

GREENING CHINA'S FINANCIAL SYSTEM

CHAPTER 3:

ENVIRONMENTAL AND INDUSTRIAL POLICY ENVIRONMENT FOR THE DEVELOPMENT OF GREEN FINANCE IN CHINA

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EXECUTIVE SUMMARY

This paper outlines the frameworks of Chinese law and policy concerning *environmental protection, public investment, financial policy and industrial policy* and the challenges they face.

Policy and Legal Frameworks: Over the past 20 years, China has built up a comprehensive system of laws, regulations, rules, standards and guidance on environmental protection. These policies stimulate demand for green investment. However, key challenges to the implementation of the legal and policy framework include: (i) an inadequate institutional and legal system, (ii) tensions between the national environmental protection system and local implementation, (iii) fragmentation of regulation and management across watersheds and ecological regions and (iv) weak standards encouraged by ambiguous rules. Overall, this results in poor enforcement and supervision of existing rules, reducing effective demand for green investment and failing to abate demand for environmentally damaging investment.

Public Investment: China has also developed a system for direct public financing of environmental works, made up of on-budget fiscal expenditure, ecological compensation systems and special funds. Key challenges here are (i) fragmentation of funding channels, (ii) reactive funding lacking a long-term strategy and (iii) weak supervision and performance management.

Financial Policies: In recent years, attention has turned to the role of financial institutions and markets in supporting environmental protection and industrial transformation. Starting in the 1990s, China has developed policies to establish systems for carbon markets as well as green credit, green securities and green insurance. Financial institutions have developed policies and products to support environmental protection in response to these policies. But some challenges and limitations have also been revealed, including: (i) unattractive risk: return rates for green investments; (ii) a lack of environmental competency within commercial banks; (iii) green finance being overly dependent on the government; and (iv) green finance being overly dependent on bank finance.

Industrial Policies: Industrial policy is a key feature of China's economic development model, with the aim of upgrading industries developing strategic emerging industries. New industries to be encouraged include energy conservation, environmental protection, bio-technology, new energy, new materials and new-energy automobiles, while out-of-date production capacity, techniques, equipment and products are to be phased out. However, in practice, resource-intensive industries have continued to grow. This leaves the economy vulnerable to the volatility of international resource prices and places it at the lower end of the industrial value chain with low added value.

This chapter sets out the following recommendations in each of these areas:

Environmental legal and policy frameworks:

- Remove ambiguous policy objectives
- Base standards and fees on environmental criteria
- Strengthen supervision and management of compliance with discharge standards
- Tighten discharge standards and implementation
- Strengthen regional pollution caps and a system of discharge permits
- Reinforce pollutant discharge control in rural areas
- Include more pollutants under control

Public investment:

- Coordinate between the different funding channels
- Provide performance-related guarantees on the provision of special fiscal funds
- Diversify environmental financing channels
- Innovate financing models and actively roll out the public-private partnership model

Financial policy:

- Enable development of green capital markets
- Shift from reliance on administrative instruments to enabling market forces
- Shift from implicit to explicit support and guarantees

Industrial Policy

- Support and align with environmental policy
- Encourage technology innovation
- Promote strategic environmental industries
- Require environmental impact assessments for industrial policy

INTRODUCTION

Since the reform and opening up, China's economy has grown rapidly. By 2010 its overall GDP exceeded Japan's for the first time and ranked second in the world. However, increasingly severe environmental problems are associated with China's economic growth.

Since 2005, China has become the world's top polluter. In 2013 sulphur dioxide, nitrogen oxide, organic pollution (measured by Chemical Oxygen Demand) and ammonia nitrogen emissions were respectively 20.44 million, 22.27 million, 23.53 million and 2.46 million tonnes (Huidian Research, 2015). Pollutants discharged in many regions have exceeded the carrying capacity of the local environment. In 2011 China became the nation with the highest carbon dioxide emissions in the world.

Among 74 cities monitored, based on recent ambient air quality standards, only three of them meet the required standard. Some reaches in the watersheds of Dianchi, Yangtze River, Haihe River, Huaihe River and Yellow River are seriously polluted, and 60 per cent of underground water monitoring sites have poor or very poor water quality (RT, 2015). Regarding soil pollution, 16 per cent of soil pollution monitoring sites exceed national limits and 19 per cent of arable land has excessively polluted soil. Heavy metal pollution, including mercury and persistent organic pollutants, are environmental problems of high concern (Ministry of Environmental Protection, 2014a). In addition, environmental accidents happen too frequently and environmental pollution damages people's health, causing major impacts on social welfare.

