or legal compliance issues, influencing the profit making and normal operation.

Regulators

Regulators in China's green bond market, or agencies from central government side responsible for green bond regulating, include China Banking Regulatory Commission (CBRC), the people's Bank of China (central bank), the Ministry of Finance, NDRC, and China Securities Regulatory Commission (CSRC). The corporation between agencies established a monitoring system for green bonds. The State Council has proposed strengthening supervision and liaison among departments and agencies. The proposals include regulation of bond market entry, strengthening information disclosure, strengthening the rating system and protecting investors. Coordination also involves investigating false information, internal transactions and price manipulation (CBI et al., 2015). The main functions of relevant agencies and their relation to the green bond market can be seen in the following Table 3-1.

Table 3-3. Main regulators in China's green bond market

Regulators	Main functions	Relations to green bonds
China Banking Regulatory	CBRC does not participate in	Published " <i>Green credit guidelines</i> ",

Commission (CBRC)	supervision of bond issuance but mainly monitors the banks.	which is used to evaluation criteria of green standards for green bonds
People's Bank of China (central bank)	The central bank controls market access, bond issuance and liquidity and is responsible for overseeing bond rating agencies in China.	As a part of the green financial system, the central bank has a full-time working group responsible for green bonds.
Ministry of Finance	The Ministry of Finance is responsible for examining the qualification of bond guarantor, securitization of credit assets and custody arrangements for intermarket bonds. In addition, the Ministry of Finance and the State Administration of taxation have formulated relevant regulations on the exemption of income tax on interest income of government bonds. The Ministry of finance has set up the rating of government bond issuance.	Provide tax reduction incentives for green bonds.
NDRC	NDRC supervised the issuance of corporate bonds and provided approval.	NDRC has the right to promote sustainability of the development agenda and the bond market.
China Securities Regulatory Commission (CSRC)	All major listed companies issue bonds on the stock exchange. It is also responsible for supervising stock issuance in stock market and all listed companies. In addition, it monitors transactions, securities registration and settlement institutions, rating agencies and legal businesses engaged in securities issuing law firms.	CSRC is responsible for promoting the integration of green bonds and quotas, norms and processes of bonds between Chinese and foreign investors.

Source: CBI et al, 2015

Regulators are the primary driver for the green degree promotion of green bond market since they defined the taxonomy of green industry and the classification of green bonds; besides, the guidelines for the application, issuance and certification of green bonds were also released by them, adding to their authorities in designing the green degree of green bond market.

However, due to the involvement of several regulating agencies, the regulating framework is chaotic considering inconsistency in guidelines and regulations from different agencies. Additionally, although all regulators provided a clear category for green industry and green projects, none of them set specific requirements or definitions for green degree within the industry according to the actual green level.

Auditors

In most cases, green bond auditors are external auditing or consulting company hired by the issuers to conduct auditing for their green projects. Four major accounting firms (Ernst & Young, E&Y; Deloitte, DDT; Klynveld Peat Marwick Goerdeler, KPMG; Price Waterhouse Coopers, PWC) dominate the external verification and auditing market of green bonds. According to statistic data from CBI and CCDC, in 2017, 58% of the total China's green bond issuance received external verification from E&Y, DDT, KPMG or PWC (CBI & CCDI, 2018). The remaining 24% are inspected by local Chinese agencies, including specialized green bond inspectors, rating agencies, business consulting firms and so on (CBI & CCDI, 2018). 19% of the green bonds have no external verification information, including private offerings, green asset support bonds and some bonds approved by NDRC (CBI & CCDI, 2018), because the guidance from NDRC does not require mandatory external verification for green bonds (NDRC, 2015).

As the third-party organizations, the auditors are supposed to provide authoritative certification to guarantee the greenness of target projects as promised, while considering the voluntary nature of auditing and the lack of entry barriers and certification system in the auditing market itself, the credibility of certification from third-party auditors remains to be proven.

However, auditors can still play an important role in promoting the green degree of green bonds. In the green bond market in China, third-party rating agencies are attempting their trials. As an example, the Green bond assessment and certification system released by China Bond Rating Co., Ltd (CBR) integrated the professional business and environmental benefit of targeted company, which divided projects into deep green (G1), green (G2), relatively green (G3), light green (G4) and non-green (NG) (CBR, 2016). Its assessment process can be seen in the following flow chart.

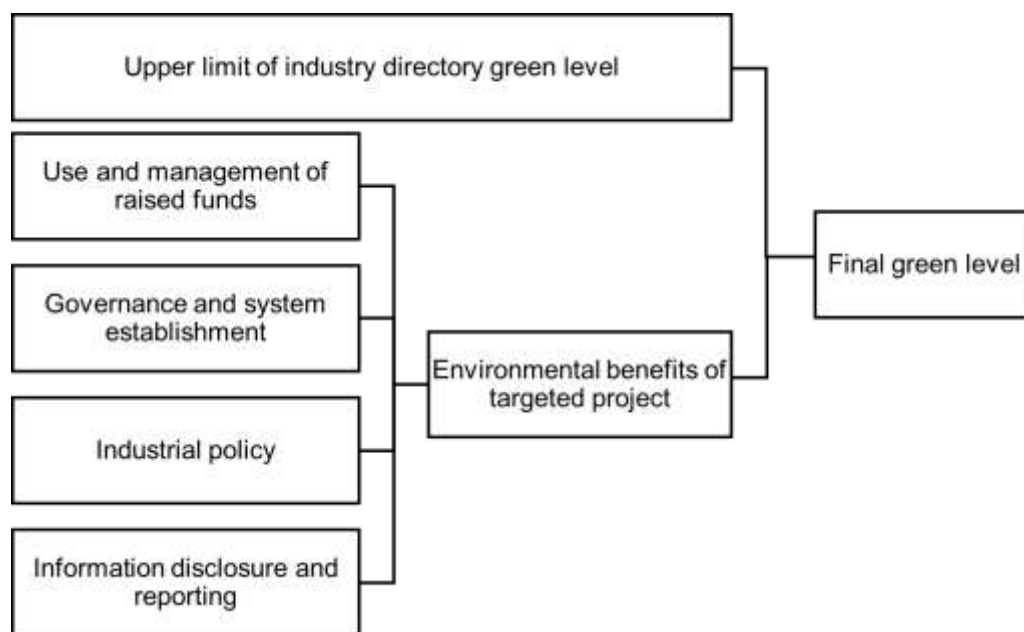


Figure 3-1. Flow chart of Green bond assessment by CBR

Source: CBR, 2016

According to Ma, the Chief economist of the research bank of the people's Bank of China, director of green finance Specialized Committee in China Finance Association (Hexun Bond, 2016), “this rating system is very meaningful to classify the green degree on the basis of

judging whether the project is green or not. It can force enterprises to disclose relevant environmental information. This method system has strong foresight and professionalism, and can guarantee the high quality of green bond third-party evaluation and certification.”

Regional Authorities

Regional authorities, or local governments, including provincial, municipal governments and governments of autonomous regions, are the direct driver and incentive provider to promote local green bond market. Therefore, their actions and regulations are directly related to the green degree of local green bond market. As the downstream of the central government in the political system, they bear the pressure from environmental performance evaluation and also the requirements of green finance promotion (Central Committee of CPC & State Council, 2016). And under current circumstances, without achieving targeted environmental goals, the politician in charge will face the “name and shame” punishment and may even put an end to his/her political life.

It can be seen from local regulations and guidelines that regional authorities would provide policy preference based on local situation and local pillar industry, for example, the green agriculture in Huzhou, Zhejiang Province. However, the ranking for green degree was not introduced into the local regulation system, either.

3.2 Governance Trend of Green Bonds

As a policy or government driven country, policy trend plays an essential role in the development of an industry in China. From the perspective of supporting green financial development, China has carried out the exploration of the green finance field since the CBRC's Guidance on Energy Saving and Emission Reduction in 2007 (CBRC, 2007). In 2015, the Central Committee of CPC and the State Council issued the strategy and top-level design of the green financial system proposed in the Overall Plan for the Reform of the Ecological Civilization System (CPC & State Council, 2015), and all kinds of green financial products and tools including green bonds have entered the period of rapid development. In particular, in 2016, China's green bond market started from scratch and became one of the largest green bond markets in the world (CBI & CCDC, 2017).

There are mainly three types of policies related to green bonds: type one is macro policy and development strategy at national level concerning green development (seen in Table 3-5), which emphasizes the importance of greenness in economic development and hence provides motivations for the implementation of green financial system and green bonds; type two is green financial policy which directly provide guidance for green bonds implementation in practice (seen in Table 3-6); type three is policies and regulations published at local level providing direct incentives for green bond market promotion from a practical perspective (seen in Table 3-7).

