Can Green Bonds Help Air Pollution Mitigation in China?

Potential and Challenges

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May, 2014 in Monterey

Abstract

This paper aims to examine the potential of green bond implementation in China suited with Chinese air pollution situation. It researched the green bond origination, history, defininationand categories and so on. The paper applied literature review, case study and internview methods to purpue a conclusion.

Since the financial crisis, many countries are exploring how to re-engineer the financial system integrating sustainability, social responsibility and environmental factors. Green bonds are one of the forms of investment with an environmental focus. China is a country with both large amounts of financial capital and severe environmental issues. Pursuing economic development in a sustainable manner is a crucial topic for emerging market economies, such as China. One of the most vicious environmental issues that cause direct damage to human health is the air pollution problem, which has worsened in recent years.

This paper focuses on the outdoor air pollution in China, which has significant adverse impact on residents' health and the country's overall economic development. The main source of outdoor air pollution in China is industrial coal burning. And to reduce the industrial coal burning, there are three main solutions: increase renewable energy use, improve energy efficiency and enhance clean production. Cases from the World Bank and IFC on green bond issuance and their proceed use show evidential facts that green bonds could help air pollution mitigation by providing financial resources for energy efficiency, for the energy conservation sector and for leveraging more capital flow into the environmental area.

Green bond implementation in China could potentially contribute two positives: on the one hand, green bonds could help solve the financial resource shortage for mitigating the air pollution problem; on the other hand, they can add to the environmental finance products' diversities. This paper explores the potential and the challenges of green bond issuance in China based on a key question: can green bonds help air pollution mitigation? By studying the green bond product (concept, feature, proceed use) and bond market, and analyzing the financial need for air pollution mitigation in China, we can conclude a positive answer to the question proposed.

Keywords: Green bond, Air pollution, Sustainable finance, Mitigation, Policy reforms

Executive Summary

'Green bond' refers to any bond whose proceed is used for environemtnally friendly project in this paper. It originated around 2007 and is a new concept in the sustainable finance field. Parties like supranational organizations, such as the World Bank, governments and corporations are the main issuers for green bond in the current market. As the bond market is an important component of the financial system leveraging optimal capital use, green bonds could be a strong instrument to leverage private finance into the 'green' sector. To date, the green bond market is still accounting for a small portion of the global bond market. Yet the green bond market is growing rapidly, as the result of both increased interest from the financial market and public institutions' promotion.

China, as the leading economic body in the emerging market, confronts both severe domestic environmental problems and international pressure. The air pollution in China is especially stringent. It is damaging health, food supply, tourism and economic development. While the air quality continues to worsen and the government faces public criticism, more proactive solutions ought to be taken into place. The emergent air pollution problem needs strong financial back up to tackle the matter.

There is enormous space to explore the potential and challenges for green bond issuance in China mitigating the air pollution.There is a vast interest and development potential in China for environmental finance tools, such as green bond. Government, enterprize, finance market, public opinion and investors generate demand and incentives for green bond issuance.

International case studies of energy efficiency projects in China from the existing green bond market showcase that green bond is an efficient mechanism channeling private capital to environmental area. Besides its direct and notable impact on energy efficiency improvement and energy conservation, green bond also helps mobilizing more financial resourse into broader environmental sectors. The existing green bond programme facilitated the development of businessline in Chinese financial institutions for financing green proejcts, such as Minsheng Bank's green loan to energy saving industry.

While the research demonstrates vast potential interest and need for green bond implementation in China, there is a series of issues need to be aware of. Green bond, as a financial instrument, is not of perfection itself. For instance, the financial yield of green bond is not necessarily higher than other financial products besides the green campaign. There are existing risks of green bond investment. As a green label for investors, it is a double-edged sword. The investor faces reputation risk when the green project failed to deliver the expected outcome in terms of environment protection. There is no fixed definition for green bond and the green bond market is lack of transparency. Whereas the relevant stakeholder bear the demand and incentives for green bond implementation, the domestic awareness and knowhow about green bond is still at an early stage. And the current Chinese finance market is not yet mature and sophisticated enough for issuing green bond. The corporate bond market just witnessed its first default of a solar energy company this year. To carry on the next step, a favorable market environment for green bond issuance needs commensurate innovative policies, such as to form a set of clear environmental standards in order to guide the financial institutions and enterprises' environmental practice.

Table of Contents

List of Figures

List of Tables

Abbreviations

ADB	Asian Development Bank
AfDB	African Development Bank
ASIFMA	Asia Securities Industry & Financial Markets Association
CCER	China Certified Emission Reduction
CECC	China Energy Conservation Center
CGN	China Guangdong Nuclear Power Group
CICERO	Center for International Climate and Environmental Research University of Oslo
CSRC	China Securities Regulation Committee
CUFE	China University of Finance and Economics
DRC	Development and Research Center
EBRD	European Bank for Reconstruction and Development
EDF	Electricite de France
EIB	European Investment Bank
EPLA	Environmental Pollution Liability Insurance
ESAP	Environmental and Social Action Plan
ESPS	Environmental and Social Review Summary
ESRD	Environment and Social Review Document
ESRR	Environment and Social Risk Rating
EXIM	Export-Import Bank of China
FYP	Five Year Plan
GBP	Green Bond Principles
GDP	Gross Domestic Product
GHGs	Greenhouse Gas
HTAC	High Temperature Air Combustion
IEA	International Energy Agency
IFC	International Finance Corporation
JUCCCE	Joint US-China Collaboration on Clean Energy
LESS	Lead Environmental and Social Specialist
MOF	Ministry of Finance
NAFMII	National Association of Financial Market Institutional Investors
WB	World Bank
WHO	World Health Organization
OECD	Organization of Economic Development and Cooperation
PBOC	People's Bank of China
QFII	Qualified Foreign Institutional Investors
SEB	Skandinaviska Enskilda Banken AB
SMEs	Small and Medium size Enterprises
SOE	State Owned Enterprise

SPD	Shanghai Pufa Development Bank
SPV	Special Purposed Vehicle
SSgA	States Street global Advisors
TIAA-CREF	Teachers Insurance and Annuity Association-College Retirement Equities Fund
UN	United Nations

1 Introduction

1.1 Background

1.1.1 Green Bond Definition

There is no unified definition of green bond in the world to date and there are different descriptions about it. The World Bank defines green bonds as 'bonds for which the proceeds are used to support projects aimed at tackling the causes and consequences of climate change' (World Bank, 2012); while others describe green bonds as 'fixed-income financial mechanisms which use the capital raised to fund projects with environmental benefits' (Sustainable Prosperity, 2012). There may be some confusion when differentiating between 'climate bonds' and 'green bond', as many think they are identical (DeMates, 2014). The majority of green bonds issued so far are used for climate change mitigation and adaptation on low carbon economy development, renewable energy, energy efficiency, forest management, urban transportation, flood prevention, mass transit and so on (World Bank, 2014b). However, the existing climate-themed bond market is much larger than the 'labeled' green bond market. The green bond concept could go far beyond climate mitigation and adaptation purposes to other environmental objectives, such as waste management and water purification. In this paper, a broader green bond concept will be taken at the measure of whether the bond's purpose is to serve a low carbon economy transition and environmental purpose. Therefore, in this paper, the term 'climate bond'is covered by the 'green bond' concept (Caldecott, 2011).

1.1.2 Air Pollution in China

Air pollution is causing an increasing number of dramatic occurrences of deaths in China year by year. Besides direct damage to human health, it further exacerbates food security and economic growth. One statement from the Chinese Ministry of Environment in 2013 indicated that only three of the seventy four Chinese cities' air quality monitored by the central government met the minimum standards (See Appendix 3: 2013: Annual Average PM2.5 Concentrations of 74 Chinese Cities). This air pollution is causing foreign intellectuals and tourists to leave and will eventually deteriorate Chinese economic growth (Wong, 2014). The Chinese government has listed solving the pollution problem as one of the nine 'major tasks in 2014' (Tatlow K., 2014).

Urgent action is needed to deal with the air pollution issue in China. In 2013, the national government formed a comprehensive 'Air Pollution Prevention Action Plan' to tackle the issue.

1.2 Problem Statement

As one of the developing countries with most rapid growth, Chinese regulators are pushing a green market reform in the finance sector to steer sustainable economic growth (Kidney, 2013). The green finance's current development situation in China could be perceived from three aspects: banking (green credit), insurance (environmental pollution liability insurance), and securities (emission trading market). Yet each aspect faces certain issues for future growth, to name a few:

- a system for monitoring, reporting and verifying has not been established for green meaurement;

- there is no sufficient pressure from the law or law enforcement. The legislation enforcement body is not clearly identified, therefore it rendered a vacumm space for the enterprises to circum the legal rules ;

- green credit-related policies are not highly operable. The policies lack of specific criteria for the carriers to apply.

Among all, there is a notable issue, which is the green credit products in China do not have many varieties and there are no tailored environmental financial products (DRC, 2013).

Green bond could be an useful instrument contributing to the mitigation of Chinese air pollution and the enrichment of Chinese green credit products. While there is no single specially-labeled green bond in the Chinese market yet (Wang, 2013), there is space to explore the possibilities. When facing the increasing demand for green bonds, however, questions like what are the future directions for green bond and how much impact can green bond generate remain unknown.

1.3 Purpose and Research Questions

This paper aims to build a tentative exploration about implementing green bond into the Chinese market and the potential of green bonds for mitigating Chinese air pollution. The analytical framework will build on several key research questions by understanding the current green bond market, products and particular situation in China. And then conclude with a research analysis of the green bonds' potential in China and what needs to be done for the next steps.

Research Question 1:

What is a 'green bond'?

Research Question 2:

What is the Chinese air pollution situation?

Research Question 3:

How is the Chinese green finance market and bond market?

Research Question 4:

What are the incentives and obstacles for implementing green bonds in China?

Research Question 5:

What are the international experiences and lessons on green bonds pertaining to air pollution mitigation?

Research Question 6:

What are the next steps to be taken for issuing green bonds in China?

1.4 Research Method

The objective of this paper is to explore the possibilities of applying green bonds into the Chinese market and deploy the green bond issuance to tackle the air pollution issue. The research is based on the situation of the current green bond market, the Chinese green finance system and air pollution, with empirical evidence. This thesis is perceived from three angles:

- literature review to have the green bond topic conceptualized by identifying the current green bond market size, green bond history, issuer, green bond features, categories and principle;

- analysis of green bond issuance in the context of current Chinese green financial system and air pollution situation;

- reflection and discussion on the demand, incentives and challenges of issuing green bonds in China to cope with the air pollution issue.

Qualitative analysis, case study analysis, stakeholder analysis methods and interviews are applied in this paper for this interdisciplinary research.

Literature review is conducted in order to identify the concept of 'green bond', distinguishing it from the other bond products in the market and, hence, the current international green bond market situation. It enables the author to determine the relevant green bond cases pertaining to air pollution mitigation for showcasing the concept to the Chinese market.

Cases are used to examine international experience and refer to the pertaining green bond case on air pollution mitigation in the Chinese market.

Interview is the main approach of narrating the issuance and the use of proceeds of green bonds from the existing successful cases and their relevance to Chinese sustainable finance reform and air pollution mitigation. This is also a main approach to sort out the stakeholder perception for green bond implementation in China.

To be in accordance with the research topic, interviews were undertaken with sustainable finance experts, university academicians, Chinese financial regulators and green bond issuers at a sustainable finance symposium or via phone calls. Interviews with the World Bank and IFC, as the main green bond issuers, composed an important part of the case studies in this paper. It enabled the author to gain insight and clarify the green bond concept, structure and implementing mechanism in practice, as well as the vaired of interests on green bond implementation.

Interview questions list:

1. What is green bond origination?

2. How do you define green bond?

3. What is the difference between green bond and impact bond?

4. Who are the main green bond buyers?

5. How is the green bond earnings used?
6. How do you manage green bond account?
7. What is the monitoring procesure of green bond usage?
8. How do you select projects that would apply to use green bond earning?
9. What is the limitation of green bond?
10. What is the market trend of green bond?
11. How do you see Chinese market of implementing green bond?
12. What is the green finance development situation in China? What are the instruments?
13. Is there a specific example for green finance project in China?
14. Has green bond been applied to air pollution mitigation?
15. What are the current air pollution mitigation tools?

Interviews were conducted with:

A professor from Renmin University;

A professor from China University of Finance and Economics;

A president of the Climate bond initiave;

A regulator from the China Banking Regulation Committee;

A manager from the World Bank Treasury.