China is implementing a development strategy that seeks to transform its economic development model and build a resource-conserving and environmentally friendly society. There is broad recognition that the previous extensive development model, which centred on "three-high" industries (high investment, high energy consumption and high pollution) is not sustainable and must be transformed into intensive development of "two lows and one high" (low investment, low energy consumption and high growth).

1.1 THE NEED FOR GREEN INVESTMENT

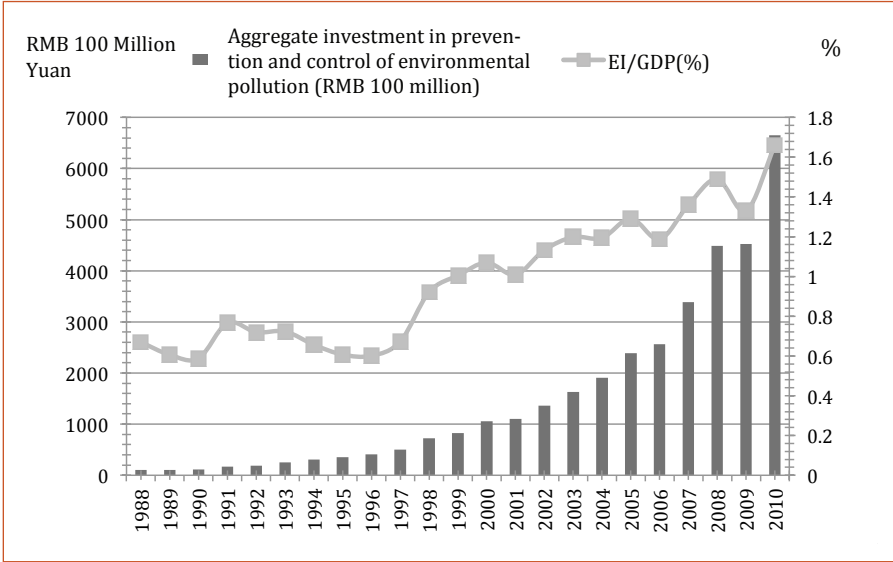
It is clear that achieving this transformation entails major shifts in both public and private investment, away from the most resource-intensive and polluting activities, towards more efficient and cleaner technologies. Associated opportunities for investment and new industrial development should be promoted in areas such as land remediation, clean energy performance contracting and renewable energy (see Annex III for estimates of investment need in key areas).

Although there is no single, common definition of environmental investment in China, or globally, broadly it includes investment in:

- **Prevention and control of environmental pollution.** This includes urban environmental infrastructure, prevention and control of legacy pollution, and investment in new waste management capacity to match new construction and industrial development.
- **Conservation and sustainable natural resource management.** This includes conservation of biodiversity and environmental systems in relation to marine, freshwater, land, forestry, grassland, desert and wetland ecosystems. It includes broad rural environment protection as well as protection of special ecological areas and nature reserves and environmental conservation related to relevant industries such as minerals, tourism, forestry and agriculture.
- **Environmental management and technology.** This includes developing the administrative capacity of public institutions; departments and agencies with environmental protection responsibility; investment in pollution prevention, control technologies, and research and development relevant to pollution prevention and control; and environmental management.

Available existing aggregate statistics tend to capture the first of these categories, urban and industrial pollution prevention and control. As seen in Figure 1, from 1988 to 2000, China’s aggregate investment in environmental protection climbed from RMB 10 billion (USD 1.6 billion) to RMB 665 billion (USD 107), displaying a stable growth tendency. During the same period, the proportion of aggregate environmental investment to overall GDP also increased from 0.7 to 1.7 per cent.

FIGURE 1: CHINA’S ENVIRONMENTAL INVESTMENTS (EI) AND THEIR PROPORTIONS TO OVERALL GDP DURING 1988-2010



Source: China Statistical Yearbook on Environment (1989–2013) and China Statistical Yearbook (1989–2013)

Investment in urban environmental infrastructure is even greater. State-owned enterprises (SOEs) are the main investors and draw on government-owned financing platform companies. Fiscal credit therefore plays a vital role.

In contrast, for industrial pollution prevention and control, investors and those involved in financing are chiefly non-SOEs. Nevertheless, a considerable portion of funds for industrial pollution control have come from state budgetary funds during the 11th Five-Year Plan period, in the form of direct investment, government subsidies and allowances, as well as credit guarantees through banks, to provide support and encouragement for enterprises’ pollution prevention and control.

This paper outlines the frameworks of law and policy concerning *environmental protection, public investment, financial policy and industrial policy* that seek to influence public and private funding investment decisions about green investment. In each case, it looks at the challenges and limitations of current policy frameworks. The final section presents a set of recommendations.