3.2.1 Macro policy and development strategy

The macro policy and development strategy provided the initial motivations for municipalities to implement sustainability and environmental protection concept from a relatively high level.

There are two key organizations actively involved in the promotion of green bond market in China. As the core authority of the only governing party in China, the Central Committee of the Communist Party of China (CPC) has the authority and right to convene annual plenary session of the Central Committee to discuss recent major deployments and decisions (CPC,

2017); while the State Council is the executive organization of the highest state power organization and the highest state administrative organization (PRC, 2004).

Table 3-4 provided a review of relevant macro policy and development plan which are directly related to environmental protection and green finance from national level. As can be seen in Table 3-4, among 10 type one policies and strategies, 9 were published by the State Council and/or the Central Committee of CPC, almost covering all the top-level designed policies these years. Green development was regarded as “basic concept” in these policies, and the “promotion of green financial system” was mentioned several times as a key method to enhance sustainability and environmental protection, which provided strong signals for municipalities and local stakeholders to participate in the establishment of green financial system and the green bond market. Additionally, since the green development index was introduced government performance examination in 2016 (The Central Committee of CPC & The State Council, 2016), municipalities and local government officials would have stronger motivations and pay more attentions to the concept of sustainability, and therefore, the establishment of green financial system and green bond market at local level.

Table 3-4. Macro policy and development strategy concerning green development

Relevant departments	Policy/Project	Key information	Issuing date
State Council	Opinions of the State Council on strengthening the development of energy saving and environmental protection industries	“To strengthen the development of energy conservation and environmental protection industry, to stimulate investment and consumption, to form a new economic growth point, to promote the transformation of industrial upgrading and development, to promote energy conservation, emission reduction and improvement of the people's livelihood, to achieve sustainable economic development and to ensure a well-off society in 2020.”	Aug. 2013
State Council	Opinions on strengthening the management of local government debt	"In the public-private partnership (PPP) model, as special purpose vehicles (SPVs), it is proposed by private enterprises that undertake public sector work, such as infrastructure construction, to provide funds for the issuance of corporate bonds, project income bonds or asset backed securities to the infrastructure items. The public sector will set up appropriate infrastructure operation pricing and financial subsidies through the use of franchise. The difference between this model and the current local debt issuance mode is to enhance transparency and have direct and indirect local government guarantees. The debt paying responsibility under this PPP mode belongs to the private sector."	Sept. 2014

The Central Committee of CPC and the State Council	Opinions of the CPC Central Committee and the State Council on accelerating the construction of ecological civilization	“We should vigorously promote green development, circular development, low carbon development, develop and expand the ecological culture, promote green life and speed up the construction of beautiful China, and adhere to the basic way of green development, circular development and low carbon development.”	Apr. 2015
The Central Committee of CPC and the State Council	Overall plan for the reform of the ecological civilization system	"Establish a green financial system.... Establishing mandatory disclosure mechanism for environmental information of listed companies. Improve various guarantee mechanisms for energy saving, low-carbon and eco-environmental projects, and increase risk compensation efforts. Establish compulsory liability insurance system for environmental pollution in the field of environmental high risk. Establish green rating system and public welfare environmental cost accounting and impact assessment system. Actively promote various international cooperation in the field of green finance."	Sept. 2015
State Council	13th Five-Year Plan 2015	Innovation, coordination, green, development and sharing are considered as the "five concepts of development", and green development is regarded as a basic concept in "13th Five-Year Plan" period and even longer period of China's economic and social development.	Oct. 2015
The Central Committee of the Communist Party of China	Outline of the 13 th Five-Year plan for national economic and social development in People's Republic of China	"Establish a green financial system, develop green credit, green bonds, and set up green development funds."	Jul. 2016
State Council	Report on the Work of the Government	“We will make major efforts to develop green finance.”	Mar. 2017
The people's Bank of China, CBRC, CSRC, the China Insurance Regulatory Commission and the National Standards Committee	Development plan for standardization system of financial industry (2016-2020)	"Green finance standard chemical plant" is listed as a key project.	Jun. 2017

State Council	Fifth National Conference on financial work	“We encourage the development of green finance.”	Jun. 2017
The 19th National Congress of the CPC	Xi Jinping's report at the 19th National Congress of CPC	"We will step up efforts to establish a legal and policy framework that promotes green production and consumption, and promote a sound economic structure that facilitates green, low-carbon, and circular development. We will create a market-based system for green technology innovation, develop green finance, and spur the development of energy-saving and environmental protection industries as well as clean production and clean energy industries."	Oct. 2017

Note: reference list can be found in Appendix.

3.2.2 Green bond guidelines

Green finance policies and regulations provided a guideline for the issuance of green bonds, covering bond taxonomy, issuance auditing, annual auditing, information disclosure, etc. According to the Guidance on the development of green bonds (China Securities Regulatory Commission, 2017), green corporate bonds must be invested into green industrial projects, while the Guidelines for the issuance of green bonds (NDRC, 2015) and the Green bond support project directory (People's Bank of China, 2015) set the boundary and defined the taxonomy of green bonds, which was not fully aligned with current international standards, especially action that categorized the upgrading of thermal power into green industry. However, considering the current energy structure and environmental situation, climate change is not the only concern of China's sustainable development, therefore, it is reasonable to have a different taxonomy based on local situation (source from interviews).

Currently, the information disclosure of green bonds is usually on the basis of common bond information disclosure requirements, with additional requirements in green project compliance, the expected environmental benefits, fund management and information disclosure management system disclosure during issuance period. In the duration of green bonds, the information disclosure mainly concerns three modules: the use of raised funds, the progress and statue of targeted projects and the realization of environmental benefits. The third-party auditing agencies were encouraged to involve in the evaluation and certification during the issuance and duration period of green bonds. There are mainly three regulators in green bond market, i.e. the NDRC, China Interbank Trader Association (CITA), and CSRC and People's Bank of China.

Table 3-6 provided a review of regulation and standard guidelines for green bonds in China, providing detailed items for the green bond guidelines from abovementioned agencies, which illustrated a comprehensive regulating system of current green bond market in China with requirements from various regulators, setting the green category, clarifying the issuance process and requirements, and steering the involvement of relevant stakeholders.

Table 3-5. Green finance guidelines

Relevant departments	Policy/Project	Key information	Issuing date
CBRC	Notice of the China Banking Regulatory Commission (CBRC) on the submission of green credit Statistics	It provides the type of asset that meets the green bond issuance standard, but it does not provide a specific measure of green emission performance standard.	Feb. 2012
People's Bank of China, UNEP's sustainable financial project	Setting up a green financial working group	Participants include government departments, financial market participants, and Chinese and international experts working in green finance.	Aug. 2014
State Council	Opinions on strengthening the management of local government debt	"In the public-private partnership (PPP) model, as special purpose vehicles (SPVs), it is proposed by private enterprises that undertake public sector work, such as infrastructure construction, to provide funds for the issuance of corporate bonds, project income bonds or asset backed securities to the infrastructure items. The public sector will set up appropriate infrastructure operation pricing and financial subsidies through the use of franchise. The difference between this model and the current local debt issuance mode is to enhance transparency and have direct and indirect local government guarantees. The debt paying responsibility under this PPP mode belongs to the private sector."	Sept. 2014
National Development and Reform Commission	Guidelines for the issuance of green bonds	"Green bonds are mainly used to support the technical transformation of energy saving and emission reduction, green urbanization, clean and efficient utilization of energy, the development and utilization of new energy, the development of circular economy, water resources conservation and the development and utilization of unconventional water resources, pollution prevention and control, ecological agroforestry, energy saving and environmental protection industry, low carbon industry and ecological text, pilot demonstration, low-carbon pilot demonstration and other green circular low-carbon development projects."	Dec. 2015
People's Bank of China	Green bond support project directory	Supporting categories of projects: energy conservation; pollution prevention and	Dec. 2015

Relevant departments	Policy/Project	Key information	Issuing date
		control (pollution control, environmental remediation, coal cleaning); resource conservation and recycling; clean transportation; clean energy; ecological protection and adaptation to climate change.	
People's Bank of China, UNEP's sustainable financial project	Establishing China's green financial system	The founding meeting of the green finance Specialized Committee of China Finance Association and the report of the green finance working group were held.	Apr. 2015
The people's Bank of China & the Central Bank of Scotland	The establishment of the G20 Green Finance Research Group	Studying the experience of developing green finance in various countries, exploring the establishment of a global green financial system, and strengthening international cooperation in green finance.	Jan. 2017
The people's Bank of China, the Ministry of finance, the development and Reform Commission, the Ministry of environmental protection, the Banking Regulatory Commission, the Securities Regulatory Commission and the Insurance Regulatory Commission	Guidance on the construction of a green financial system	"Improve the relevant rules and regulations of green bonds and unify the definition standards of green bonds; take measures to reduce the financing cost of green bonds; study and explore the third party assessment and rating standards for green bonds; actively support the eligible green enterprises to finance and refinance, and support the opening of green bond index and green stock index; gradually establish and improve the mandatory environmental information disclosure system of listed companies and debt enterprises, and guide various institutional investors to invest in green financial products."	Aug. 2016
Beijing Financial Work Bureau, Beijing development and Reform Commission, Beijing banking regulatory bureau, central bank management department, etc.	Implementation of capital green financial system	It is clearly proposed to speed up the construction of green finance system based on green credit, green bond, green listed company, green fund, green insurance and carbon finance. It is the strategic direction of capital financial development and an important support for the construction of "high precision" economic structure.	Jan. 2017
China Securities Regulatory Commission	Guidance on the development of green bonds	"We should encourage local governments to make full use of various preferential policies, such as interest discount, financial subsidies, the establishment of green corporate bond investment funds and other preferential policies to support the development of green corporate bonds."	Mar. 2017