Stakeholder analysis is applied to analyze the key interest parties for green bond issuance in China. It is applied in parts in the paper:

-Chapter 3 analyzed the current and potential green bond demand and incentives from investor, government, financial maket, enterprises and security point of view based on literature review and interview;

-Chpaeter 5 identified five key stakeholders, they are: financial market, investors, enterprises, government, and international organizations based on the previous findings in the paper. A comprehensive analysis and summary of the main stakeholder's interest is conducted in this chapter to recognize the interest and existing challenges.

Through the stakeholder analysis, the paper can conclude the main development perspective of green bond implementation in China, as well as the existing obstacles for practice. The author therefore propose tentative policy suggestions based on the stakeholders' interests.

1.5 Thesis Outline

With above applied methodologies, the thesis research and formation are carried on with six chapters, structured as below:

Chapter 1

Introduction part explicates the motive for this paper with background information. It lists the key research questions that are to be explored in the paper with a problem statement, research methodologies, and thesis scope.

Chapter 2

Analytical framework expresses detailed introductions for the bond market and the green bond market. It reviews bond market's function and capacity in the financial market and distinguishes the 'green bond' concept from other sustainable finance products. It describes the origin, history, categories, feature and principles of green bonds in order to clarify the term and usage.

Chapter 3

The author conducted background research on the Chinese air pollution situation, green finance tools and bond market in this chapter in order to understand the concrete conditions for applying green bonds in the Chinese market. By understanding the particular situation of air pollution, green finance tools and the bond market in China, it helps identify the potential and obstacles for green bond implementation in China.

Chapter 4

This chapter studies the existing successful international green bond examples. The cases are selected with close relevance to Chinese application and an informational interview with the green bond issuer and programme manager is conducted in the section. Chapter 3 realizes that the main source of Chinese outdoor air pollution is from industrial coal burning. And the principal ways of mitigating this is to increase energy efficiency, apply clean production technology and extend renewable energy use. Therefore, this chapter examines providential cases of the World Bank and IFC's green bond proceeds use lent for energy efficiency improvement in China. The paper diagnoses the green project criteria, implementing procedure and the project result and impact.

Chapter 5

To conclude and analyze the background research of the Chinese situation from Chapter 3, Chapter 4 describes the incentives and demand for green bond implementation in China from different stakeholder perspectives: the investor, government, enterprises, financial market and public opinion.

Chapter 6

The paper concludes that green bonds have vast potential to help Chinese air pollution mitigation. Yet, there are stumbling blocks in the current Chinese market environment. The financial market is not mature and sophisticated enough to bring up a creative environment

for sustainable finance innovation. A more stable and instructive policy framework needs to be set in order to incentivize the market development.

1.6 Scope

The paper looks at green bond development potential Chinese market. It aims at researching and discussing the demand, incentivies and potential of implementing green bond in China with reference of the successful international experiences. Green bond and air pollution data and figures are collected from internet source. And the stakeholder perceptions are sorted out by the interviews with relevant scholars, international programe officers and financial regulators.

Limitation: as a new topic of green bond in the world, there is not a flood of literature and empirical evdidence for green bond success yet. The current academic research is limited and the existing green bond issuance is countable in numbers by institutions. Green bond is at infant stage in Chinese market, the practical impact is yet to be seen along with time and there is no single case of green bond issuance in China yet by the time of the completion of this paper.

There are many contemporary work streams, publications and research papers about sustainable finance, as it is a trendy topic to explore. In this paper, the professional terms are distinguished based on the convention, authoritative sources and the relevance to the topic.

Sustainable finance: sustainable finance is a term that refers the integration of sustainability to financial system. According to the Responsible Business Center of University of California Berkeley, sustainable finance is 'the practice of creating economic and social value through financial models, products and markets that are sustainable over time'[1].

Green bond: a financial product that is with environmental purpose. In this paper, green bond refers to any bond issued, whose proceed is used for environmentally-friendly projects, such as climate resilience programme, climate adaptation, renewable energy, energy efficiency, flood management and waste disposal.

Air pollution: there are two types of air pollutions (indoor and outdoor), technologically speaking, and this paper focuses on outdoor air pollution, which is a more notable issue in China currently. Outdoor air pollution is measured by PM, which is composed by sulfate, trates, ammonia, sodium chloride, black carbon, mineral dust and water. It is a mixture of solid and liquid particles of organic and inorganic materials in the air. The vicious components are those particles, whose diameters are 10 microns or less ($\leq PM_{10}$). In China the main measurement of air quality is $PM_{2.5.}$ The major source for outdoor air pollution can be industry, transport, buildings and power generation (WHO, 2014).

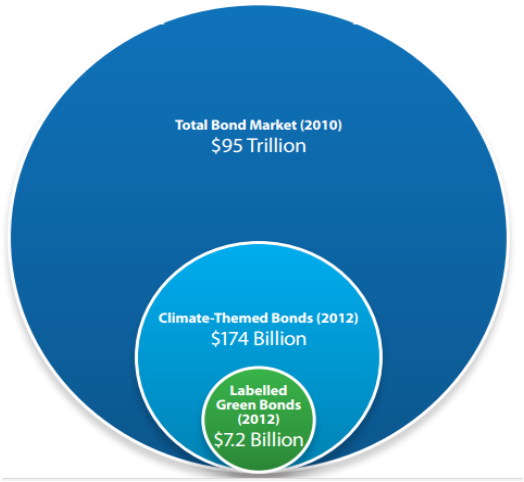
[1] http://responsiblebusiness.haas.berkeley.edu/programs/sustainablefinance.html

2 Research Framework

2.1 Bond Market

Bond, as a financial product, is a form of debt. It is an agreement between two parties (lender and borrower) that the borrower will pay the lender money back with interest at agreed rate. It is with congenital risk of default. The bond market, as a platform of bond issuance and trade, is an important component of the financial market, as well as an important vector of a central bank's monetary policy. A well-organized and mature bond market provides effective investment tools with low risk for the investors and fund raisers. Meanwhile, the yield rate of bonds is an important datum for all types of financial products' return rate. From 2002-2011, the bond market's growth rate retained 9.79% at average. In 2010, bond market total scale reached USD 95 trillion. Until 2013, the green bond market only accounted to a small fraction of the global bond market at about 0.017% (Wang, 2013; Zhongshan News, 2013).

Figure 2-1 Global Green and Climate-Themed Bond Markets vs. Total Bond Market (USD)



Source: Sustainable Prosperity, 2012. (Figure not to scale)

2.2 Green Bond Market

As of 2014, the green bond has been in the market for approximately seven to eight years, beginning with bonds for retail markets in Japan. It is known as the environmentally-themed Uridashi bond. By 2011, Japan remained the biggest green bond market in the world (Kidney, 2011; Kidney, 2012). Uridashi bonds are the bonds issued in Japan denominated by foreign currencies (USD, Euro, Swiss Franc and Australian Dollar etc.) and the majorities are with fixed rate. The Uridashi bonds allow Japanese residents to harvest a higher interest rate through the investment of the Yen, compared to the local low interest near zero (Bakewell, 2012; Arima, Bennet & Dore, 2012).

At the request of a group of Scandinavian pension funds, who were seeking green investment products in 2008, the World Bank started the green bond's promulgation under the 'Strategic Framework for Development and Climate Change' (Reichelt, 2012). To date, the total scale of green bond issuance by the World Bank is up to USD 5.3 billion, covering

17 currencies via 61 transactions[2] (See Appendix 1 World Bank Green Bond Issuance to Date). The total green bond issuance of IFC, a member of the World Bank group, has reached USD 3.4 billion.

Figure 2-2 IFC Green Bond Issuance

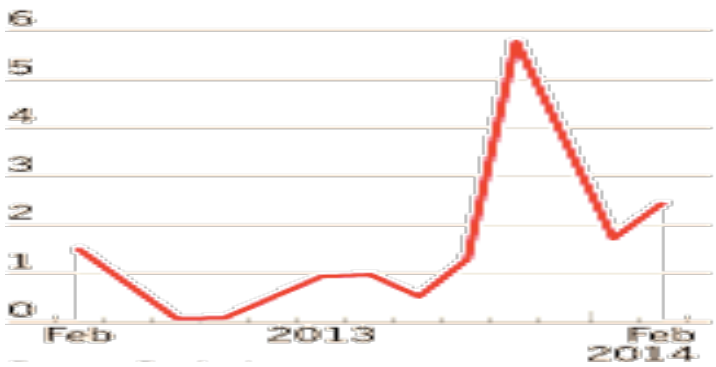
Lead Manager	Currency	Trade Date	Maturity Date	USD Millions (equivalent)
SEB	USD	15-Apr-10	28-Apr-14	200.0
Nomura	AUD	15-Feb-11	24-Feb-14	42.4
Nomura	AUD	10-May-11	19-May-14	44.8
Nomura	EUR	10-May-11	19-May-14	22.8
Nomura	ZAR	10-May-11	19-May-14	25.9
Nomura	AUD	23-May-11	27-Jun-14	37.1
Mitsubishi	ZAR	23-May-11	03-Jun-14	60.8
Nomura	TRY	20-Sep-11	29-Sep-15	113.7
Nomura	AUD	20-Sep-11	29-Sep-15	74.4
JPMorgan	USD	26-Apr-12	15-May-15	500.0
Nomura	TRY	13-Aug-12	20-Aug-15	88.2
Nomura	BRL	13-Aug-12	20-Aug-15	11.8
Nomura	AUD	14-Aug-12	20-Aug-15	12.5
JPMorgan	USD	04-Feb-13	15-Feb-23	10.0
Citi/JPMorgan/ Morgan Stanley	USD	14-Feb-13	16-May-16	1,000.0
Nomura	AUD	16-Oct-13	16-Oct-18	20.7
Nomura	BRL	16-Oct-13	13-Oct-16	198.5
BOA/Citi/Credit Agricole/SEB	USD	15-Nov-13	15-Nov-16	1,000.0
				$3,463.6

Source: IFC, 2014.

Currently, the major issuers of green bonds are multilateral organizations, such as the World Bank, IFC and the European Investment Bank. Corporate green bonds are emerging. In November 2013, a French power group, EDF, issued the first Euro dominated green bond at the size of 1.9 billion with success among institutional investors (Bolger, 2014; Chestney, 2014). Corporate green bonds were issued later by Toyota and Unilever, the world's second largest household goods producer. It signals that corporate issuers are ready to grasp their share in the green bond market (Boulle, 2014) (See Appendix 2 Notable Existing Green Bond and Related Issuance).

Figure 2-3 Global Green Bond Issuance (USD Billion)

[2] http://treasury.worldbank.org/cmd/htm/WorldBankGreenBonds.html



Source: Bolger, 2014.

2.3 Green Bond Demand

Green bonds, as an initiating stream in the bond market, have been in the market for 7-8 years. Private investors are enlarging their role in the green bond market, which was previously dominated by public financial institutions, such as pension funds. The increasing attention from the private sector to green bond issuance in addition to the public domain renders the possibility of green bonds moving from being a minority in the bond market to becoming a mainstream investment method (Economist, 2014) (See Appendix 3 Notable Existing Green Bond and related Issuance).

Since 2007, the green bond market has a compound annual growth rate of 55%. According to the International Energy Agency, a mature and liquid green bond market needs to scale up its capital size to at least USD 200-300 billion (IEA, 2012). World Bank president Jim Yong Kim has released a strong signal to expand the global green bond market size to USD 20 billion by September 2014 at the World Economic Forum in Davos. HSBC predicted that this year the green bond market will double its size from 2013, reaching USD 25 billion. And the United Nations will endeavor to increase the size of the green bond market to USD 50 billion by December of 2015 through the high-profile climate summit on UN climate negotiations (Chestney, 2014) (World Bank, 2014a). SEB anticipates that by 2020, the green bond market share will account for 10-15% in the global corporate bond market (Economist, 2014).