2

ENVIRONMENTAL POLICIES

2.1 ENVIRONMENTAL LAWS, REGULATIONS AND STANDARDS

Over the past 20 years, China has formulated and released laws, regulations, rules, standards and guidance on environmental protection, which have built up to form a comprehensive policy system for environmental governance. This system includes provisions on public funding and fiscal support for environmental investment, as well as regulations to eliminate the most polluting technologies and pricing, and pollution fees and fines for non-compliance designed to incentivize and encourage businesses to invest in resource conservation, environmental protection and clean industrial upgrading. Key elements are outlined in Table 1, with more detail in Annex I.

TABLE 1: SUMMARY OF CHINA'S FRAMEWORK OF LAWS, REGULATIONS AND STANDARDS

The Environmental Protection Law	Basic legal framework for environmental protection in China, and includes several provisions on the role of public finance.
Special laws on pollution prevention and control	Laws focused on pollution control in relation to freshwater, air and sea and to noise, radioactivity and solid waste. In each case the laws include provisions on (1) fines and pollution pricing, (2) encouragement advanced green processes and materials, (3) phasing out of backward production techniques and equipment and (4) ecological compensation mechanisms.
Circular economy and clean production	Circular economy refers to the efficiency of materials and energy use. Relevant laws address (1) industrial, fiscal and taxation policies; (2) supervision of polluting and high-resource industries; (3) encouragement for the development of technologies for resource recycling, regeneration and re-use; and (4) public-private funding mechanisms.
Energy conservation, emission reduction and renewable energy	Key laws include the Law on Energy Conservation, the Renewable Energy Law, the Electric Power Law, and the Law on the Coal Industry. These laws create a framework for industrial policies to encourage energy conservation; restrict the development of high-energy-consumption and high-pollution industries; and develop energy-saving and environmentally friendly industries, including through the use of fiscal funds, taxes and subsidies, and guidance to financial institutions.
Administrative regulations	While the preceding laws provide overarching policy frameworks, there are also detailed rules for prescribing the specific measures for implementation in individual industries such as electronics, agriculture, sewage treatment and for particular environmental areas such as specific watersheds. In many cases, implementation is carried out by provincial governments and other local government agencies, so the administrative regulations of the State Council require and encourage action by local government to regulate industries, collect pollutant discharge fees and manage them as financial resources for environmental protection.
Standards	Standards for environmental quality are at the heart of the environmental governance system, and are set through a combination of national and local authorities. They are the basis for setting pollutant discharge standards, fees and permits and evaluating environmental impacts. Standards are set through a combination of national and local government bodies.
Environmental prices	Traditionally, the pricing of water, coal, electricity, natural gas and urban heat supply has not reflected the true cost of scarcity of natural resources and has acted as a subsidy for resource use. Increasingly, reforms are seeking to bring these prices into line with market principles.

The overarching Environmental Protection Law (2014) lays out several provisions in relation to public and private financing for investment in environmental protection and green technologies, including:

- **An increase in government spending** on environmental protection and pollution control (Article 8).
- **Government bodies to make budget allocations** for rural drinking water protection, domestic sewage and other waste disposal, pollution control for the livestock industry, prevention of soil pollution, and treatment of industrial and mining pollution (Article 50).
- **Use of economic levers to support the development of environmental protection industries**, through targeted finance, taxation, price and government procurement (Article 21).

- **Use of economic levers to encourage enterprises to reduce pollution beyond basic compliance requirements**, through targeted finance, taxation, price, government procurement (Article 22).
- **Strengthening pollution fees** to prevent and control of environmental pollution (Article 43).
- **Fiscal support for ecological protection** through a system of national and local fiscal support, and guidance from national to local level on the operation of a system of compensation for ecologically protected areas (Article 31).
- **Green procurement where** state authorities and other institutions financed by fiscal funds target energy, water and materials-saving products, equipment and facilities in their own operations. (Article 36)
- **Encouragement for the use of environmental pollution liability insurance** (Article 52).

Underlying these direct fiscal and financial measures, China's environmental management system stipulates that environmental quality standards and pollutant discharge standards should become increasingly rigorous over time. Such policies should continuously stimulate the expanding demand for investment in greener and more efficient products, processes and infrastructure, which is the basis for the development of green finance.