Relevant departments	Policy/Project	Key information	Issuing date
China interbank trader Association	Guidelines on green debt financing tools for Non-Financial Enterprises	Based on green bond principle (GBP) and other domestic and foreign green bond practice, based on the practice of interbank market, the four core mechanisms of green debt financing tools are clarified, including fund use, selection mechanism, special household management and information disclosure. It is clear that the association will encourage enterprises to register and issue green debt financing tools by opening up green channels for the registration and evaluation of the green debt financing instruments and unifying the signs of the registration notice. At the same time, the association also encouraged the issuer to submit an independent third-party certification authority, to encourage market making institutions to conduct market business of green debt financing tools in the two market and to improve the market liquidity of green debt financing tools.	Mar. 2017
Office of the national development and Reform Commission	Public-Private Partnership (PPP) project special bond issuance guidelines	"The listed companies and their subsidiaries are encouraged to issue special PPP project bonds, with a focus on the support of energy, transportation, water conservancy, environmental protection, agriculture, forestry, science and technology, secure housing projects, medical, health, pension, education, culture and other traditional infrastructure and public service areas."	May. 2017
State Council	Overall plan of green financial reform and innovation test area	The executive meeting of the State Council decided to select some areas of Zhejiang, Jiangxi, Guangdong, Guizhou and Xinjiang to build various green financial reform and innovation experimental areas with special emphasis and characteristics and explore the replicable experience on the system mechanism.	Jun. 2017
People's Bank of China & China Securities Regulatory Commission (CSRC)	Green bond assessment and certification behavior guidelines (temporary)	There are mainly five indicators used for green bond evaluation: whether the green project has been invested or not. whether the green project screening and decision-making system is effectively	Oct. 2017

Relevant departments	Policy/Project	Key information	Issuing date
		implemented; whether the green bond raising fund management system has been effectively implemented; whether the green information disclosure and reporting system is effectively implemented; whether the environmental benefits of green projects are expected to achieve.	

Note: reference list can be found in Appendix.

3.2.3 Incentives from regional authorities

Government regulatory authorities and Stock Exchanges have played a key role in promoting the development of green bonds. There were several challenges existing in the development of green bond market, which influenced the issuers’ desire for green bond issuance and investors’ trust and interests in green bonds, including (SynTao Green Finance & CBI, 2017):

- Lack of specific supportive policies for green bonds from local level
- Lack of understanding the green bond issuing process
- Some bond issuing companies and green projects have relatively low credit ratings
- Lack of green projects to promote green bonds issuance in specific and long-term ways from local level
- Lack of guided investment or demand support
- External certification causes additional costs for green bond issuers

Under this circumstance, at local level, many provincial and municipal governments have used incentives such as policy signals, facilitation measures, fiscal incentives and recognition to encourage the development of local green financial system and green bonds and to overcome the difficulties, in order to mature the regional green bond market.

Table 3-6 provided a compilation of policy tools used to promote green bonds from provincial and municipal levels, mainly concerning policy signals, facilitation measures, fiscal incentive and public recognition. Incentives in different regions differed due to local development situation and the authority’s decision.

For example, among all the regional authorities that provided incentives to green bonds, Huzhou is a demonstration which suit its measures to local conditions. Considering its position as “the birthplace of beautiful countryside and the ecological nourishing area of Taihu Valley”, it emphasized the development for green agriculture and green forest by giving more convenience for the issuance of green bonds in these aspects and providing more funding (Huzhou Municipal Government, 2017), which embedder the green awareness into the incentives based on local conditions.

Table 3-6. Policies from regional authorities related to green bonds

Province/City	Issuing agencies	Relevant document	Key information ¹	Issuing date
Beijing	Beijing Finance Bureau, the people's Bank of China, Beijing energy conservation and environmental protection center, etc.	Memorandum of cooperation initiated by green bond Alliance	Promoting cooperation within the scope of responsibilities to boost the issuance of green bonds by enterprises in the Beijing area.	Jul. 2015
Guiyan New District, Guizhou	Provincial Finance Office, Guiyang regulatory authority, China Insurance Regulatory Commission, Guiyang branch of the people's Bank of China	Development and construction of green financial port in western Guizhou New Area (2016-2017) 3-year action plan	Encouraging and supporting the development of green bonds and support overseas green bond issuance.	Oct. 2015
Guiyang, Guizhou	Provincial Finance Office, Guiyang regulatory authority, China Insurance Regulatory Commission, Guiyang branch of the people's Bank of China	Construction of Guiyang international financial center (2015-2017) three-year action plan	Actively introducing domestic and foreign capital development and application of green bonds and other green financial instruments.	Oct. 2015
Guiyan New District, Guizhou	Provincial Finance Office, Guiyang regulatory authority, China Insurance Regulatory Commission, Guiyang branch of the people's Bank of China	The overall plan of green finance reform and innovation pilot area in Guiyan New District, Guizhou Province	Accelerating the infrastructure construction of green financial port; accelerating the introduction and cultivation of financial institutions; innovating green financial products and services; improving the elements of green financial development	Oct. 2015
Huzhou, Xhejiang	Municipal government	Huzhou green financial reform and innovation five-year plan; Huzhou green financial reform and innovation 2016 action plan & Huzhou green financial statistical index system	"It is necessary to establish a directory of bond issuance and promote the issuance of green corporate bonds."	Apr. 2016

¹ In key information part, statements with quotation marks are directly cited and translated from original documents by the author, statements without quotation marks are descriptions based on the original documents and the author's personal interpretation.

Quzhou, Zhejiang	Municipal government	"Financing the green industry and greening the financial industry"	Quzhou has been established as a pilot city for comprehensive reform of green finance in Zhejiang Province, and the municipal government had set up a leading group for green finance.	Apr. 2016
Gansu	Bank of Gansu	Green industry project library	According to the catalogue of green bond supporting projects, the project database of green industry is selected and the enterprises in the province that meet the standards of green enterprises are selected.	Jun. 2016
Datong, Shanxi	Green Financial Work Coordination Group	Action plan to promote financial revitalization in 2016	"It is necessary to develop green finance"	Jun. 2016
Qinghai	The people's Bank of China, Xining central branch, provincial finance office and Qinghai Banking Regulatory Bureau	Opinions on strengthening environmental protection and financial integration to promote green development	Increasing support through green bonds tax exemption and raising green rating	Aug. 2016
Suzhou, Jiangsu	The people's Bank of China Suzhou central branch, the municipal finance office, the Municipal Economic Information Committee and the Municipal Environmental Protection Bureau	Interim Measures for assessing the performance of green banking in Suzhou's banking financial institutions	Putting the financing and green bonds issuance support for energy saving and environmental protection enterprises into the bank performance evaluation system.	Sept. 2016
Datong, Shanxi	Green Financial Work Coordination Group	The overall program outlines of Datong's Green Financial Development	The development of green finance requires product innovation and the introduction of green bonds and other financial products.	Sept. 2016
Ankang, Shaanxi	Municipal Government	Construction work plan of green financial demonstration city in Ankang City	It is needed to issue green bonds, reduce the financing cost of green bonds, support green bond issuance through professional guarantee and credit mechanism, and explore the third-party evaluation and rating mechanism of green bonds.	Nov. 2016
Xiamen, Fujian	Municipal Finance Office, banking regulatory bureau, Finance Bureau, Xiamen Central Branch of the people's	Opinions on promoting Xiamen's banking financial institutions to develop green finance	It requires that banks broaden their sources of funds by issuing green bonds and reduce the cost of financing. It is necessary to develop green bond market and encourage eligible enterprises to	Nov. 2016