2.4 Green Bond Categories and Features

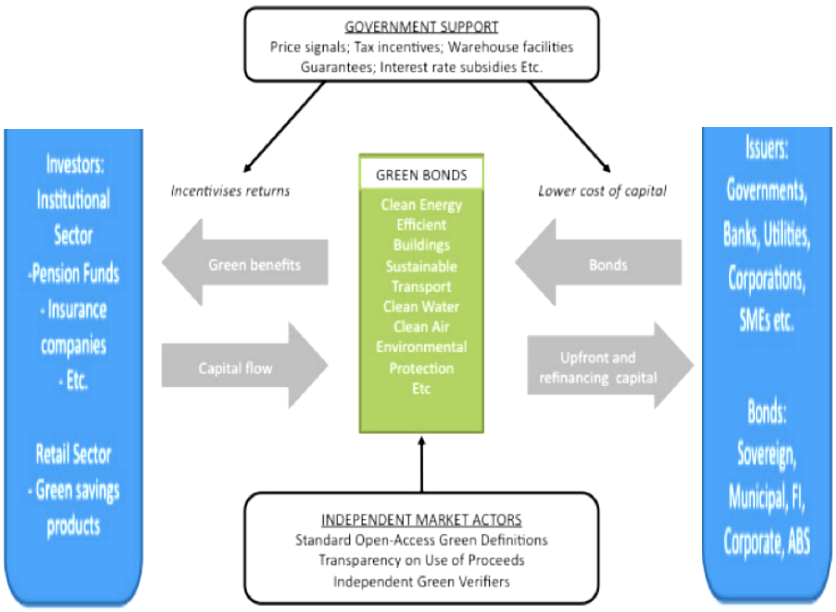
Green bond can have different criteria to categorize them. They can be labeled as 'wind bond', 'water bond', 'environment sustainability bond', 'solar project bond', 'rainforest bonds', 'green sectorial bonds' and 'green infrastructure bonds' based on its serving purpose; from the issuer, green bond could be categorized as 'sovereign bond', 'municipal bond', 'financial institution bond' and 'corporate bonds'; while 'index-linked carbon bonds' is one type of green bond, named for the measure of its performance. From the bond's structure, it can be categorized as a 'traditional bond' issued by the government or supranational organizations, such as the World Bank; 'structured bond' issued by corporates and 'asset securitization product' issued by special purposed vehicle (Wang, 2013). GBP differentiated green bonds into four types: 'green use of proceeds bond', 'green use of proceeds revenue bond', 'green project bond' and 'green securitized bond' (Ceres, 2014).

Green bond could be issued by supranational organizations, governments, development banks, commercial banks and corporations. The buyers could be institutional investors, such as pension fund and individual customers, such as those in the Japanese retail market. The dominant investors of green bonds currently in the market are still institutional investors, just as the other bond market products.

Green bonds' interest rates vary depending on the peculiar situation. It can be fixed rate, floating rate, index linked, coupon linked to environmental performance and so on. The interest rate of green bond does not have a significant difference with other financial instruments, as well as its credit ratings. The first World Bank's green bond's interest rate denominated in Swedish krona is 0.25% higher than the Swedish government bonds. The majority of World Bank's green bonds have an AAA rating based on the WB's credit quality (Della R., Kaminker C. and Stewart F., 2011; World Bank, 2008).

Green bond could be guaranteed by a third party for securitization or backed by the issuing institution, assets, mortgages and public loans that are covered by green bonds. An important feature of a green bond is that its project performances will be measured and monitored to ensure the proceed use will deliver its environmental objective (Sustainable Prosperity, 2012).

Figure 2-4 Green Bond Market Structure



Source: Kidney & Oliver, 2014.

2.5 Green Bond Principles

Green Bond Principles were promulgated at the beginning of 2014 in order to guide investors and issuers on capital use in green projects. It is the outcome of the joint work of multiple stakeholders with commitment from first-class investment banks around the world, including JP Morgan Chase, Bank of America Merrill Lynch, SEB, HSBC, Morgan Stanley,

Crédit Agricole Corporate and BNP Pariba. The Principles' design also consulted the World Bank and IFC. The Principles are voluntary based guidelines. They are composed of four key components that are: the use of green bonds' proceeds, process for project evaluation and selection, management of proceeds and reporting.

The principles are with three main aims:

- 'provide issuers guidance on the key components involved in launching a credible Green Bond;
- aid investors by ensuring availability of information necessary to evaluate the environmental impact of their Green Bond investments;
- assist underwriters by moving the market towards standard disclosures which will facilitate transactions' (Ceres, 2014) (Bolger, 2014).

The Principles recognize seven broad project categories for the green bond programme. They are:

- renewable energy;
- energy efficiency;
- sustainable waste waste management;
- land use;
- biodiversity conservation;
- clean transportation; and
- water (Chestney, 2014).

There are numbers of other existing green bond/green project principles, criteria and standards developed by different parties, such as the World Bank, OECD, and Climate Bond Initiative, to name a few.

Table 2-1 Other Existing Green Bond Project Guidelines

Institutions	*Identification*	*Name*
World Bank	**Green Bond Issuer**	**World Bank Green Bond Project Selection Criteria**[3]
European Bank for Reconstruction and	**Green Bond Issuer**	**EBRD Criteria**[4]

[3] http://treasury.worldbank.org/cmd/htm/GreenProjects.html

[4] http://www.ebrd.com/pages/workingwithus/capital/sri.shtml

Development		
International Finance Corporation	**Green Bond Issuer**	**Definitions and Metrics for Climate-Related Activities**[5]
European Investment Bank	**Green Bond Issuer**	**Environmental and Social Practices Handbook and EIB's Screening and Assessment Criteria for Energy Projects**[6]
Climate Bond Initiatives	**independent, third party standard**	**Draf Green Bonds Taxonomy**[7]
OECD	**independent, third party standard**	**Defining Low Carbon, Climate Resilient Infrastructure Systems**[8]

Source: Ceres, 2014.

2.6 Air Pollution Situation

2.6.1 Source and scale

Chinese air pollution is a current notable issue in the world. Its pollution level is on par with the Great Fog of 1952 in London. The US embassy published astonishing news that the American measurement of Chinese air quality indicated that Beijing's air pollution was far beyond the security levels in 2009. The Chinese government, since then, started to monitor seventy four Chinese cities' air quality under public pressure for information transparency. The result in 2013, sadly, indicated that seventy one of the monitored cities failed to meet the minimum air quality standard (See Appendix 4) (Wong, 2014). Twenty of the most polluted cities' air pollution level is fifteen times higher than the World Health Organization's standard (Bloomberg, 2014).

While outdoor air pollution can be attributed to several factors, such as household, transport and biomass combustion, the main source of Chinese air pollution is industrial coal burning. China's coal consumption amounts to 3.8 billion tons per year, near half of the world's total (Riley, 2013a). In 2007, industry's $PM_{2.5}$ emission in China was 9.059 tonnes, far

[5] http://www.ifc.org/wps/wcm/connect/534495804a803b32b266fb551f5e606b/IFC_Climate_Definitions_2013.pdf?MOD=AJPERES

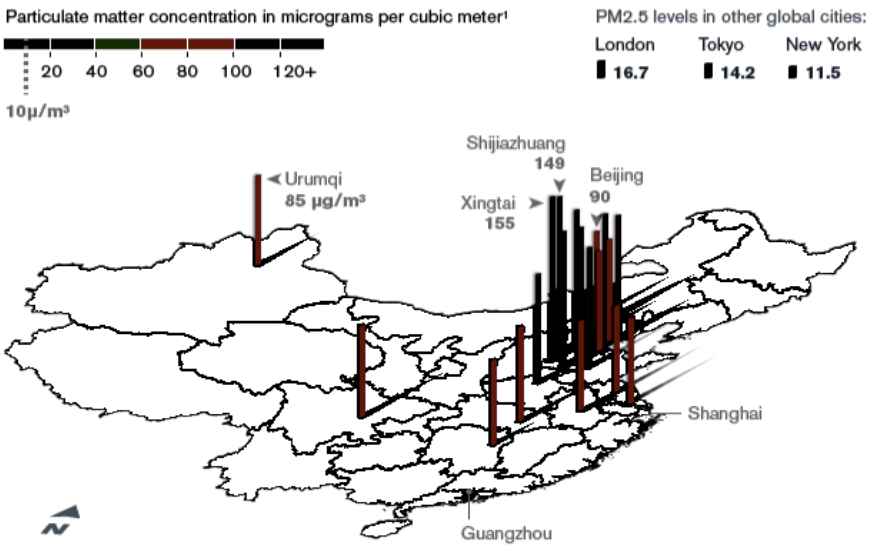
[6] http://www.eib.org/attachments/strategies/eib_energy_lending_criteria_en.pdf
http://www.eib.org/attachments/strategies/environmental_and_social_practices_handbook_e

[7] http://www.climatebonds.net/taxonomy-project/

[8] http://dx.doi.org/10.1787/5k8zm3gxxmnq-en

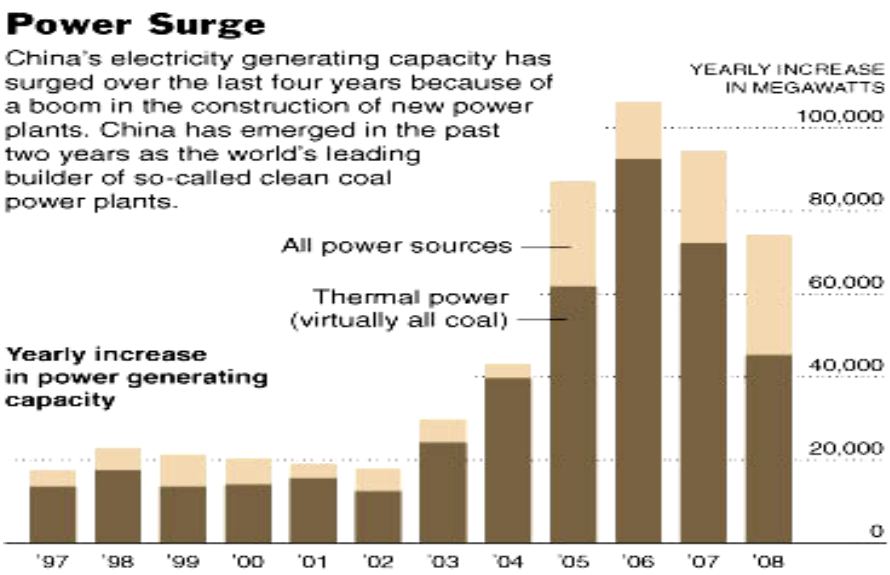
outnumbering the other sources. Among the industries, power-generation accounts for the most pollution at 34%. 1,178 out of 4,400 worst-offending waste gas polluters are power generation-related enterprises. Geographically speaking, eastern China, which is the most developed region, has the most pollution and highest polluting level. And in central and western China, there are several highly-concentrated pollution areas (Li, 2011).

Figure 3-5 2013 Average Annual Outdoor Air Pollution



Sources: Bloomberg, 2014. (Greenpeace East Asia based on Ministry of Environmental Protection and local Environmental Protection Bureau data, World Health Organization, Environmental Protection Agency, Tokyo Metropolitan Research Institute for Environmental Protection, King's College London)

Figure 3-6 Coal Consumption Increased in China for Electricity Generation



Source: Lovett, 2014. China National Bureau of Statistics, via CEIC data.

2.6.2 Impact

The severe air pollution issue deteriorates the domestic residents' health directly. It is murderous, dubbed the 'airpocalypse'. Air pollution caused 3.2 million deaths around the globe in 2010 and 7 million in 2012 (Lin and Khan, 2014). It is ranked as the seventh riskiest factor in the world. And Chinese outdoor air pollution culminated in the premature death of 1.2 million people in 2010. It accounted for nearly 40% of the world total. A joint study by the World Bank and the Chinese State Environmental Protection Administration showed the figure that 350,000 to 400,000 deaths occur in China annually due to the outdoor air pollution (Riley, 2013a). Up to 0.5 million premature deaths resulted from the air pollution in each recent year in the most polluted cities, such as Beijing and Shanghai. The figure has hit a historical record (Bloomberg, 2014).

The national economy bears a big economic cost. Environmental degradation was at 230 billion USD in China in 2010, which accounts for 3.5% of GDP. And air pollution resulted in degradation costs of 42.9% of the accumulated environmental cost. In 2004, the national expense of China on waste gas management was virtually RMB 92.23 billion (Li, 2011).

The air pollution deters tourists and foreign intellectuals (Wong, 2013b). The Beijing's Forbidden City lost three quarters of its tourists at some day time due to air pollution (Kaiman, 2014b). Two thirds of the European Union Chamber of Commerce's member companies recognize that air pollution is the main barrier for recruiting international talents. And 48% respondents of the American Chamber of Commerce's sury claimed difficulties at hiring or keeping senior staff in China for the same reason this year (Lin and Khan, 2014).