2.2 RESPONSIBILITIES AND MANAGEMENT OF ENVIRONMENTAL POLICY

The **Ministry of Environmental Protection** is the key competent authority under the State Council with responsibilities laid out in the Provisions on the Main Functions, Interior Institutions and Staffing of the Ministry of Environmental Protection (2008):

- **Decision making:** establish and improve basic system for environmental protection and develop environmental protection planning and budgeting
- **Coordination:** plan and coordinate major environment problems and ecological preservation as a whole
- **Regulation:** supervise and manage pollution and ecological damage

Other government agencies responsible for environmental protection include natural resource development and management agencies for water, forestry, land, mineral and marine resources; and economic and industrial management agencies for fishery, agriculture, industry and transportation. These agencies coordinate environmental protection planning and management in their sector; guide and supervise agencies, public institutions and enterprises within their sector; execute environmental protection laws, regulations and policies; organize the implementation of major projects in environmental protection; and promote clean production, technologies and techniques.

In China, local environmental protection work is managed locally. The superior (e.g., regional and national) environmental protection authority is only responsible for guidance for its direct subordinates. Staff, property and materials of subordinate environmental protection departments are managed by the finance department of the government at the same level. As a result, local governments retain staffing power and financial authority. This type of financial system will often result in local protectionism.

There are three main models for coordinating the roles of different bodies in public environmental protection:

1. **Integrated and separate departmental management model:** Multiple government departments manage separate components of one item, and the law establishes one comprehensive management department to enable coordination (e.g., the case of nature reserves).

2. **Centralized and supportive management model:** A structure of competent administrative department and relevant supporting departments for a certain item are clearly defined by law and regulation (e.g., in Article 5 of the Law on Desert Prevention and Control prescribes that the administrative department in charge of forestry of the State Council is responsible for the organization, coordination and direction of the desert prevention and transformation of the whole country).
3. **Centralized and level-based localized management model:** Where administrative authorities under the State Council exert management and supervision on a certain item centrally, administrative authorities under local governments at various levels are responsible for regulation of the same item in their respective jurisdictions (e.g., in the case of pollution control).

2.3 ENVIRONMENTAL POLICY: ANALYSIS OF CHALLENGES

As the central government seeks to advance its environmental protection work, problems and limitations in the existing legal and policy framework are emerging, including:

- **An inadequate institutional and legal system.** Among China's legislation for environmental protection and regulation, there is considerable overlap of institutional responsibilities and authority, without clear division of responsibilities for each department in the process of law enforcement and, in fact, some contradictions between different legal documents. For example, in relation to water pollution, the roles of the departments of environmental protection, the maritime administrative body, the departments in charge of water administration, state land and resources, health, construction, agriculture and fishery are not clearly defined.
- **Tensions between the national environmental protection system and local implementation.** Central government departments are responsible for nationwide environmental protection, developing policies and technical standards, and monitoring implementation. But the interests of local government responsible for environmental protection within their jurisdiction are often not aligned with these goals. For example, there are resource conservation agencies established for the seven major river basins; however, they do not have the power to intervene in local water management, and the functional departments at the central government level have not imposed restrictions on local governments' water-use policies. Local government policies are driven by local and short-term economic interests rather than conservation of the overall resource, leading to conflicts about water use among different departments.
- **Fragmentation of regulation and management of watersheds and ecological regions.** Existing regional environmental management systems fail to effectively solve the intergovernmental competition that cuts across boundaries. Within the scope of major river basins in China, there are many instances of cross-boundary pollution of water environments. In many cases, local governments at the upper reaches of rivers have not carefully fulfilled their regulation responsibilities, but it is the people and economies in the lower reaches that suffer loss due to water pollution.
- **Weak standards encouraged by ambiguous rules.** Environmental laws state that economic development must be considered in parallel with environmental objectives and that pollutant discharge standards must take into account environmental, economic and technical conditions (People's Republic of China, 1984). When setting resource fees, affordability to enterprises must be taken into account. These factors tend to weaken the economic incentives for resource users to invest in conservation and pollution control, as the prices they are paying do not reflect the true costs. For example, in 2011 the average industrial water resource fee was RMB 0.13/tonne, only equal to 8 per cent of actual water intake costs (RMB 0.4-1.6/tonne); the average pollutant discharge fee of industrial sewage was RMB 0.12/tonne, only equal to 2 per cent of actual disposal costs (RMB 5-10/tonne); while the average industrial sewage treatment fee was RMB 1.28/tonne, only equal to 20 per cent of actual disposal costs (Ma, 2014). In 2013 profits of large-scale industrial enterprises amounted

to RMB 6.3 trillion, but their water bill was only RMB 60 billion, less than 1 per cent of their profits (Ma, 2014). Rather than affordability being a true concern, low environmental standards offered a financial bonus for companies that did not shoulder environmental costs.