	Bank of China		develop green bond financing tools.	
Guangdong	Provincial Environmental Protection Office, the people's Bank of China Guangzhou branch and the provincial finance office	Opinions on strengthening environmental protection and financial integration to promote green development	Supporting environment-friendly enterprises to carry out direct debt financing, and promote the issuance of green financial bonds.	Nov. 2016
Beijing	Municipal Government	Beijing's financial industry development plan during the 13th Five-Year period	It proposed to build a green financial system including green bonds, and put forward specific measures for the establishment of the system.	Dec. 2016
Inner Mogolian	Autonomous Regional People's Government	Opinions on the implementation of green financial system	Constructing green credit, green bonds and other diversified services, complementary green financial service system.	Feb. 2017
Inner Mongolia Autonomous Region	Autonomous Regional People's Government	Opinions on the implementation of green financial system	According to the definition standards of green bonds, the audit of environmental information of bond issuers should be strengthened. Third-party assessment is encouraged. All kinds of institutional investors, such as pension funds and insurance, are supposed to be guided to invest in the green bonds issued by the autonomous region enterprises. Eligible local financial institutions are encouraged to issue green financial bonds. Policy guarantee institutions are encouraged to guarantee corporate green bonds and reduce the financing cost of green bonds. Establish a green financing guarantee fund. With the advantage of Inner Mongolia as an important area of the "Silk Road Economic Belt", the financial institutions and enterprises in the area are supported by the region to issue green bonds abroad and attract international funds to invest in green financial assets such as bonds in the region.	Feb. 2017
Shanghai	Lujiazui Financial City Council green finance Specialized Committee, Lujiazui Green Finance Development Center	Research on the path of developing green finance in Shanghai	"Shanghai needs to further strengthen the policy support of green finance, cultivate the investors of green finance, promote the opening of the green securities market, cultivate the third-party certification body, and strengthen the environmental information	Mar. 2017

			disclosure, and carry out deep exploration and research."	
Futian District, Shenzhen	District People's Government Office	Opinions on promoting the rapid, healthy and innovative development of Futian District's financial technology	It is encouraged to use financial technology to improve the green financial system, and the construction of auditing and trading platform for green bonds based on block chain and intelligent contract technology; and the tax reduction for green bonds is 2%.	Mar. 2017
Zhongguancun, Beijing	Zhongguancun Management Committee of Beijing	Supportive fund management for promoting deep integration and innovative development of science, technology and finance in Zhongguancun national independent innovation demonstration zone	For the enterprises issuing green bonds, the subsidy is given by 40% of the coupon interest. The annual direct financing discount of the single enterprise was 1 million yuan as the upper limit, and the same financing discount for 3 years was the upper limit.	Apr. 2017
Yangzhou, Jiangsu	Yangzhou Central Branch of the people's Bank of China	Implementation rules for guiding opinions on the construction of green financial system	It will vigorously support corporate financial institutions to issue green financial bonds to support the accelerated development of green industries, and vigorously support eligible green enterprises to broaden financing channels by issuing bonds.	May. 2017
Fujian Province	Provincial government	Implementation scheme of green financial system construction in Fujian	1) Support green enterprise to issue bonds; introduce third party assessment; establish a mechanism that will help reduce the cost of issuing bond, such as guarantee and discount. 2) Encourage enterprises and financial institutions to issue green bonds; increase publicity on various kinds of enterprises' green bonds and strengthen the tracking of fund use; encourage third party organizations to study and issue relevant analysis reports; supports corporate financial institutions to issue green financial bonds. 3) Actively guide insurance institutions to serve green projects. Strengthen the docking with the asset management agencies of the major insurance companies, and promote the establishment of a green business department or professional team in Fujian, and provide funds for the key green projects through equity and creditor's rights. 4) Support Fujian Provincial Re-Guarantee	May. 2017

			Company to carry out green re-guarantee business and providing creditworthiness service for Fujian enterprises to issue green bonds.	
Ganjiang New District, Jiangxi	People's Government of Jiangxi Province	The overall plan of green finance reform and innovation pilot area in Ganjiang New District, Jiangxi	Constructing green financial organization system; innovating and developing green financial products and services; widening the financing channels for green industry; orderly exploring the construction of environmental rights and interests trading market; developing green insurance; ramming the green financial infrastructure; building a green golden financial development mechanism for the transformation and upgrading of the service industry; and establishing green financial risks. guarding mechanism	Jun. 2017
Hami, Changji, Karamay in Xinjiang	The people's Bank of China, NDRC, the Ministry of finance, the Ministry of environmental protection, the China Banking Regulatory Commission, the Securities Regulatory Commission and the CIRC	The pilot scheme for green financial reform and innovation system establishment in Hami, Changji and Karamay, Xinjiang Uygur Autonomous Region	Cultivating and developing green financial organization system; innovating and developing green financial products and services; supporting green industry to broaden financing channels; securing and orderly exploring the construction of environmental rights and interests trading market; consolidating the green financial infrastructure; building green financial services industry transformation and upgrading development machine system; establishing green finance to support small and medium-sized cities; developing and characteristic small towns' system and mechanism; constructing green financial risk prevention and resolution mechanism.	Jun. 2017
Guangzhou, Guangdong	Office of the people's Government of Huadu District, Guangzhou	Several measures to support green finance and green industry innovation and development in Huadu District,	Enterprises in the pilot area will benefit from many aspects, such as financial reward, listing support, industrial support, simplified examination and approval, and innovative services. Since 2017, Huadu will arrange 1 billion yuan per year for five years from	Jul. 2017

		Guangzhou	district finance to, support green finance and green industry development through green fund, green credit, green bonds, green insurance and so on. At the same time, green and fast approval channels, and innovate green financial products and services will be developed.	
Guiyang, Guizhou	General Office	Construction of green finance reform and innovation pilot area in Guian New District	Establish a green bond issuer bank before the end of the year, and continue to encourage and support eligible enterprises to issue green bonds. The provincial development and Reform Commission and the provincial finance department will continue to explore measures to reduce the cost of issuing and managing green bonds. The central government's policy is refined into a clear framework for the implementation of tasks. Set up a leading group on the green financial innovation and development work of Guizhou province.	Jul. 2017
Guangzhou, Guangdong	People's Government of Guangdong Province	General plan of constructing green finance reform and innovation pilot area in Guangzhou, Guangdong	Cultivating and developing green financial organization system; developing green financial products and services; supporting green industry to broaden financing channels; orderly exploring the construction of environmental rights and interests trading market; ramming the green financial infrastructure; strengthening the exchange and cooperation of green finance; constructing the transformation and upgrading of the leading industry of green financial services; and establishing green financial risk prevention and resolution mechanism.	Jun. 2017

Zhejiang	Huzhou Financial Work Office	The overall plan of green finance reform and innovation pilot area in Huzhou and Quzhou, Zhejiang	Building green financial organization system, speeding up the innovation of green financial products and service mode, widening the financing channels of green industry, steadily and orderly exploring to promote the construction of environmental rights and interests trading market, developing green insurance, establishing green credit system, strengthening the foreign exchange and cooperation of green finance, and building the upgrading and upgrading of green industry. developing and characteristic small towns' system and mechanism; constructing green financial risk prevention and resolution mechanism.	Jun. 2017
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3.3 An empirical case of clean energy projects

According to the information disclosure requirements for green bonds, relevant environmental benefit targets of green bonds should be contained in the auditing reports for issuance and annual auditing. For the disclosure and information transparency, completeness and precision, and comparability are requested (EIB & GFCCSFB, 2017).

According to the selection results stated in the Methodology chapter, only hydro power projects and wind farm projects were selected and evaluated in this study. Environmental benefits of targeted projects during operation stage were estimated according to *Guidelines for calculating energy saving and emission reduction of green credit projects (2013)*, which considered the emission difference for the same amount of electricity generated between clean energy sources and standard coal, calculated as:

$$\Delta_{coal} = kP + Q$$

$$\Delta_{CO_2} = k' \Delta_{coal}$$

Δ_{coal} : Reduce of standard coal consumption due to targeted projects, ton

k : coefficient of National standard coal consumption per kWh electricity generated in the last year, ton/kWh

P : The external power supply of the project, kWh

Q : Standard coal used for external heating, ton

Δ_{CO_2} : Carbon dioxide emission reduction, ton

k' : coefficient, usually adopt 2.4

Note: the equations above were translated and adapted from *Guidelines for calculating energy saving and emission reduction of green credit projects (2013)* (Chinese version) by the author, therefore, it is not the official version for translation and the credibility cannot be guaranteed.

3.3.1 Disclosed environmental benefits in prospectus

Relevant environmental performance indicators used in the auditing reports for cleaner energy projects mainly concerns the reduce of standard coal consumption, CO₂ emission reduction, dust emission, SO₂ emission reduction and NO_x emission reduction. Data were published and audited by third-party auditors. The environmental benefits of selected projects can be seen in Table 3-7, and the environmental benefits per kWh electricity generated or per billion CNY bond raised can be seen in Table 3-8, which provided a direct comparison between different projects.