Figure 3-7 Air Pollution Takes Toll on China's Tourism

Source: Yahoo News, August 13, 2013[9].

Air pollution in China is further exacerbating food security. Scientists alerted the Chinese public that the air pollution in China has a similar effect as with nuclear winter. It slows down plants' photosynthesis process and may eventually damage the national food supply.

Air pollution is also potentially pernicious to social security (Zhao, 2012). In 2009, the Chinese government made its first compromise in many years on information transparency to the public in the disclosure of air quality data. The citizens are raising their voices higher and higher, pushing the Chinese government to take more proactive measures for air pollution mitigation. Some citizens have taken the air pollution matter to court, bringing accusations against the local government (Kaiman, 2014b).

2.6.3 Mitigation methods

The Chinese government has sought to alleviate the pollution problem through assorted measures. However, the government kept receiving criticism for its inaction and inefficiency (Xinhua, 2014). The Beijing government took some temporary measures to improve the air quality prior to the Olympic Games in 2008. Some industries were shut down for months and 50% of cars were prohibited from transportation (Wong, 2013b). This year, the Beijing government formed emergency measures to shut down schools and factories, as well as limiting government car use, if the air pollution level remains unsafe for three continuous days (Kaiman, 2014b).

[9] http://news.yahoo.com/air-pollution-takes-toll-chinas-tourism-070442471.html

Last year, the China State Council addressed a timeline for new fuel standards and set limits on coal burning in its national plan. The plan also introduced vehicle emissions to take high-polluting vehicles off the road (Wong, 2013c). The government is modifying the existing environmental laws. For the first time, it will authorize the local government's right to close polluting factories and implement penalties to violatiors (Kaiman, 2014a). The government installed emission controls in industrial complexes and mega power plants. Yet there is lack of standards for implementation and supervision. Other methods, such as mandates to reduce capacity in polluting industries, subsidies for emission mitigation, were also promulgated. However, none of them have proved effective against heavy polluters and industrial overcapacity (Hornby, 2014).

The State Council issued 'Air Pollution Prevention Action Plan' for 2013-2017 to tackle with the pollution problem in northern China. The plan strives to mitigate the air pollution from ten aspects:

- Reduce pollutant emission;
- Optimize industrial structure;
- Accelerate enterprises' technological transformation;
- Increase clean energy supply;
- Restructure the industrial geography;
- Complete environmental economy policy;
- Enhance legislation and supervision;
- Build a regional cooperation mechanism;
- Establish emergency system;
- Clarify the government's and enterprises' responsibility (Government, 2013).

In conclusion, the reliance of coal energy is impeding the rapid development of the Chinese economy after the initial expeditiousness growth since Chinese economic reform in 1970s. To restructure the energy system strategically is the core solution to the air pollution issue (Kai, 2014).

2.7 Current Environmental Finance Tools

Given that green bond is an environmental finance tool, it is essential to recognize the current Chinese green finance market and the available instruments. The specific finance appliances for air pollution mitigation are covered under the finance tools depicted below.

2.7.1 Green finance market

Chinese green finance development is on the way. The government and enterprises are working together explore the financial means, such as green fund (interview with Renmin University).Green finance development in China can be perceived from three perspectives: banking, insurance and security. Each sector has led progress on integrating sustainability and environmental factors into financial market. Yet each sector is facing its own challenges for

future development. There is an obvious lack of environmental finance varieties and the bond market is not utilized for green finance growth at this stage.

2.7.1.1 Banking

Green credit is the main character of the banking sector's green finance development. Green credit means both lending more credit to environmentally-friendly projects and paying more attention to environmental performance on project financing. This has been led from two directions: the national policy drive and the banks' self-initiation. The national policy is the main driving force of the green credit promotion. The CBRC issued a 'green credit policy' in 2007, which came into force in the following year. The main principle of the green credit policy is to encourage the banks to issue more loans to energy conservation and environmental protection projects and reduce loans to high energy consumption and high polluting projects. Since then, loans to the energy conservation and environmental protection sector have surged. The banks' self-initiation includes the voluntary adoption of international standards, such as the Equitor Principles (DRC, 2013).

Table 3-2 Loans to Energy Conservation and Environmental Protection Projects

Year	2007	2008	2009	2010	2011	2012
Projects amount	2,715	2,983	6,412	7,259	9,349	10,874
Loan balance (RMB trillion)	0.341	0.371	0.856	1.172	1.468	3.58

Source: DRC, 2013. China Banking Sector Social Responsibility Report, CBRC, 2009-2012.

2.7.1.2 Insurance

An environmental characteristic insurance tool is environmental pollution liability insurance (EPLI). It allows the third party to receive compensation from the insurance companies for its loss during a pollution accident, if the accident was induced by the policy holders. The central government started to conduct EPLI pilot programmes in 2007. The adoption of EPLI among enterprises has been slow with light growth. In 2012, over two thousand enterprises have EPLI and in some regions the EPLI share only accounts for 0.01% of the total property and casualty premium income (Zhao, 2013; DRC, 2013). Under the public pressure because of the fog and haze, last year, the Chinese government made EPLI compulsory for high environmental risk industries, such as heavy metal, petrochemical and chemicals (Wang, 2014).

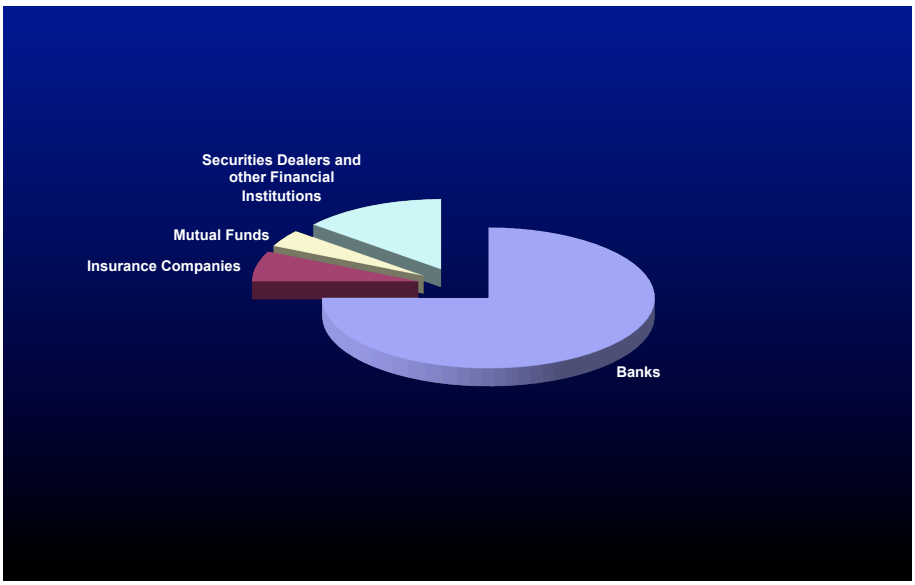
2.7.1.3 Securities

The main green mechanism in the securities sector is emission trading market. It includes air pollutant, water pollutant and carbon emission trading. Some examples prove that the emission trading mechanism is effective at mitigating air pollution. Over thirty industrial companies shut down their coal burning boiler or switched to clean energy, and in Chongqin city near forty industrial coal burning companies reduced the amount of coal consumption. Experts anticipate that the emission trading mechanism will play a larger role in air pollution mitigation in the coming future. The existing mechanism's capacity, however, is currently vey limited, with only ten major emission exchanges in China (Hong, 2013; Zhou 2014).

2.8 Chinese Bond Market

China's domestic bond market is ranked as the fourth largest in the world after the US, Japan and France. Its market size is at near 4 trillion USD with 30% annual growth. The market, nevertheless, remains untapped by international investors (Noble, 2013). The Chinese bond market investors are composed of banks, insurance companies, mutual funds, securities dealers and other financial institutions. Among them, banks are the dominant players. In 2011, the market shares of banks, insurance companies, mutual fund and securities dealers and other financial institutions are 75%, 7%, 4% and 14% respectively (ADB, 2013).

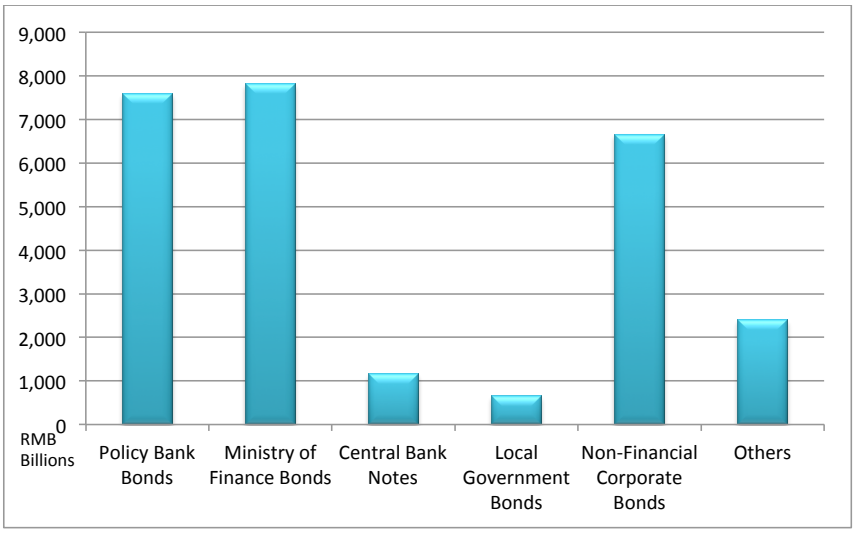
Figure 3-8 Chinese Bond Market Investors, 2011



The Chinese bond market consists of four major types of bonds:

- Government bonds, issued by the Ministry of Finance;
- Central Bank Notes;
- Financial bonds, issued by policy banks, commercial banks and other non-financial institution bonds;
- Non-Financial Corporate bonds (ASIFMA, 2013).

Figure 3-9 Chinese Bond Market Sector Sizes as of December 2012.



Source: ASIFMA, 2013

Among them, the corporate bond market in China ranks as the third largest in the world after the US and Japan. And it is forecasted that the Chinese corporate bond market may outnumber the US and become the world's largest by 2015. The corporate bond market has witnessed an exponential increase in the past years. Its market size rose from RMB 500 million in 2005 to RMB 8.5 trillion at the end of 2013 (Gough, 2014).

2.8.1 Green bonds in China

There is no single specially-issued green bond in the Chinese market yet (Wang, 2013). The only bonds, whose proceeds are linked closely with green projects are corporate bonds issued by solar photovoltaic and wind turbine manufacturers (Zhang, 2014).

The existing green-themed bonds in China, however, are witnessing the first Chinese corporate bond default this year. A small solar cells and panels manufacturer, Shanhai Chaori Energy Science and Techonology Company, failed to make its annual interest payment for a bond issued in 2012. The bond size is of RMB 1 billion. There was no government intervention in this case, distinguishing it from usual cases (Gough, 2014). The company may have its note delisted from the Shenzhen Stock Exchange as an aftermath. This will be the second case of a solar equipment manufacturer having its securities suspended. The default of Chaori has causedvalarm for the Chinese corporate bond market. More bond defaults may come into occurrence, as more bonds are maturing in the following years. The government's non-acting in this case is taken as a sign of reduction in government interference and increase of market self-discipline.

This attempt to implement green bond issuance in China is just beginning. JUCCCE, a joint pulic dialogue by the American and Chinese government officials on clean energy, is seeking to increase financing options for clean energy projects by initiating green municipal bonds.

JUCCCE's Green Municipal Bonds is currently in development[10]. It aims to expand access to electricity, energy efficiency and renewable energy generation while the municipal bond market in China is emerging. At the initial stage, JUCCCE offers policy suggestions for building up a transparent municipal bond market with investment tools at low risk to green projects that meet national targets on energy efficiency, emissions reductions and renewable energy generation. JUCCCE also identifies the market-based opportunites for green municipal bond issuance. In pursuant, JUCCCE will offer training to Chinese officials through government training academis on channeling municipal bonds' capital to green project financing.

[10] http://juccce.org/projectlisting
http://sustainabledevelopment.un.org/index.php?page=view&type=1006&menu=1348&nr=747

3 Incentives and Demand for Green Bond Implementaion in China

To implement green bonds in China, the demands and incentives can be perceived from various angles. Stakeholder analysis is applied in this section. And the author identifies the key interest parties as: investors, government, financial market, enterprises and public opinion.