It is illustrated in the tables that there were five wind power projects, with annual electricity generation ranging from 1.1*10⁸ kWh to 41.8*10⁸ kWh, with CO₂ emission reduction comparing to thermal power as 168±150*10⁴ t/y. Meanwhile, it is noteworthy that the emission reduction per 10⁸ kWh electricity generated is CO₂ 8.56±0.55 *10⁴ t/y, while the dust emission reduction, SO₂ emission reduction and NO_x reduction per 10⁸ kWh electricity generated were fluctuating dramatically, ignoring they were supposed to be calculated based on the same criteria.

For hydro power projects selected, since there were only 2 project data available, the fluctuation of emission reduction is not clear, but the average SO₂ and NO_x reduction values are significantly higher than the values of wind power projects.

The annual electricity generated per billion CNY bond raised differed a lot, however, considering the use of fund-raised included project construction, interest reimbursement, etc., it is difficult and meaningless to compare the emission reduction resulted from per billion invested. Additionally, only the operation stage was taken into account during the issuance of green bonds, leaving the impacts during construction and end-of-life periods.

Table 3-7. Environmental benefit targets of selected green bonds

Company	Bond value	Project Name	Annual electricity generated	CO ₂ Reduction	Dust Reduction	SO ₂ Reduction	NO _x Reduction
	Billion CNY		*10 ⁸ kWh	*10 ⁴ t/y	t/y	t/y	t/y
China Longyuan Power Group Co., Ltd.	6.0	Nanri Island Offshore wind farm in Putian, Fujian	14.16	117	/	11200	9686
		Zhumushan Wind farm in Qujing, Yunnan	3.59	39.4	190	1535	1017
		Qinnan 106MW wind power project in Qinzhou, Guangxi	2.53	21.95	10300	1277	724
		Yagongzhang Wind farm in Le'an, Jiangxi	1.36	12.161	5700	700	400
		Qihe Wind farm project in the ancient city of Lijiang, Yunnan	1.33	11.94	5600	694	394
		Langxi Wind farm (46.2MW) in Xuancheng, Anhui	1.04	9.21	4333	535	304
		Mudian Low-speed Wind farm (50.6MW) in Xuyi, Longyuan	1.14	9.37	4409	545	309
		Longyuan Xinfu Wind farm in Nanning, Guangxi	1.19	10.16	4781	591	335
		Goudaozui Wind farm (48.4MW) in Jiangxi	1.07	10.11	4760	588	334
		Wuqi Wind farm (50MW) in Shaanxi	1.05	11.56	5683	450	298
		Baima Wind farm (48.3MW) in Xuancheng, Anhui	1.04	9.32	4387	542	308
		Longyuan Kushui Wind farm (201MW) in Hami	4.41	42.5	1910	1581	1632
		Third Wind farm in Zone B, Hami, Xinjiang	6.85	73.75	363	2872	1904
Longyuan Alashankou River bass wind farm (49.5MW) in Xinjiang	1.04	9.09	45	354	235		

CGN New Energy Holdings Co., Ltd.	2.0	Chaohu Guanhu Wind farm (49.5MW)	1.28	9.49	12	64	58
		Chenhui Yadian Tengliang Wind farm (49.5MW)	1.26	10.87	12	63	57
		Hongji Wind farm (49.5MW) in Daqing	1.28	12.17	12	64	59
		Guazhougan River mouth wind farm (200MW) in Gansu	4.49	35.30	43	224	205
		Huanggainao Wind farm (200MW) in Guyuan	4.46	38.44	42	222	203
		Pingtian Dalian Offshore Wind farm (300MW)	9.31	69.21	88	464	424
		Bameng Wuliji Wind farm (49.5MW)	1.11	9.55	11	55	50
Huadian Fuxin Energy Corporation Limited	3.0	Suofengying Hydro power station	18.4	115.93	209	695	695
		Goupitan Hydro power station	73.2	461.67	831	2769	2769
		Silin Hydro power station	33.0	207.97	374	1247	1247
		Shantuo Hydro power station	36.8	231.99	417	1391	1391
		Ahai Hydro power station	74.0	466.46	839	2797	2797
		Liyuan Hydro power station	62.0	390.82	703	3445	3445
		Ludila Hydro power station	66.0	416.03	748	2496	2496
		Suzhou straw power generation project	2.0	13.5	/	/	/
China Energy Saving Wind Power Generation Co., Ltd.	0.5	Not specified in relevant prospectus	1.1	9.73	/	60	55
Datang Guoxin Bbinhai Offshore wind power Co., Ltd.	1.0	Binhai Offshore Wind farm (300MW) in Jiangsu	7.9	66	2400	4767	1899
		Limin Wind farm in Shuozhou	4.63	32.55	1500	2600	1500
		Pinglu Wind farm in Shuozhou	4.52	51.57	1400	2500	1400

		Wangqiying Wind farm in Fengning, Henan	7.71	64.37	153	559	1370
Xiehe Wind Power Investment Co., Ltd.	0.5	Nanzhao Huanghou Wind farm	2.12	16.98	72	487	551
		Yushan Wind farm	0.96	7.77	33	223	250
		Shengjingshan Wind farm in Jinmen	1.06	8.49	36	244	276
		Lixi Wind farm	0.89	7.21	31	207	234
		Jintang Wind farm	0.96	7.69	33	221	250
China Three Gorges Corporation	26.0	Wudongde Hydropower Station	389.1	3116.3	/	332000	93500
		Xiluodu Dam	610.0	4885.8	/	520000	147000
		Xiangjiaba Hydropower Station	332.3	2661.0	/	283000	80000

Source: relevant auditing reports of green bond issuance, seen in Appendix.

Table 3-8. Environmental targets of selected green bonds

Company	Bond value	Energy type	Item	Annual electricity generated	CO ₂ Reduction	Dust Reduction	SO ₂ Reduction	NO _x Reduction
	Billion CNY			*10 ⁸ kWh	*10 ⁴ t/y	t/y	t/y	t/y
China Longyuan Power Group Co., Ltd.	6	Wind power	total	41.8	387.52	52461	23464	17880
			per *10 ⁸ kwh	/	9.27	1255	561	428
			per billion CNY	7.0	64.59	8744	3911	2980
CGN New Energy Holdings Co., Ltd.	2	Wind power	total	23.2	185.03	220	1156	1056

			per *10 ⁸ kwh	/	7.98	9	50	46
			per billion CNY	11.6	92.52	110	578	528
Huadian Fuxin Energy Corporation Limited	3	Hydro power	total	365.4	2304.37	4121	14840	14840
			per *10 ⁸ kwh	/	6.31	178	640	640
			per billion CNY	121.8	768.12	1374	4947	4947
China Energy Saving Wind Power Generation Co., Ltd.	0.5	Wind power	total	1.1	9.73	/	60	55
			per *10 ⁸ kwh	/	8.85	/	55	50
			per billion CNY	2.2	19.46	/	120	110
Datang Guoxin Bbinhai Offshore wind power Co., Ltd.	1	Wind power	total	24.8	214.49	5453	10426	6169
			per *10 ⁸ kwh	/	8.66	220	421	249
			per billion CNY	24.8	214.49	5453	10426	6169
Xiehe Wind Power Investment Co., Ltd.	0.5	Wind power	total	6.0	48.14	205	1382	1561
			per *10 ⁸ kwh	/	8.04	34	231	261
			per billion CNY	12.0	96.28	410	2764	3122
China Three Gorges Corporation	26	Hydro power	total	1331.4	10663.10	/	1135000	320500
			per *10 ⁸ kwh	/	8.01	/	852	241
			per billion CNY	51.2	410.12	/	43654	12327

Source: caculateed based on Table 3-9.

3.3.2 Qualitative environmental impacts during life-cycle

During last decade, the pace of China's electric power construction continued to accelerate, and many indicators ranked first in the world. By the end of 2015, the total electricity consumption of the whole society reached 5.68 trillion kWh, and the power generation installed in China reached 1.53 billion kW, of which 320 million kW was generated by hydropower and 131 million kW by wind power (NDRC & NEA, 2016). While together with the rapid development of clean power supply, problems such as abandoning wind, abandoning light and abandoning water are prominent in some areas. Additionally, environmental and social impacts exist during the life-cycle of power plants, which are difficult to be quantified to make comparisons and hence not reflected in green bond evaluation and information disclosure system. Potential environmental impacts of wind farms and hydropower plants during life-cycle are described in the following section to provide a thorough and comprehensive understanding of impacts of green bond projects.

3.3.2.1 Wind power

According to LCAs focusing on the environmental impacts of wind farms, equipment production stage and farm construction can be regarded as the main source of environmental impacts, including indicators such as global warming potential, abiotic depletion, acidification potential, eutrophication potential, human toxicity potential, ozone layer depletion potential, terrestrial eco-toxicity potential, freshwater aquatic eco-toxicity potential, marine aquatic eco-toxicity potential and photochemical ozone creation potential (Xu et al., 2018 & Yang et al., 2018). Excusing quantitative data, potential environmental impacts of wind farm also include:

Visual pollution

Under the conditions of wind and sunlight, sunshine shakes on the rotating blade, and the shadow can cause the symptoms of vertigo, distraction and other symptoms, and affect the normal work and life (Furze, 2002). If wind turbines are arranged on both sides of highways, the rotating shadows and light reflections will affect the driver's vision, thus affecting driving safety (Sun, Wang, Li, & Ma, 2008). Also, the construction and existence of wind farms will disturb local scenery.

Electromagnetic radiation and interference

Electromagnetic radiation is mainly concentrated on the distributed arrangement of wind power generation equipment, transformers, transmission lines and so on. Electromagnetic interference is mainly reflected in the influence of television, broadcasting, communication and radar (Krug & Lewke, 2009).

Noise and vibration

The working principle of wind turbines is to turn gears through mechanical rotation by generating turbine blades to generate electricity. But the process of gears occlusion will produce vibration, resulting in noise, which may affects human and animal health (Kurpas, Mroczek, Karakiewicz, Kassolik, & Andrzejewski, 2013).

Ecological impacts

Ecological pollution is mainly manifested in earth fill and excavation, dust, land, vegetation rolling, solid waste, and domestic sewage and garbage during the construction process (Wang & Wang, 2016).

Chemical pollution

Chemical pollution mainly comes from oil pollution, equipment disassembly, refueling, oil replacement, cleaning, oil leaking, oil seepage and other accidents, especially in sea, lake, aquaculture areas (Ma et al., 2013).

3.3.2.2 Hydropower

It has been argued that large hydropower projects have a wide range of impacts on environment with long influencing period, complicated influencing factors, which are incomparable to other engineering projects. The effects of hydropower project on environment have both advantages and disadvantages while the practice of hydropower construction in China suggested that the impact of hydropower development on the environment is dominated by favorable effects considering its replacement of fossil fuels, but the adverse effects cannot be ignored and must be taken seriously (Editorial board of China Hydropower Project, 2000), especially in some areas with fragile ecosystem such as the Tibet Plateau and the Yunnan-Guizhou Plateau.

Inundation of the reservoir area

After the construction of hydropower plants, especially the dam, the water level raised. In the range of backwater, arable land, mineral deposits, historic sites are inundated, and the factories, railways, highways and facilities need to be removed; the residents need to migrate and the towns need to be moved.

Landslides and slump

The shear strength of the bunker decreases when the bank slope is soaked, and it may collapse due to loss of stability when the reservoir water level falls (Li, Fan, & Cheng, 2006). Large-scale bank collapse in the reservoir area will aggravate reservoir siltation, and landslides near the dam site will bring extremely adverse consequences to the normal construction and operation of the project (Zhou, Lu, & Yang, 2017).

Reservoir sedimentation

As the flow rate decreases after storage, the sediment carrying capacity decreases, which makes sediment grains gradually sink and coarsely deposit. Deposition will not only reduce the decline and prosperity, shorten the reservoir life, increase the submergence loss, but also affect the normal operation of power stations and shipping (Huang et al., 2017).

Change of ecosystem

The construction of the hydropower stations has a great impact on the ecological environment, including the ecosystem of the reservoir and the lower reaches of the land, the aquatic ecosystem of the river or the estuarine ecosystem. Reservoir inundation affects the survival of terrestrial plants and animals and destroys their living environment, and the habitat destroy of Green Peafowl (*Pavo muticus*) by Gegan Hydropower plant in Yunan is a typical example (Guokr, 2017). Besides, the change of water environment has a fatal impact on species, population, habitat and breeding place of rare and endangered underwater acoustic organisms. After the construction of Gezhouba Dam and the Three Gorges Dam, the passage of Chinese sturgeon (*Acipenser sinensis* Gray) into the upper reaches of the sturgeon was cut off (Yao, 2007).

Change of water quality

After the reservoir impounded, the decomposition of organisms in the reservoir area increased the fertility of the reservoir water, facilitated the propagation of microorganisms in the water, and was beneficial to the growth of fish (Bhatt & Khanal, 2012). However, if the depot is not thoroughly cleared, excessive organic matter decomposes at the bottom of the depot, absorbs oxygen from deep water and produces hydrogen sulfide, which can also deteriorate the water quality (Bhatt & Khanal, 2012).

Impacts on climate change

The reservoir forms certain water area, and the large water areas can change the microclimate in the vicinity (foggy, rainfall patterns, temperature variation and so on), and change the ecological balance in the vicinity of the hub (Mcphee et al., 2010).

Additionally, considering the methane and carbon dioxide emission during the construction stage and the climate effects due to plant loss, soil erosion (Gaudard, Gabbi, Bauder, & Romerio, 2016; Mukheibir & Pierre, 2013), some researchers suggested that the life-cycle greenhouse gas emission per kilowatt-hour electricity generated of hydropower is similar to natural gas, for large hydropower station built in tropical areas or temperate peatlands, the emission can be even higher (USC, n.d.), which means the climate change effect of hydropower projects may be even higher than fossil fuel plants, especially large plants in tropical areas or temperate peatlands, therefore, the greenness of hydropower projects should be further questioned.

Induced earthquake

Since the 1960s, many large reservoirs in the world have experienced earthquakes after impoundment (Xiaojun & Tao, 2009). Generally, there are recent active geological structures in the reservoir area that induces earthquakes, with high geostress and local stress concentration. When the reservoir is impounded, the pore water pressure in the stratum increases, which changes the stress state of the original stable rock mass and enhances the block activity (Haselsteiner, Heimerl, Arch, & Kohler, 2009). However, there is no scientific research showing direct causal connection between hydropower plant construction and earthquakes.

3.3.2.3 Summary

Any human activities would have impacts on the environment and ecosystem, clean energy projects such as wind farms and hydropower plants cannot be an exemption. It cannot be denied that using clean energy sources or renewable energy sources greatly reduced climate change potential during the operation stage, however, it does not mean that other environmental impacts during the life-cycle are not important – researches suggested that the greenhouse gas emission of hydropower plant during life-cycle can compensate the carbon emission reduction in an operation period of 1 to 2 years (Zhang, Karney, Maclean, & Feng, 2007), while it can be around 0.5 year for wind farm (Yang et al., 2018).

Additionally, from the case of green bond projects related to green bonds, it can be seen that there are problems existing in the information disclosure section, among which two are very significant:

1. Not all important indicators are included in the disclosure requirement system

2. Not all issuers would disclose their environmental information

Green bonds, as the financial tool to raise funds and therefore promote environmental protection and sustainability, cannot neglect its essence as a financial instrument, namely profit seeking. Therefore, indicators or impacts that cannot be quantified to provide potential investors with intuitionistic comparisons and understanding probably will not be put into disclosure system.

Green bond issuers who are seeking for funds have low willingness to disclose their environmental impacts. Meanwhile, there is a lack of adequate incentives or punishment to non-compliance of disclosure requirements. Under this circumstance, parts of the issuers chose not to provide their environmental information to the public.

4 Discussion and Analysis

The overall situation and development of China's green bonds are prosperous and promising:

From the top-level design, China now advocates five major development concepts and especially green development, which provided strong motivations for municipalities and companies to explore green financial system in order to promote sustainability; while local governments hope to finance the infrastructure construction and industrial upgrading in cities through green bonds, hence incentives were raised to support and encourage the green bond market from provincial and municipal level. Additionally, since the issuance of green bonds in many ways reflects the sense of responsibility of enterprises, some enterprises in green industries want to issue green bonds, to establish a beneficial image of enterprises.

Meanwhile, problems are still existing in current system. On the one hand, relevant governance system for monitoring is not well-established, leading to the situation where there is a lack of laws and regulations to abide by and non-compliance are not prosecuted concerning information disclosure and fund use in green bond market, additionally, there is limited requirements related to the degree of green for green bond projects; on the other hand, the third-party auditing market is imperfect, which resulted in the credibility issue of auditing reports. Therefore, improvement should be promoted to assure the green degree and credibility of green bond market in China.

4.1 Stakeholders and Their Roles

Among five key stakeholders, issuers are the one whose desire and willingness for greenness can be directly reflected on the real performance of targeted green bond projects considering its connection and relation with actors in the practice. The upper limit of green level in certain industries would set a boundary for the greenness of targeted projects, while the lower limit of a project's green level depends on the design, implementation and maintenance of the project, which are influenced by the governance system and issuer's willingness.