3.1 Investors

Green bonds, as a financial product, have three key features and criteria for investors to make investment decisions. They are: green purpose, interest benefit and risk. As sustainability awareness is growing, investors, especially institutional investors, have become more and more interested in investments that generate positive environmental and social benefits such as impact investment. A notable example is that the first issuance of green bond from the WB was at the request of Nordic pension fund investors. Both of the Chinese institutional investors and public finance institutions, such as SOE investment fund, China Development Bank, are increasing environmental criteria in their investment activities (Zhao, 2013).

International investors also bear a huge demand for investment in the Chinese bond market. The Chinese bond market remained closed to the world with only a gradual opening. China established the Qualified Foreign Institutional Investors (QFII) programme in 2002, allowing foreign capital to come into China with a limited quota. In 2013, the CSRC adjusted the quota to 150 billion USD from 30 billion USD at both the demand of international investors and the need of Chinese capital market development. Foreign direct investment in China keeps witnessing incremental increases in recent years along with Chinese bond market growth (Ye & Lim, 2013).

Individual investors are the potential bodies to tap into the large domestic savings in China. Driven by the traditional prudent mindset, most Chinese people deposit their savings in banks. However, the national government bond is an exceptional investment product that attracts Chinese domestic residents for the same token, given the public confidence toward the Chinese treasury. The national government bond is therefore considered risk-free debt with high stability, liquidity and profitability. There is great passion from Chinese residents toward national government bonds. At the date of the national government bond issuance, it is usually sold out within half a day (Li, 2006). There is a promising potential application of national green bonds issued by the central government. Following the traditional investment habit, national green bonds could potentially satisfy both the financing demand and the public zeal for a better environment.

3.2 Government

Under the Chinese context, it is the most feasible for the government to issue green bonds, preceding the other possible issuers, namely, the multilateral organizations and corporates. It is the Chinese government's goal to improve energy intensity, grow environmental industries and reduce environmental stress listed on its 12th Five-Year Plan. To meet the objectives of the 12th Five-Year Plan, the State Council announced its decision to support environmentally-friendly and energy-saving enterprises and issue bonds and apply other financing tools (State Council, 2013).

In 2013, China stated an investment plan for air quality improvement of 275 billion USD for the next five years, which requires vigorous finance capital support (Kidney & Oliver, 2014). The main resource for air pollution mitigation in China is public finance from the governmental fiscal budget. And both the enterprises and government are facing public finance shortage problems (Wang, 2013). Whereas China has the largest domestic savings in the world, green bonds could ideally leverage private financing into the environment sector, mitigating the financing difficulties. The Chinese government has indicated a strong signal for greening the Chinese financial market, green bonds could be a flagship demonstrating the government's determination in terms of dealing with the pollution issue, as both the Chairman and Prime Minister of China stated at the beginning of this year (China News, 2014; Government, 2014a).

Based on the fact that the Chinese government has dominant power and image for Chinese people, the central government bond is normally considered a zero-risk product and has high popularity among all financial products. A government-issued green bond in China has a great likelihood of mobilizing private finance and meeting the public demand for a better environment. Facing criticism for its nonfeasance on the air pollution issue for Chinese government, a green bond that aimed to tackle air pollution mitigation issued by the government could regain public confidence in this aspect.

The local government's debt has faced public criticism since last year, since Fitch downgraded Chinese local government debt from AA- to A+. Facing the uncertain and different anticipation about Chinese housing prices, the local government credit is in doubt and anticipates change. The local government was not legally entailed to issue municipal bonds previously according to the Chinese constitution. Independent financing platforms were founded backed by local government assets in order to raise capital through bond issued by the platform. On the 20th of May this year, the Ministry of Finance issued a note on local government bond issuance and imbursement. The note authorizes the local government's right to issue municipal bonds and instructs the management method. The release of autonomy for local government bonds will simplify local government financing and debt management and generate a canonical local bond market (Zhang & Zhao, 2013; Government, 2014b). The green bond programme could help the local government optimize its debt structure and allocate financial resources towards environment friendly projects with efficacy.

3.3 Financial Market

The majority of Chinese bond market is bank loans. They account for 132% of the GDP, exceeding the developed country's rate of 123%. China has the largest short term debt ratio in the finance market among the listed firms at 78% in tenor of less than one year, while in a more developed country, such as the US, the short term debt ratio is only 28% (Sorge, Zhang, & Koufopoulos, 2013). Since the first corporate bond default at the beginning of this year, the finance market is anticipating structural change with enhanced regulations.

The introduction of green bonds to China will enrich the variety of Chinese financial products in the market. It can promote the bond market's sophistication in China and strengthen market-driven capital allocation in the financial system. By serving the green purpose and ensuring green bonds' transparency, it reduces finance systemic volatility and increases finance stability in the long term. Green bonds help mobilize financial resources from the private sector efficiently at a low cost, compared to the current private lending and direct the capital flow to the environmental sector tackling the air pollution issue. It can further help prevent corporate bond default due to lack of supervision, comprehensive bond

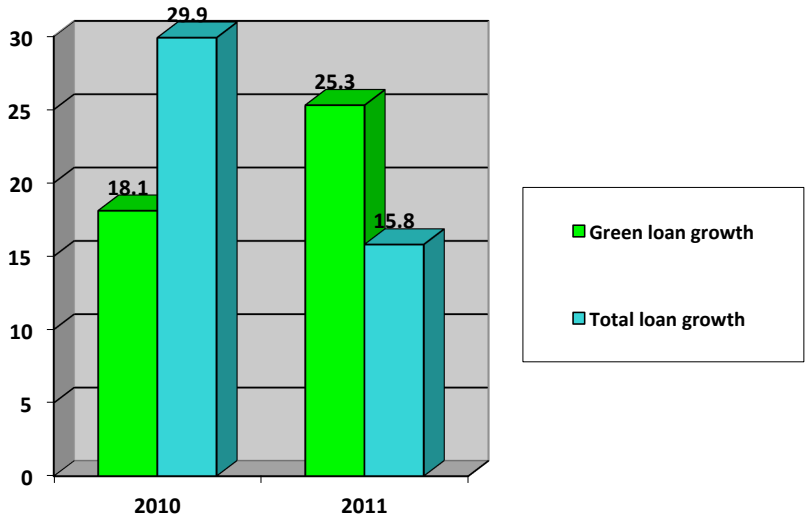
structure design and monitoring mechanism. It will also alter the traditional investment diagram in the financial market from fossil fuel to clean energy and other environmentally-friendly projects (Qgg, 2014).

Green bonds could further tap foreign investment into the Chinese environmental sector and open up the Chinese bond market to international investors. It will spur market growth and regulatory improvement in the current bond market, given the fact that even though China's bond market is the fourth largest in the world, it is still small when compared to a more developed market, such as the US and Japan (ASIFMA, 2013). It is only one sixth of US market share and one fifth of Japan's. Green bonds therefore have huge potential to attract more capital flow into China for green investment from the international market.

3.4 Enterprises

The current industrial companies, including the power generation corporations, who are the biggest air polluters, are in need of financial capital in order to transform their current technology to clean production and to conserve energy and increase energy efficiency. The emerging new industries, such as solar and wind energy need money for continuous growth too. Facing a growing financing demand from the new industries, the current finance market, which is dominated by banks, used to allocate the major financial resources to the big corporations and SOEs. In 2009, the banks' loans to energy-saving and environment protection projects was RMB 856 billion and accounted for only 8.93% of the total loan scale. The 'green' loan is increasing under the market and policy drive, but it is still a small share, compared to others (Wang, 2013, p131). Green bonds issued by the national government and local government could increase financial access for enterprises' green pursuance, especially for the SMEs.

Figure 4-1 Banking Loan Total Growth and Green Loan Growth (2010-2011).



Source: PBOC's statistic report; China Banking Association's annual Banking CSR report (Wang, 2013).

Corporate bonds are becoming the main financial resource for the low carbon industry. The new energy industry bond scale quadrupled last year (Wang, 2013). Corporate green bonds allow the companies to raise money directly and receive public supervision. For smaller environmental enterprises, bonds are an important method to leverage capital for company growth. The corporate green bond needs to be well-regulated with encouragement in a benevolent market economy.

3.5 Security

While there is a great interest and demand for green bond implementation in China and the world, green bond as a financial product itself shares the same characteristics as others. Talking about any financial product, it is invetible to examine its risk and security. The green bond's sercurity can be assured by three perspects:

1. Credit rating. As discussed above, the issued green bond up to date by the World Bank/IFC or other enterprise share a high credit ranking by the major rating agencies mostly in equivalent to AAA or AAA-;

2. According to the CBRC and Industiral Bank of China's statistics, the green credit assets are so far high quality assests with only 0.22-0.32% non perfoming assest rate(interview with CBRC);

3. The green bond interest and payback can be guaranteed by the project profit. The local government's green bond can be assured by the government fiscal buget. In the case of the World Bank, it is guaranteed by the member country's redit.

The principal economist of PBOC, Dr. Majun pointed out that the green bond attracts investors not only for its social value but also for its high liquidity and profitable returns. Green bond's maturity period is normally for 3-7 years. It is tradeable at secondary market. Some of the green bond receives tax treatment from the government as incentives, it therefore brings high returns to investors. Through investing green bond, the investors avoided the project risk through the high standard project screening by the issuing bodies, such as the World Bank (Ma, 2014). CBRC promulgated Notice on Green Credit Statistics last year as a guideline for green credit use into industries defining the green criteria, so to assuse the use of green credit. This guideline is for any forcoming green bond issuance to follow.

4 International Case studies

According to the Chinese Air Pollution Prevention Action Plan, increasing renewable energy, improving energy efficiency and increasing clean production are the principal solutions to the air pollution issue. Case studies of the World Bank's green bonds' proceeds use in energy efficiency projects in China and IFC's Beijing Shenwu thermal energy technology project are introduced and analyzed in this section. Interviews were conducted with the World Bank Treasury Office and IFC senior energy specialist pertaining to green bond issuance, proceeds use, project profitability and potential application to China.

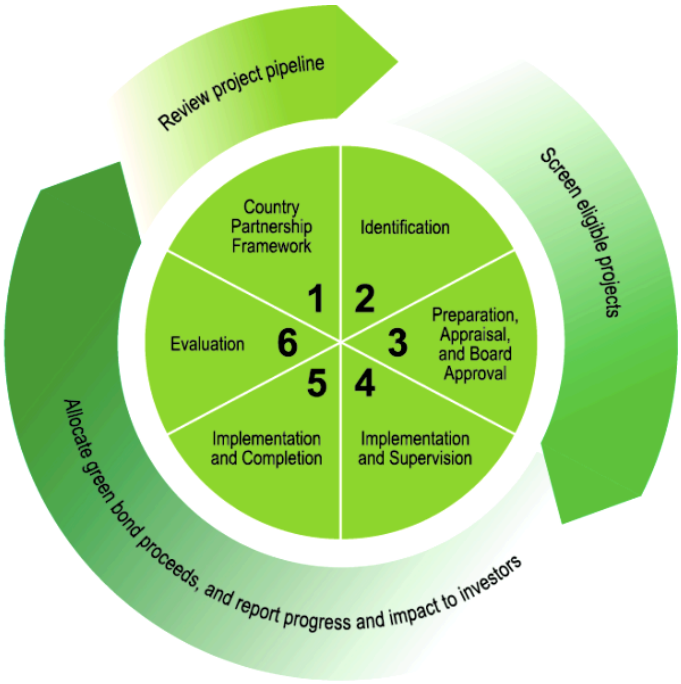
4.1 World Bank Green Bond Project

The green bond issuance (when and how often) of WB depends on the demand of investors. Coupon rates vary from each bond. Some is low at 0.05%, while some are ashigh as 7.2%. The green bond has an AAA rating based on the credit quality of the World Bank. The main buyers of WB green bonds are institutional investors such as commercial banks and pension funds. The WB then uses the green bond proceeds as loans to its member countries' projects. The project selection is based on pre-formed criteria with high environmental standards. The previous matured green bonds were imbursed well. And the WB has great interest in tapping the Chinese bond market with this applicable impact investment form.

4.1.1 Procedures and Criteria

The World Bank deploys a life cycle procedure with six steps, shown in Figure 5-1, to screen each project. In addition, the green bond projects in WB then proceed based on the three stages outlined in the outer circle of the graph: Review project pipeline, Screen eligible projects, Allocate bond proceeds and report progress and impact to investors.