Considering the core value of green bonds, which is to raise funds for projects with environmental benefits, the issuers are supposed to have high awareness of enhancing greenness throughout their projects. However, according to the empirical case study concerning clean energy power plant construction, out of 11 green corporate bonds selected, only 7 had information disclosure related to their designed environmental benefits, and no reports illustrated potential negative environmental impacts resulted from projects construction, which shows relatively low awareness of environment protection and a lack of transparency, leading to the accusation of greenwashing.

Therefore, with the relatively low desire of green bond issuers to be green, it is difficult to request the downstream actors to work together to promote greenness.

Investors, as another important driving force, would promote greenness of green bond market through preferential investment decisions towards projects with higher environmental benefits. Institutional investors looking for ESG criteria from environmental consultant to make greener investment decision may in the other way push green bond issuers and actors in the green projects towards higher green level for more funding.

Essentially, the greenness shall be enforced by the governance system, otherwise it will not come itself. Therefore, regulators shall cooperate with other stakeholders to set a clear definition for greenness and establish a governance system to be followed. Lessons can be

learned from current GBP and CBI system to provide definition, requirements and a monitoring system. Also, as the direct incentive providers, regional authorities can provide more preferential incentives to projects with higher green level, so as to encourage and influence issuer’s desire of being green.

4.2 Motivation - Incentive - Information - Supervision Analysis

In this study, the Motivation – Information – Incentive framework was used to evaluate the policy system related to green bonds so as to understand the strength and weakness of current design for green bond system in China.

4.2.1 Motivation

Motivation is generally considered in psychology to be concerned with the origin, direction, intensity and continuity of behaviour (Geen, 1995), while in this paper, motivation refers to the initial preference of local governments in their behaviour before considering the incentives and constraints from the central government.

It can be seen from the national strategy that as one of the “five concepts of development” (State Council, 2015), sustainable development or green development has been raised to an essential position for the country’s future. Under this circumstance, green finance was promoted to facilitated “green, low-carbon, and circular development” (Xi, 2017), and the establishment of green financial system was raised in the Overall plan for the reform of the ecological civilization system (CCCPC & State council, 2015). With the explicit policies and strategies from the central government, local governments would have strong willingness to actively implement relevant policies and conduct actions, considering the private interests of local governments (Tang & Chen, 2017). Therefore, in this case, no matter whether the central government's information monitoring channels are smooth or not, regional authorities will carry out spontaneous execution (Tang & Chen, 2017).

4.2.2 Incentive

Current incentives from local governments provided convenience for green bond issuance in all aspects from simplifying the procedures to giving direct subsidies, while different provinces or municipals have different preferential policies, i.e. there is no standardized or unified incentive system in national level. The trials of local incentives are compiled and concluded as follows:

Table 4-1. Policy tools for local government to encourage green bonds

Incentive type	Policy instrument	Policy description
Policy signals	Special documents	Issue special documents to encourage green bonds
	Special working group	Set up special working groups to support green bonds.
	Green bond pilot zone	Set up green bond pilot zones
Facilitation measures	Green pathways	Provide fast pathways for green bonds issuance, simplify the application procedures and give priority during application process
	Project library	Establish green bonds issuing project library, strengthen qualified project reserves

	Forums	Hold green bond forum, training or project meeting to encourage and support green bond issuance
	Stimulating financing demand	Promote the green transformation of local economy and stimulate the demand for green financing
Fiscal incentive	Cost sharing	Share issuance costs by offering grants, guarantee subsidies and discount bonds.
	Credit enhancement	Enhance credit through guarantee funds, bond portfolios and special construction fund portfolios.
	Tax deduction and exemption	Within central policy framework, tax breaks are offered to issuers and investors.
	Guided investment	Introduce government capital into green bond market to encourage market investment in green bonds
Recognition	Recognition for institutions	Commend the issuer and the participating agencies
	Green label	Provide green label for green bonds
	Media coverage	Organize media reports on green bonds and relevant projects
	Inclusion in evaluation indicators	Introduce green bonds in performance evaluation system

Source: SynTao Green Finance & CBI, 2017

Note: This table is translated by the author based on SynTao Green Finance & CBI, 2017, the description is adjusted according to the author's observation and understanding.

Among all the regional authorities that provided incentives to green bonds, Huzhou is a demonstration which suit its measures to local conditions. Considering its position as “the birthplace of beautiful countryside and the ecological nourishing area of Taihu Valley”, it emphasized the development for green agriculture and green forest by giving more convenience for the issuance of green bonds in these aspects and providing more funding (Huzhou Municipal Government, 2017), which embedder the green awareness into the incentives based on local conditions.

However, issues in local government’s incentive system still exist, which mainly concerns:

(1) Insufficient incentives and details.

Currently, the local governments do not have launched enough substantial financial incentives, or there is no sufficient detail for specific financial incentives. For example, it was mentions in the Opinions on strengthening environmental protection and financial integration to promote green development in Qinghai that there would be “green bond tax exemption” (People’s Bank of China et al., 2016), however, details were not provided how much and by what means the tax exemption would be conducted.

(2) Lack of differentiation between projects with different green degree.

In most cases, incentive measures do not distinguish the "green degree" of the project. The degree of subsidy has only been differentiated according to the place of ownership. For example, Futian District Government passed a resolution to issue a 2% discount on each enterprise's dual-venture and green bonds and a 1% discount on the central institution (Futian District People's Government Office, 2017), which did not differentiate various types of green projects and provided preferential trend for projects with higher green degree.

4.2.3 Information

Information communication in this system concerns three sources, i.e. central government, municipalities and companies. This study has a specific focus on information concerning bond issuers, i.e. information disclosure requirements on issuers and relevant implementation.

Considering the multi-regulator system and their independent requirements for information disclosure, difference exists in the information disclosure requirements among three regulators, concerning:

(1) Whether the green bond info disclosure is distinguished from common bonds

NDRC did not have special requirements for the information disclosure of green corporate bonds. Issuers only need to follow the general disclosure rules of corporate bonds according to "Information Disclosure Guidelines for Corporate Bond Issuance" (NDRC, 2015).

(2) The scope of information disclosure

The information disclosure scope from CITA covers green industry project category, project identification basis or standard, environmental benefit targets, etc. (CITA, 2017), while the People's Bank of China and CSRC put forward the requirements of the issuer to disclose the criteria for project screening, the plan for fund use and the management system (People's Bank of China & CSRC, 2017).

(3) The requirements for the disclosure time nodes and forms

The People's Bank of China has made clear requirements for the time node, the categories of information documents and the content of disclosure, but it did not explain the details of the disclosure (People's Bank of China & CSRC, 2017). CITA has made a relatively clear description of the information disclosure content, form and disclosure place of the green bonds. A disclosure table was provided directly by CITA (CITA, 2017), which added the practicality in green bond disclosure process.

The requirements for issuance of certification information is not perfect in current green bond system in China. Although the People's Bank of China has clearly pointed out that the issuers should regularly disclose information, including the use of funds, in other trading markets, such as green bonds qualified by NDRC (NDRC, 2015), the requirements are not so clear, and information that needs to be disclosed is not clear and standardized. Additionally, from the case of green bonds for clean energy, it can be seen that not all issuers followed the instructions for information disclosure in real practice. With a relatively low disclose rate, not all significant and typical environmental information was contained in the reporting system. In general, there are two problems existing in current information system:

(1) The quality of disclosure needs to be improved.

The overall information disclosure degree of environmental benefit part is relatively low. The majority of green bonds mentioned in this study have a rough description of the investment direction of the fund raised, such as “the fund raised is put on schedule, the use has not been changed”, and the description of the project only lists the name of the project, without further detailed information.

(2) The form of disclosure needs to be standardized.

Information disclosure of green bonds is quite different in content and form according to different guidelines, which made it difficult to compare the green degree of green bonds approved by different agencies. For example, on the basis of the “Guidelines on green debt financing tools for Non-Financial Enterprises” issued by the Association of Dealers in 2017, green corporate bonds have not yet made mandatory special requirements for information disclosure of the overall progress of the project and have relatively lower requirements for environmental benefit disclosure. Additionally, the existing green bond information disclosure approaches are not the same, some were disclosed in the general annual report, some have targeted special disclosure reports, and there are no standardized disclosure form requirements for environmental benefits in general annual report, which made it difficult for potential investors to track, and required further standardization.

4.2.4 Supervision

Supervision in this system is separated into two parts: regulators from the government side and auditors in the market. The regulators focus more on the market access, rating, etc. during the issuance process and provide approval, while auditors tend to provide certifications during the life-cycle of green bonds.