Figure 5-1 World Bank Green Project Cycle



Source: World Bank Green Projects.

The second stage integrates the project selection criteria. The formation of the green bond projects' criteria is a mutual effort of the World Bank and the investors. Together with investors, the World Bank selects the key project types or criteria that fit in its goal of promoting low carbon development. The Center for International Climate and Environmental Research at the University of Oslo (CICERO) conducts independent review of the joint proposal from the WB and the investors. The CICERO endorses the selected project types or criteria, which shape a solid foundation for screening green bond projects.

Figure 5-2 World Bank Green Bond Project Selection Criteria

Eligible MitigationProjects	Eligible Adaptation Projects
Solar and wind installations	**Protection against flooding (including reforestation and watershed management)**
Funding for new technologies that permit significant reductions in greenhouse gas (GHG) emissions	**Food security improvement and implementing stress-resilient agricultural systems (which slow down deforestation)**
Rehabilitation of power plants and transmission facilities to reduce GHG	**Sustainable forest management and avoided deforestation**

emissions
Greater efficiency in transportation, including fuel switching and mass transport
Waste management (methane emissions) and construction of energy-efficient buildings
Carbon reduction through reforestation and avoided deforestation

Source: World Bank, 2013a

4.1.2 Energy Efficiency Financing

An exemplary case of the WB green bond programme is the China Energy Efficiency Financing[11] projects. As the main source of Chinese air pollution is industrial coal burning, near half of the total energy consumption in China is ascribed to the energy-intensive manufacturing industries. The energy utilization level is far behind the international advanced standard and there is great improvement potential to increase energy efficiency in the manufacturing industries, as well as conserving energy and reducing GHG emission.

The China Energy Efficiency Financing project I started in 2008 with the aim of mainstreaming investment in energy conservation in China's industrial sector. It targeted energy efficiency improvement in medium and large industrial enterprises. The total financing amount from WB is 200 million USD. The project is composed of two parts:

- finance different commendable energy conservation projects in the medium- and large-sized manufacturing companies and;
- facilitate the government implementing stronger industrial energy efficiency policies and programs.

The funding (green bond proceeds) was issued as loan to the Chinese government and carried out by two Chinese local banks: Export-Import Bank of China and Huaxia Bank. The project ending date was once extended from the end of 2013 to the end of 2016.

By the same token, a China Energy Efficiency Financing project II[12] is carried out built on the project I. It aims to expand the scale of commercial lending from Chinese banks to low carbon production activity reaching the untapped saving potential of energy consumption from the industrial companies in the power sector. The project was initiated in 2010 and to be closed by the end of 2014 with 100 million USD funding from the WB. China Minsheng Bank acts as the project implementing agency. The project consists two parts that are energy

[11] http://treasury.worldbank.org/cmd/pdf/ProjectExampleinChina_EnergyEfficiencyFinancing.pdf

[12] http://treasury.worldbank.org/cmd/pdf/ProjectExampleinChina_EnergyEfficiencyFinancingII.pdf

efficiency investment subprojects, technical assistance and capacity building of the Minsheng Bank (Zhang, 2013).

4.1.3 Results

Project I's implementation has demonstrated satisfactory results. It achieved an annual reduction of 1.9 tons of coal equivalent and 4.6 million tons of carbon emission. It exceeded the original project target of 4 million tons of carbon emission reduction per year at full operation. As the project carries on, it expects more energy conservation of 2.07 tons of coal equivalent and carbon emission reduction of 5.05 tons by the end of 2016.

For the policy purpose, the project has successfully contributed the formation and implementation of the energy efficiency policy in the Chinese 12th Five Year Plan. It catalyzed the establishment of the China Energy Conservation Center[13], which is the research body of energy efficiency policy, legislation and planning. It also carries tasks such as:

- advise on energy-saving evaluation of fixed assets investment;
- popularize energy-saving techniques, products and mechanisms;
- broadcast energy-saving information and offer training and consulting service.

To a further extent, the project helped the Chinese banks build up a sound energy efficiency lending business line. It leveraged more bank capital into the energy efficiency area and expanded the energy saving from the manufacturing industry to other industries, for example the construction sector (Wang, 2013).

Project II has achieved 0.05 million tons of coal equivalent energy savings and 0.12 million tons of GHGs reduction per year. On top of this, the project successfully supported and leveraged 23.8 million USD for energy efficiency investment and renewable energy commercial lending.

4.2 IFC-Beijing Shenwu Thermal Energy Techonology Project

4.2.1 Environmental and Social Review Procedures

IFC is the private sector arm of the WB (Economist, 2014). The environmental and social review is obligatory to the full range of IFC's projects. Each project undertakes project appraisal by IFC. The process involves six steps:

- Appraisal planning: the lead environmental and social specialist (LESS) will conduct interviews and site visits with key stakeholders in order to collect complete data and determine the extent of project information review;
- Conducting the appraisal: form project environmental assessment and pay site appraisal visits;
- Identifying performance standard gaps, categorization, peer revivew, completing appraisal and investment review meetings;

[13] http://www.chinanecc.cn/introduction.jsp

The performance standards of IFC are:

PS1: Social and Environmental Assessment and Management Systems
PS2: Labor and Working Conditions
PS3: Pollution Prevention and Abatement
PS5: Land Acquisition and Involuntary Resettlement

- Preparing the environmental and social review summary (ESPS) and environmental and social action plan (ESAP);

The IFC projects are categoried into three types based on their environmental and social impact.

Table 5-1 IFC Project Categorization

Categories	Description
A	Projects with potential significant adverse social or environmental impacts that are diverse, irreversible, or unprecedented.
B	Projects with potential limited adverse social or environmental impacts that are few in number, site-specific, largely reversible, and readily addressed through mitigation measures.
C	Projects with minimal or no adverse social or environmental impacts.

Source: IFC Environmental and Social Review Manual

- Actions requiring completion before Board approval, Commitment or First Disbursement: IFC and the project manager agree to undertake actions that fill the performance standard gaps before initiating the first investment. This needs to be supervised by LESS to ensure its efficacy;

- Environment and social review document (ESRD) and environmental and social risk rating (ESRR) record: collection and analysis of project due diligence information will form the base for ESRR by the LESS (IFC, 2013).

4.2.2 Beijing Shenwu Thermal Energy Techonology Project

This project is a category B programme according to the environmental and social review of IFC. Beijing Shenwu Thermal Energy Co. (Shenwu) is a private company founded in 1995 by Dr. Wu Daohong, who is a pioneer in the HTAC field in China. The company's main service is to design, fabricate and install high temperature air combustion (HTAC) equipment and system. HTAC technology is 'combustion of hydrocarbons with very high air preheats temperatures using a regenerator in the burner' and it serves energy saving and emission reduction. HTAC can reach 30% to 50% fuel savings (Hughes & Sebestyen, 2008). Shenwu's customers are the energy-intensive industries, the heavy consumer of fossil fuels. Shenwu's HTAC application can reach 30% carbon emission reduction.

IFC approved financing for the Beijing Shenweu thermal energy project in 2010 for three to five years with the following aims:

'(i) Support innovation and contribute to development of clean technology sector in China.
(ii) Assist the government of China to achieve its energy efficiency and CO2 emmisions reduction goals.
(iii) Enable cleaner production best practices in key polluting industries in China and other developing regions.'

The project was also anticipated to create over 600 job opportunities in three years.

IFC offered a 22.14 million USD loan to the company. The specific expense of the investment will cover the expansion of the company's facilities, development of HTAC applications for more industries, research and development and market and business growth. The investment will be used in both the Beijing and Hubei provinces, where Shenwu's subsidiary branch is located. The current world HTAC market is dominated by multinational companies. IFC hopes to apply its rich investment experience in the clean technology sector and take advantage of its global client network to help Shenwu in expanding its business into more industries and regions (IFC, 2010).

4.3 Case Summary

The WB China Energy Efficiency Financing projects successfully prove that green bonds, as a new financial instrument, not only can contribute to energy efficiency improvement effectively with notable achievement, but also can leverage more finance resources into the sector. It helps the development of the bank's energy efficiency lending business line, which contributes to a bigger and more complete systematic financing mechanism for energy efficiency and therefore cut air pollution generation from the root directly.

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The international cases sited above demonstrate that green bond has a positive impact on chanelling financial capital to new energy and environmental friendly industries effectively. And it is further stimulating a systemic reform in the banking and finance system. The successful cases render us forsee a huge potential of green bond implementation in China to accelerate capital flow into environmental friendly industry and spur the green finance reform.

5 Stakeholder Analysis

5.1 Financial Market

A 'sustainable bond market' has been conceived and a growing interests from varied of stakeholders are coming along. The sustainability initiating investors, such as the Nordic pension fund, who first demanded for green bond to the World Bank and the Californian teachers' pension fund, who is driving the integration of social responsibility to finance investment, are the main driving force for a sustainable bond market. And the international organizations, such as the World Bank, IFC and Bank of MerryLinch, who are the green bond issuers, have provided a development platform for sustainable bond market.

The government is joining the arry. Massachusetts State in the America, labeled part of its government bond as green bond as the first of its kind last year, the total raised amount publicy was USD 670 million. The Finance Bureau of Massachusetts stated that USD 100 million is going to support the expenditure of 'environment friendly' infrasture projects (Gilbert, 2014).

Along the increasing action and intiative for sustainable finance development, the 'sustainble bond market' is incubated and growing rapidly at the international market. In China, the broad interest is also emerging from varied of financial industry participant, including governmental brain power, such as the Development and Research Center of the China State Council. DRC is conducting a collaborative project with IISD as 'Greening China's Financial System' and green bond issue has drawn the attention of Chinese experts. For a further step, IISD is in partnership with the British Embassy in Beijing and the Climate Bond Initiave for a green bond scoping study in China. In the finance market, SDP Bank together with the Development Bank of China and Shenzhen Emissions Exchange issued the first carbon bond in China for CGN this year in May. The carbon issuance contributes significance to sustainable finance market reform and the extension of renewable energy financing channels (Zhu, 2014).

However the existing green bond programmes in the international market are subjected to each issuer's particular 'green' criteria and project selection process. Even the promulgation of Green Bond Principles offered a series of indicators on voluntary basis, there is lack of unified green bond code for the followers. Besides the broad emerging interest and stirring industry tempt in China, the commensurate policy framework, guidelines and regulations are not yet in place. This exposes the market to the risk of an unregulated environment for green bond project and given China's political singularity, a centralized policy framework for green bond guidance is crucial and necessary for its further growth.

5.2 Investors

At the international context, social responsible investors have been one of the the main driving fores for green bond issuance, such as the Nordic pension fund, who impeled the naissance of the first green bond programme of the World Bank and TIAA-CREF, who incorporates social responsibility into its investment decision and manages a specialized 'Social Choice Bond Fund', of which, 10% of the fund will be invested to bonds that generates measurable direct positive social and/or environmental impact (Gilbert, 2014).

Besides the self initiative of social responsibility, investing in green bond can not only help investors gaining profit, but also winning reputation. Many green bonds, especially the ones from multilateral organizations, such as the World Bank, its returns are based on the insticutional credit with high ratings of AAA or AAA-, which guarantee the stable interest return at very low risk. And in order to promote geen bond investment, the prerequisite of project information and management transparency helps investors understand and gaining knowhow of the green project opration and management. SSgA, a global leading asset management firm has forseen the green bond promising future. In 2011, it established a green bond strategy and through the dominant investment on green bond, it managed to AA or above credit ratings (Ditan, 2011).

IISD report asserted that the interest in green bonds from investors of developed countries are growing rapidly (Kidney& Oliver, 2014). And investors are showing bulky appetite for Asian market with air pollution and climate change as the main incentives. The first Asian green bond issued by south Korea's KEXIM Bank exposed the investors' demand are three times higher than the issuance amount. The worsening pollution situation engaged governmental support for low carbon and clean energy projects. The projects therefore are gaining the investors' preference (Syntao, 2013).

While the development countries' investors are actively tapping their maket share for green bond programme, China, as one of the largest capital market in the world has immense potential for green finance investment. The key is to find a suitable tool to channel the capital flow to environmental industry and green bond is one of the ideal mechanisms. As a relatively new entry product in the Chinese market, a stronger environmental awareness needs to be plant among Chinese institutional investors. And a stable policy framework support from the government is the right arm.

5.3 Enterprises

The international cases of company green bond showcase the success and popularity of green bond issuance. Green bond is an innovative financing methods for companies, especially for those who were not preferred by social responsible investment. Such as the Exelon Corp., which is an energy manufacture and distributor. It was avoided by many social responsible investors before because it operates nuclear power production. Last year it founded an independent uinity 'Continental Wind' for wind power generation. And the Continental Wind successfully gained USD 613 million capital for its project bond (Gilbert, 2014). Therefore green bond could mitigate the financing difficulties for certain enterprises.

CGN scucessufully issued RMB 1 billion carbon bond at the fix rate of 5.65%, which is 0.05% lower than the AAA credit bond in the market, with a floating rate of 0.05-0.2% linked to CCER. The successful financing for this first carbon bond issuance in China, which filled the gap of direct carbon linked financial products, reflect the market confidence toward green bond.

It took two years for the first carbon bond issuance of CGN together with SDP Bank, the Development Bank of China, and the Shenzhen Emissions Exchange. The expert team spent over half year on product design and registered it at NAFMII last October. While it encountered high financing cost by the end of last year. The carbon bond has to be registered again after two months if not sold. The second registration completeted effciciently through the 'green way' that NAFMII opened for CGN. The CGN carbon bond case reflects the market confidence for green bond and the positive antipation from

stakeholders. More and more carbon emission exchanges are being opened, which will catalyst a fast maket growth.

The investment bank manager of SDP Bank Bin Yang concluded that there were many difficulties and challenges. While the carbon market is still at its early age, the trading volume of carbon targets, listed product is at small amount. The clients of regional emissions exchanges have positive antipation for the market future, yet there are many uncertainties for what can be done in a recent time (Bao, 2014).

5.4 Government

As the previous chapter stated that since Chinese government has high credit among Chinese people, it is the most feasible to issue governmental green bond as the flagship of national green determination and enhance its national image. After being authorized by the Ministry of Finance for local governmental bond issuance, some municipal green bond is at gestion.

The Ministry of Environment Protection is the main body for environmental finance implementation in China, such as its participation to Green Credit Guidelines. The Foreign Economic Cooperation Officce of the Ministry of Environment has extentive collaborative project with university scholars and academies on environmental finance. It formed a 'Green Bond Fund' for investing in green bond from enterprise in order to support the environmental friendly industry growth. The national research centers are also conducting research and projects for financial system reform integrating sustainability in reference of the international experiences.

The government is playing a supportive role in the green finance area, which renders an optimistic future for green bond programme development. Yet the governmental action are not strong enough without a systemic policy indication. The information communication and exchange is not fluent among governmental organizations and green fiancne stakeholers, such as international NGOs. The government should take more vigorous and proactive stand in the green finance industry reforming progress.

5.5 International Organizations

International organizations are the external driving force for green bond issuance and the refences for green bond promulgation in China. The World Bank and IFC's green bond capital has been used in China to stimulate the environmental industry growth and mitigate the financing difficulties for new industry. The international institutional investors are showing eagerness for Chinese green bond market and the international green bond issuers are interested in tapping Chinese capital market (interview with the WB).

This June, IFC issued the first RMB green bond at offshore market, Longdon Stock exchange with HSBC as the main distributor. In March, IFC became the first multilateral organization that issues RMB bond and raised RMB 2 billion from international investors. And this green bond project rasied RMB 0.5 billion capital. The main buyers are from Asia and Europe. The vice president of IFC stated that IFC endeavours to support Chinese capital market development, which is essential for migitate the SMEs financing difficulties. And IFC will continue deepening its work on offshore RMB asset liquidity and yield curve (Gao, 2014). International organizations will keep playing a steering stick role in the Chinese financial market for sustainable finance reform.

6 Conclusion

To conclude, this paper examined the severe air pollution situation in China, which needs immediate action to solve the issue. The Chinese government has promulgated an action plan for the coming years with a vigorous finance capital requirement.

Green bonds could help air pollution mitigation by tapping the huge potential in the private sector in China and channel the capital into the environmental sector. International examples of green bonds demonstrate success of their contribution to energy efficiency improvement, energy conservation, clean technology application and carbon emission reduction.

Chinese and international investors (institutional and individual), central and local governments, finance market, enterprises, especially SMEs, and public opinion incubate demand for green bond issuance in China. Green bonds not only can provide financial capital to mitigate air pollution, but also can contribute to the financial market products' diversity. It can further spur finance market development and enhance the systemic stability in the long run.

Neverthess, green bond is not with perfection. While a vast interest is burgeoning to green bond, there are critisim of green bond shortcomings that should be awared of:

- As a financial product in essence, green bond carrys an inborn invetiable financial risk. Especially for corporate green bond, it is not rated as high as government bodies, even when their bonds are covered by assets(CDC Climat, 2012);

- Green bond's yield is not higher than most other bond products, thus it lacks of attraction to investors from profitability perspective;

- Green bond's market is still at a small share of the total bond market. Its environmental effect is still limited in a short time frame(O'Brien, 2011);

- There is no universal standard or criteria of green bond. Therefore it would be difficult to measure the green bond impact and conduct project quality control. The current 'green' standards are decided by each issuer. Mr. Angur McCrone, Chief Editor of Blomberg New Energy Finance argued that how do we measure the impact of green bond? Because of lack of common standard, it is likely to result the situation that one project is just relatively greener than the other. Thus it is difficult to quantify the absolute value of green bond's effect to the environment (McCrone, 2014);

- When enterprises can have reputation benefit buy investing or issuing green bond, they also face the same risk if the outcome does not meet the expectation;

- Given green bond is a new member in the financial market and environmental area, there is lack of transparency of how green bond is being deployed in each concrete project (Banktrack, 2014).

Whereas there is a great potential to introduce green bonds in China, there are existing obstacles.

6.1 Challenges

6.1.1 Receptivity

Even the contemporary environmental issues, e.g. the air pollution in China, are stringent now, developing countries generally share a lower environmental awareness given theireconomy development priority. Green bonds, as an innovative form of impact investment are a new concept and product originated at the query of institutional investors in developed countries. The understanding and receptivity of the notion of green bonds is yet to be proliferated among developing countries, policy makers, investors and enterprises. The current understanding of climate finance and its tools is still limited and at the initial stage in China (interview with CUFE).

Green bonds are just one strain of impetus among many others, such as green fund, green investment bank etc. in sustainable finance reform to re-engineer the financial system and alter the traditional investment mindset. And green bond issuance requires a series of policies to support and a comprehensive green performance evaluation and appraisal system of a project, which needs much progress to be attained.

6.1.2 Market Environment

The Chinese bond market is among the largest in the world, yet it has remained closed to international investors. Hence, the green bond initiative relies on the Chinese interior verve, for instance, the dash from the government or financial institutions.

The existing green bond default in China indicates the regulatory inefficiency and market immaturity for green bond implementation. A longer-term market development and more complete policy regulation need to take place for a mature and stable market environment gestation.

6.2 Next Steps

Sean Kidney, president of Climate Bond Initiative, identifies a roadmap of four steps for growing a green bond market in China in a working paper for the 'Greening China's Finance System' project of the China State Council and International Institute for Sustainable Development. They are:

1. Define eligible green investments;
2. Direct regulators to incorporate regulatory provisions needed to establish a green bond market;
3. Establish investor green bond roundtables domestically and internationally to prepare demand;
4. Pilot green bonds through different issuer types (Kidney& Oliver, 2014).

The Industrial Bank of China, who is under preparation to be the first green bond issuing bank in China, appeals for individual bond design with incentives, tax favor and subsidy from the government. The bank also calls for a comprehensive evaluation system to track the green bond and project performance and quantify the green bond's environmental effect. In addition the bank also propose to the regulators that the administration procedures should

be more simplified in order to increase efficiency and inject financial power into the green industries in the market in a timely manner (Liang, Jiang & Chen, 2014).

The author recognizes that the below two steps are essential for introducing green bond to Chinese market.

6.2.1 Stable Policy Frame

The government shall form a stable policy frame with a clear and strong signal of environmental protection and air pollution mitigation objectives. A series of legislation are to be formed prioritize energy efficiency and conservation programs. Especially for the big companies and SOEs among the heavy polluters, the government needs to strengthen its policy implementation effort in order to push those taking stronger actions on air pollution mitigation. The government needs to incentivize the emerging new industries' development creating more innovative and growing space for them in the market.

Clear environmental standards shall be formed in order to guide the financial institutions and enterprises' environmental practice.

Enhanced supervision in the corporate bond market is needed to protect investors' interests and prevent further debt default.

6.2.2 Green Bond Pilot

After the establishment of a stable policy frame with a strong environmental focus, the market should be directed and impelled toward innovative financing. Green bond pilots could then be established. The government, policy banks and commercial banks in China are the ideal candidates to issue green bonds with cogent credit back-ups. While state-owned enterprises in China have higher stringency for capital sufficieny and governmental policy orientation, they are also suited to issue green bonds.

The risk of green bonds varies depending on the issuer and projects. In the case of government-issued green bonds, it imposes a low risk, whereas the corporate green bond could have a higher default risk and therefore require a guarantee or high credit rating.

To ensure the bonds' proceeds use, green bond principle and environmental criteria need to be deployed both at the beginning when screening the projects and during the programme implementation process in order to monitor the projects' performance and outcome.

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Appendix

1. World Bank Green Bond Issuances To Date

FIRST ISSUE DATE	VOLUME	COUPON	MATURITY DATE	LEAD MANAGER
April 24, 2009	USD 300 million	Floating	2012	SEB
December 4, 2009	USD 180 Million	2%	2013	SEB
December 15, 2011	USD 510 Million	0.50%	2013	SEB
November 24, 2008	SEK 3.350 Billion	3.5%	2014	SEB
February 2, 2010	NZD 150 Million	5.23%	2015	Daiwa Securities
June 8, 2010	MXN 40 Million	6.15%	2015	JP Morgan
June 8, 2010	ZAR 25 Million	7.2%	2015	JP Morgan
July 16, 2010	USD 10 Million	Floating	2015	Clariden Leu
September 1, 2010	USD 50 Million	1.375%	2015	JP Morgan
October 27, 2010	MYR 12 Million	1.375%	2015	TD Securities
January 22, 2014	USD 550 Million	Floating	2015	BoAML, Goldman Sachs
August 22, 2013	USD 550 Million	0.375%	2015	Morgan Stanley, SEB
November 16, 2010	AUD 30 Million	5.4%	2015	JP Morgan
November 30, 2010	USD 10 Million	1.5%	2015	Daiwa Securities
December 21, 2010	USD 10 million	2.05%	2015	Daiwa
December 1, 2010	USD 10 Million	2%	2016	SEB
January 25, 2011	USD 30 Million	2.135%	2016	JP Morgan
January 20, 2011	USD 10 Million	Floating	2016	Daiwa Securities

January 12, 2011	USD 10 Million	1.98%	2016	JP Morgan
February 17 , 2011	USD 30 Million	2%	2016	JP Morgan
February 18, 2011	USD 10 Million	2.34%	2016	Daiwa Securities
February 25, 2011	USD 20 Million	2.3%	2016	Daiwa Securities
March 17, 2011	USD 10 Million	2.2%	2016	Daiwa Securities
April 14, 2011	USD 10 Million	2.18%	2016	Daiwa Securities
June 13, 2011	USD 10 Million	1.71%	2016	Daiwa Securities
July 5, 2011	EUR 20 Million	2.25%	2016	SEB
November 28, 2011	AUD 13 Million	4.08%	2016	Deutsche Bank
February 22, 2010	SEK 1.575 Billion	3.25%	2017	SEB
March 2, 2010	BRL 250 Million	9.5%	2017	JP Morgan
March 2, 2010	HUF 7.950 Billion	5.5%	2017	SEB
March 2, 2010	NOK 400 Million	3.75%	2017	SEB
March 2, 2010	RUB 750 Million	7.5%	2017	JP Morgan
March 2, 2010	TRY 75 Million	10%	2017	JP Morgan
March 3, 2010	ZAR 850 Million	8.75%	2017	TD Securities
March 3, 2010	NZD 50 Million	5.625%	2017	RBC
March 5, 2010	EUR 2 Million	2.5%	2017	SEB
March 5, 2010	AUD 280 Million	6%	2017	TD Securities
February 6, 2012	USD 10 Million	0.84%	2017	Daiwa Securities
February 10, 2012	USD 50 Million	.92%	2015 - 2017	SEB
July 12, 2012	USD 10	0.625%	2017	SEB