The significance of introducing third-party certification and rating is manifold: firstly, to maintain the reputation of green bonds as a “green financing tool”; secondly, to help green enterprises gain reputation through rating and certification, and at the same time to restrain the impulse of enterprises to engage in potential pollution activities; thirdly, to force enterprises to strengthen environmental information disclosure; fourthly, to provide a reference for the government's incentive mechanism for green finance such as guarantees, discounts (Ma, 2016). However, problems are still existing in the following aspects:

(1) Conflict and inconsistency in standards among multi-regulators

There are 5 official organizations involved in the supervision for green bond issuance, among which the NDRC, CITA, CSBR & People's Bank of China dominate green bond issuance approval. However, there are conflict and inconsistency existing in their green bond project category and information disclosure requirements, which means although bonds approved by different department are all labelled as green bonds, the green degree behind each bond may differ.

(2) There is no audit procedure or format specified by law.

Current political trend in China is streamlining government and delegating authorities, and making the market to play its role. Therefore, at present, it is encouraged to find a third-party auditor to conduct the assessment and certification of green bonds issuance. Although there are guidelines such as the “Green bond assessment and certification behavior guidelines (temporary)”, they are not fully legally binding and not standardized, which added difficulties on the certification process. Two problems are the main concerns in this field, first, in

principle, it is acceptable for all bond issuers to employ any appraisal agency for certification appraisal, because there is no threshold and qualification requirement for evaluation agencies. Second, the reports issued by these evaluation agencies are not uniformly defined. They are all evaluated according to their own system.

(3) Lack of punishment or penalty against non-compliance

Additionally, there is no punishment or penalty for non-compliance existing in the gap between commitment and reality in terms of environmental benefits and fund use, which decrease the authority of guidelines and credibility of green certificate.

5 Conclusions

Green bonds are facing its prosperity in international and China's bond market, and becoming increasingly important in the fund raise process for environmental protection related projects and other public facility construction projects, with the initial objective to promote environmental protection and sustainability. Therefore, with the overarching aim of financing green project and further meeting the demand of international market for external investment, the green degree of green bond is an important topic, while not many researches dived into the assessment of designed green degree of green bond system.

Meanwhile, the profitability of a project is still the core consideration factor that determines whether an enterprise wishes to issue green bonds. Under this circumstance, the motivation of issuing green bonds is not directly related to the green degree of the project itself; even if the project itself can produce adequate environmental benefits, without bringing income and profits to the enterprise, the vast majority of enterprises will not invest in such projects. Therefore, the governors should improve the governance system to enhance compliance and use financial incentives to influence the cash flow of issuers, so as to promote the green degree of green bonds in China.

Based on literature review and interviews, this study defined five key stakeholders in green bond market in China, i.e. bond issuers, potential investors, regulators and auditors, and regional authorities. The **regulators** are the primary driving force for greenness promotion, while bond **issuers** are directly related to the implemented green level. **Investors** can use their investment preference towards green projects to influence the green degree of green bond market; **auditors** play a role in the maintenance and monitoring of green degree; and **regional authorities** are the direct incentive providers.

Essentially, the greenness shall be enforced by the government, otherwise it will not come itself., therefore, regulators provided a **clear motivation** for regional authorities to promote the development of green bond market; in provincial and municipal level, various **incentives** were offered depending on local situation to make it more convenient and practical for enterprises to issue green bonds, however, the incentives were not dependent on the green degree of green bonds but rather other non-environmental issues such as bond scale, company's register location, etc., which cannot provide enough promoting mechanism for green bond to be greener; different agencies set inconsistent non-mandatory requirements for **information disclosure** of green bonds, the regulation system for disclosure requirements is incomplete, while the practice of information disclosure by issuers is not satisfying, additionally, non-compliance did not receive punishment or penalty; the **supervision** system for green bonds is immature without complete regulation system and perfect and integrated auditing market, no specific requirements nor regulations have been set for the qualification of auditors, which has a negative impact on credibility of third-party certification.

Combining problems existing in current green bond market in China and external experience, and taking the stakeholders and their roles into consideration, this study drew recommendations in the following aspects, concerning the incentives from regional authorities, information disclosure requirements for issuers, and supervision from regulators and auditors, to help improve the green degree of China's green bond governance system.

Incentives

Incentives are essential to encourage green projects or enterprises in green industry to issue green bonds. However, incentives for green bonds are difficult to manage, and green projects and high-quality green enterprises need to be seriously identified. Therefore, as the direct incentive provider, it is necessary for **regional authorities** to provide unified incentives model, while remain variety concerning geographical difference. Also, preferential policy shall be provided to projects and industry with higher green level rather than equal support for all projects.

Information

Information asymmetry is one of the factors hindering the expansion of investment, especially green bonds. Strengthening the quality of environmental information disclosure of green bonds and listed companies plays an important role in cultivating and meeting the needs of responsible investors and promoting the further standardization of green bond market. In order to further improve environmental information disclosure system, the following suggestions from 3 aspects were put forward, i.e. monitoring system, external supervision and market construction.

(1) Unify and refine information disclosure standards and strengthen information disclosure guidelines

Disclosure requirements of different types of green bonds lead to uneven information disclosure of the overall scope of green bonds, details, disclosure forms and other aspects. Therefore, it is suggested that the **regulators** in this system cooperate to promulgate guidelines or norms for information disclosure of green bonds to avoid conflicts between different guidelines, introduce more detailed disclosure standards on information disclosure content, format, time period and so on, strengthen information disclosure guidelines, and further standardize information disclosure of green bond market. Additionally, when there is a lack of effective and reliable assessment of quantitative data, comparable qualitative information can be used to disclose further environmental benefits.

(2) Further clarify the obligations of green bond issuers to disclose environmental information

Due to current voluntary nature of information disclosure requirements, not all green bond issuers are willing to conduct disclosure. A better information disclosure system in green bond market requires gradual promotion for the obligation of compulsory disclosure of environmental information and strengthening the awareness of bond **issuers** to implement environmental information disclosure. It would also enhance this system by encouraging separate publication of social responsibility reports to disclose environmental information and engaging professional third-party **auditors** to certify social responsibility reports.

(3) Strengthen relevance of environmental information and market to stimulate the internal driving force of environmental information disclosure.

Currently, the environmental performance and relevant information disclosure is not directly related to or reflected on the operational and financial statue of a company. While to some extent, the information disclosure of green bonds reflects the performance of the company's environment and corporate governance, which is part of green rating. By establishing positive and negative lists and green ratings of environmental performance, linking the results of lists or ratings with the investment targets of institutional responsible investors, it

can guide the flow of social capital into projects with higher green level, hence improving the correlation between environmental information disclosure of issuers and the market performance, so as to reach the target of raising issuers' awareness in environmental information disclosure.

Supervision

The primary causes for the weakness of supervision in green bond market can be concluded as the institutional system is imperfect and the market is not yet fully formed. Therefore, potential solutions may concern:

(1) Intensify policy guidance and improve laws and regulations.

As mentioned in Section 4.1.4, relevant policy system has a problem of incomplete content, and a lack of practicality. In this regard, **central government** and **regional authorities** should cooperate to introduce detailed policies and practice guidelines in terms of environmental information disclosure and project implementation, including disclosure form, frequency, disclosure channel, etc. Punishment or penalty should also be introduced into this system in case of non-compliance, so as to reach the request of government governed by law, "there are laws to abide by in all administrative law enforcement activities in the government, the laws must be observed and strictly enforced, and law-breakers must be prosecuted" (Central Committee of CPC, 1978).

(2) Strengthen the market construction of auditing.

Regulators can further standardize the content of third-party certification and evaluation, strengthen the third-party green certification and evaluation of green bond maturity on the quality of green bond information disclosure, and play a better role in supervision and guidance to issuers and investors. There are three aspects the regulators should set requirements on the auditors:

- Auditors' capacity of evaluating green degree;
- Barriers to entry the auditing market and qualifications; and
- Methods to avoid malign competition.

Additionally, auditors can suggest possible green degree evaluation system within certain industry, to increase comparability between projects under same category and provide potential investors a more direct result showing the environmental impacts.

From the author's personal understanding based on this thesis project, the green level of China's green bond market is not high enough as it was supposed to be and it was not the key consideration of several essential stakeholders. But still, it helped to mitigate certain environmental impacts considering its role in financing green projects. Besides, efforts are put into its improvement mainly from the regulators and regional authorities. The author held a positive attitude towards its future development but also recognized there was still a long way to go.

This study provided a first analysis of stakeholders' role in promoting greenness in China's green bond market, and also a first review of China's green bond governance to explore its designed green degree from four perspectives, and a case study of the environmental impacts resulted from clean energy related green bonds was conducted to further understand the

potential negative environmental impacts behind current green bond information disclosure system. However, since green bonds in China are relatively new and the majority of funded projects are still under construction, no research has been conducted on the real environmental performance of green bond projects, which can be improved in future researches. Besides, this study mainly focused on the potential improvement from policy makers' perspective, while bond issuers and investors also play important roles in this system, therefore, future study may also explore potential improvement from the perspectives of bond issuers and investors to draw a full picture of this system.

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