	Million			
October 23, 2012	AUD 94.5 Million	2.910%	2017	Daiwa Securities
March 20, 2014	EUR 550 Million	0.250%	2017	Credit Agricole, MS, SEB
January 30, 2013	ZAR 83 Million	.5%	2018	HSBC
January 31, 2012	PLN 65 Million	3.25%	2019	TD Securities
July 26, 2012	RUB 750 Million	6.5%	2019	JP Morgan
December 10, 2012	MYR 23 Million	2.5%	2019	HSBC
February 27, 2013	MXN 50 Million	0.50%	2019	HSBC
March 2, 2010	COP 180 Billion	8%	2020	JP Morgan
March 5, 2010	MXN 1.250 Billion	7.5%	2020	TD Securities
March 9, 2010	JPY 125 Million	.875%	2020	TD Securities
November 2, 2010	SEK 100 Million	3.5%	2020	SEB
January 18, 2011	USD 5 Million	3.32%	2021	Daiwa Securities
May 24, 2011	USD 2.143 Million	3.5% /FLT	2021	BoAML
August 4, 2011	USD 7.69 Million	2.5% /FLT	2021	BoAML
August 8, 2011	CAD 10 Million	3%	2021	Mitsubishi Securities
October 5, 2011	AUD 10 Million	4.45%	2021	Daiwa Securities
July 12, 2012	USD 5 Million	1.5%	2022	SEB
October 23, 2012	AUD 42.2 Million	0.5%	2022	Daiwa Securities
June 7, 2013	ZAR 150 Million	7%	2023	JP Morgan
June 20, 2013	RUB 529.2 Million	6.75%	2023	HSBC

Source: http://treasury.worldbank.org/cmd/htm/GreenBondIssuancesToDate.html

2. Notable Existing Green Bond and Related Issuances(2012, excluding World Bank& IFC)

ISSUER	YEAR (S)	TYPE	AMOUNT MILLIONS	NOTES
FPL Energy American Wind LLC	2003	Wind ABS	$370	Bonds rated BBB- secured on the cashflow of 7 US wind projects.
Airticity	2006	RE corporate bond	$300.8	3 year bond to fund wind energy farms in Europe and US
Georgetown Special Taxing District	2006	EE Green bond	$14.5	For the construction of a green multi-use complex
CRC Breeze Finance (Breeze II)	2006	Wind ABS	$676	EUR 470 Million ($676 Million at an exchange rate of EUR/USD 1.44) 20 year bonds issued through SPV against a combined portfolio of wind farms in Germany and France, tranches rated BBB and BB+ (downgraded in 2010 to BB and B due to insufficient wind).
European Investment Bank (EIB)	2007–2010	Climate Awareness Bond	$1630	For investment in RE and EE. 3–8 year term. Have issued one structured note: 2007 issue due 2012: At maturity, holder receives an additional amount linked to the change in the level of the FTSE4Good Environmental Leaders Europe 40 Index over the lifetime of the Bonds, subject to a minimum of 5% of the nominal amount of the Bonds.
US Government agencies and utilities	2009–2012	Qualified Energy Conservation Bonds (QECB) program and Clean Renewable Energy Bonds (CREB)	$895	May be used by state, local and tribal governments to finance 'qualified energy conservation projects.' A cap of $3.2 Billion has been allocated to states under the US 2009 stimulus package, although only $895 Million has been utilised to date according to reports by Bloomberg New Energy Finance.

		program		
REC Group	2009	RE corporate bond	$212.5	5 year bond to fund activities of a solar energy company.
Nordic Investment Bank (NIB)	2010	Environmental support bond	$200	For financing its CLEERE lending facility on climate change, EE and RE investments. 3 year maturity
African Development Bank (AfDB)	2010	Clean energy bond	$705	5 For investment in renewable energy sources and infrastructure. 3.5–7 year terms.
Asian Development Bank (ADB)	2010	Water bond	$645	For improving water quality, management and irrigation. 2–3 year terms.
Alta Wind Energy Center	2010	Wind project bond	$580	25 year bond to fund the construction of 3GW of wind farms. Rated Ba3 by Moody's
Sunpower Andromeda Finance	2010	Solar project bond	$260	Secured on a 44MW solar park, partially guaranteed by Italian export credit agency SACE. 2 tranches at 18 year terms. The bond was structured as an asset-backed issuance, with half placed to institutional investors. The institutionally placed bonds were fully guaranteed by SACE. The second, non-guaranteed, trance was sold exclusively via the EIB.
EBRD	2010–2011	Environmental Sustainability Bond	$48	For a portfolio of green projects aimed at promoting sustainable development. 4 year term.
Delaware Sustainable Energy Utility	2011	EE bond	$67.4	Established by the state in 2007 to coordinate energy efficiency services and the deployment of renewable nergy, the bond proceeds were backed for energy conservation measures in public buildings and backed by guaranteed energy savings agreements from six energy service companies. This allowed it to gain an AA rating.
Topaz Solar	2012	Wind project	$850	The Topaz bonds were the largest for a renewable-energy project

Farms LLC	bond	without a US government guarantee and the first to be rated by the three top ratings companies. Issued USD $850 Million of 5.75 percent, unsecured debt due in September 2039 that priced to yield 379.7 basis points, or 3.797 percentage points, more than similar-maturity Treasuries, according to data compiled by Bloomberg.

Source: Sustainable Prosperity, 2012

3. 2013: Annual Average PM2.5 Concentrations of 74 Chinese Cities

RANKING	CITY	PROVINCE	ANNUAL AVERAGE PM2.5 LEVEL (MICROGRAMS PER CUBIC METER)	AVERAGE OF THE MAXIMUM DAILY PM2.5 LEVEL (MICROGRAMS PER CUBIC METER)
1	Xingtai	Hebei	155.2	688
2	Shijiazhuang	Hebei	148.5	676
3	Baoding	Hebei	127.9	675
4	Handan	Hebei	127.8	662
5	Hengshui	Hebei	120.6	712
6	Tangshan	Hebei	114.2	497
7	Jinan	Shandong	114.0	490
8	Langfang	Hebei	113.8	772
9	Xi'an	Shaanxi	104.2	598
10	Zhengzhou	Henan	102.4	422
11	Tianjin	Tianjin	95.6	394
12	Cangzhou	Hebei	93.6	380
13	Beijing	Beijing	90.1	646
14	Wuhan	Hubei	88.7	339
15	Chengdu	Sichuan	86.3	374
16	Urumqi	Xinjiang	85.2	387

17	Hefei	Anhui	84.9	383
18	Taizhou	Jiangsu	80.9	474
19	Huai'an	Jiangsu	80.8	513
20	Changsha	Hunan	79.1	325
21	Wuxi	Jiangsu	75.8	391
22	Harbin	Heilongjiang	75.7	756
23	Changzhou	Jiangsu	75.6	322
24	Nanjing	Jiangsu	75.3	312
25	Xuzhou	Jiangsu	74.9	304
26	Taiyuan	Shanxi	74.2	416
27	Huzhou	Zhejiang	73.5	414
28	Shenyang	Liaoning	72.7	464
29	Zhenjiang	Jiangsu	71.6	263
30	Yangzhou	Jiangsu	71.1	312
31	Suqian	Jiangsu	70.7	502
32	Nantong	Jiangsu	70.2	248
33	Changchun	Jilin	69.2	425
34	Nanchang	Jiangxi	69.1	255
35	Jinhua	Zhejiang	69.0	473
36	Lianyungang	Jiangsu	68.0	407
37	Maryland	Gansu	67.1	259
38	Suzhou	Jiangsu	67.1	384
39	Yancheng	Jiangsu	67.0	455
40	Jiaxing	Zhejiang	66.9	417
41	Quzhou	Zhejiang	66.5	406
42	Shaoxing	Zhejiang	66.4	426
43	Hangzhou	Zhejiang	66.1	361
44	Qinhuangdao	Hebei	65.2	335
45	Chongqing	Chongqing	63.9	187
46	Xining	Qinghai	63.2	319

47	Qingdao	Shandong	61.7	280
48	Shanghai	Shanghai	60.7	421
49	Hohhot	Inner Mongolia	59.1	216
50	Wenzhou	Zhejiang	56.5	248
51	Zhaoqing	Guangdong	54.7	174
52	Nanning	Guangxi	54.7	199
53	Taizhou	Zhejiang	53.0	284
54	Foshan	Guangdong	52.3	160
55	Guangzhou	Guangdong	52.2	159
56	Chengde	Hebei	51.5	407
57	Dalian	Liaoning	50.7	224
58	Ningbo	Zhejiang	50.4	416
59	Guiyang	Guizhou	49.4	229
60	Jiangmen	Guangdong	48.4	158
61	Lishui	Zhejiang	47.9	196
62	Zhongshan	Guangdong	47.6	146
63	Dongguan	Guangdong	46.0	165
64	Yinchuan	Ningxia	43.7	164
65	Zhangjiakou	Hebei	43.1	471
66	Shenzhen	Guangdong	39.7	131
67	Zhuhai	Guangdong	37.9	157
68	Huizhou	Guangdong	37.2	121
69	Kunming	Yunnan	35.5	123
70	Fuzhou	Fujian	33.2	112
71	Zhoushan	Zhejiang	32.1	353
72	Xiamen	Fujian	31.3	89
73	Lhasa	Tibet	26.0	101
74	Haikou	Hainan	25.6	130

Source:http://www.greenpeace.org/eastasia/news/blog/bad-to-worse-ranking-74-chinese-cities-by-air/blog/48181/

4. Typology of Potential Green Bonds

BOND TYPE	ISSUER	DESCRIPTION	ASSET CLASS	EXAMPLES
Treasury-backed bonds (balance sheet of issuer) with proceeds linked to a pool of qualifying assets, goods, services	National Government	Bonds issued by governments. Seen as backed by the full faith and credit of the sovereign	Sovereign Bond	
	Local Government/ Municipality	Municipalities and regional governments General Obligation bonds where proceeds are allocated to qualifying investments. These are essentially the same as sovereign bonds.	Municipal Bond	Three French provinces issued "sustainability" bonds in 2012. The U.S. State of Massachusetts and the City of Gothenburg in Sweden issued municipal green bonds in 2013, with proceeds earmarked for environmental projects
	Development Bank	As above	Sovereign Bond, Financial Institution Bond	World Bank, African Development Bank and IFC green bonds; EIB Climate Bond; FMO sustainability bonds; Kommunalbank Norway green bond.
	Commercial	A bank can issue a	Financial	Bank of

	Banks	bond linked to a pool of qualifying loans: wind and solar energy, rail, green buildings. This could be in the form of: - A corporate bond for government and institutional investors, or - A retail bond for individual customers of the bank. For credit purposes, the bond is the same as a standard corporate treasury-backed bond, except that proceeds are only used to finance qualifying green investments.	Institution Bond	America Merrill Lynch issued a $500 million green bond in November 2013. An Australian bank has been certified under the Climate Bonds Standard to issue $500 million in climate bonds, with proceeds allocated to a pool of wind energy loans
Treasury backed bonds with proceeds linked to a pool of	Corporations	Companies with substantial green assets on their balance	Corporate Bond	France's EDF issued a $1.9 billion green

qualifying assets		sheets. A power company can issue a bond linked to its renewable energy assets. A car company can issue a bond linked to its electric vehicle assets		bond and Sweden's Vasakronan issued a $300 million green bond in November 2013
"Dual recourse" bonds (covered bonds): the investor gets both a Treasury backing and recourse to the underlying pool of assets. If the issuer fails the investor owns the asset pool.	Commercial Banks	The extra assurance of dual resource allows banks to borrow at a lower rate than their usual bank credit rating, reducing their usual cost of funds. Most covered bonds are issued by banks operating under governing national legislation that provides assurance for investors. Asset pools are mostly made up of home mortgages, with loans for public sector buildings also included in Germany. The Climate Bond Initiative has proposed including renewable energy assets in cover pools and a tiered	Covered Bond	The established covered bond markets is worth $3 trillion. However, there are not yet any specific green covered bonds.

		risk-weighting structure to encourage green mortgages, where repayment risk will be reduced because utility bills will be lower.	
	Local Governments	Green assets could be re-financed with dual recourse bonds, providing credit transparency to what are often opaque assets.	Covered Bond
	Corporations	Utilities could issue structured covered bonds secured against renewable energy assets as a way to reduce their cost of capital.	Covered Bond

Source: Kidney & Oliver, 2014.