- **Poor enforcement and supervision.** Supervision plays a fundamental and critical role in environment resource pricing and enforcement. Currently, environmental supervision under the pollutant discharge system is limited to certain businesses and excludes, for example, smaller commercial businesses. Supervision is inadequate, without timely investigation and penalty for secret discharges and leaking emissions; therefore, the benefits from illegal behaviour are higher than the costs of legal violation, undermining the economic incentive to prevent leaking emissions and promoting secret and illicit discharges. In 2011 there were between 50,000 and 250,000 tonnes of sewage discharged along the middle reaches of Qinghe River in Beijing each day. Even after strengthening the disposal capability of sewage treatment plants, there were still several tens of thousands of tonnes of undisposed domestic sewage going into Qinghe River in 2013. In a series of special drainage rectification campaigns launched in Beijing in February 2014, among 20 pollutant dischargers, there were 15 units suspected to have engaged in excessive discharge and the other 5 units had no discharge permit at all. That is to say, the rate of secret sewage discharge is up to 100 per cent. At present, the highest penalty for secret sewage discharge is only RMB 30,000 in Beijing. It is estimated that between 2001 and 2011, low water price and undisposed discharge had helped enterprises make excessive profits in the accumulative amount of about RMB 1.5 trillion to 4.4 trillion (Ma, 2014).

The main channels for direct public financing comprise on-budget fiscal expenditure, ecological compensation systems and special funds.

3.1 ON-BUDGET EXPENDITURE

Fiscal environmental funding from the budgets of central government includes ongoing expenditure on environmental administration and protection, and allocations of capital (including as loans) for construction and retrofitting projects. The amount of investment in capital construction from the state budgetary fund is decided by the central government, and allocated by the National Development and Reform Commission (NDRC), as assigned by Ministry of Finance.

In accordance with provisions in *Budget and Measures for Administration of Capital Construction Expenditure Budget*, departments and competent authorities submit their capital construction expenditure budget each year to the finance department. The environmental protection department is therefore liable to report the allocation of fiscal funds for environmental protection to the finance department. In 2006 the state fiscal budget first established a specific category “211” for environmental protection. It includes a breakdown of expenditures into various subcategories, including environmental protection management, environment monitoring and supervision expenditure, expenditures for pollution prevention and control, natural ecological preservation, natural forestry protection, prevention and control of desertification and rehabilitation of grassland.

During the 11th Five-Year Plan period (2006–2010), capital construction funds for environmental protection from the state budget amounted to RMB 82 billion (USD 13 billion). In addition, the RMB 4 trillion (USD 600 billion) 2008–09 economic stimulus included energy conservation, emission reduction and ecological environment protection as the important areas for additional investment support.

In addition to funds received from central government, local authorities are able to invest extra-budgetary “self-raised funds” within quotas prescribed by the state. Self-raised funds include local fees and taxes, retained earnings from local SOEs, municipal debt and revenues from land sales.

In China, there is a sub-category of environmental investment termed “environmental input.” This relates to the direct use of revenues from pollution levies and from ecological compensation systems to fund pollution control and environmental protection by industry. The fees are accumulated into funds that are earmarked for pollution abatement projects in the form of soft loans available to individual enterprises and funding for local environmental protection authorities.

3.2 ECOLOGICAL COMPENSATION

China’s developing system of “ecological compensation” covers nature reserves, key ecological functional areas, mineral resources development and watershed management. It aims to provide transfer payments that compensate regions for the opportunity cost of conserving protected areas, and for investments (e.g., in reforestation and watershed management) whose benefits accrue to those down river. It is mainly carried out through fiscal payments, although there are efforts to develop it more towards a “payment for ecosystem services” system between users and stewards of natural resources.

Since 2008, the Ministry of Finance has started to implement transfer payment for key ecological functional areas, such as the Sanjiangyuan National Nature Reserve. In June 2012, the Ministry of Finance released Method of Transfer Payment to National Key Ecological Functional Areas at Local Level from Central

Treasury, offering ecological compensation to counties and cities where development is restricted by protected areas established through the National Main Functional Area Plan.

3.3 SPECIAL FUNDS

Special funds are a key mechanism for providing for environmental protection, law enforcement and pollution control. The funds are allocated from central fiscal departments to provincial environmental protection departments under the control of provincial treasuries. Examples include:

“Three Rivers and Three Lakes.” In 2005 a major environmental pollution accident took place in Songhua River and in 2007 a large bloom of blue algae caused serious pollution of Lake Taihu. In response, the Ministry of Finance established a special fund for prevention and control of water pollution in the watersheds of Three Rivers and Three Lakes and Songhua River. It provides funds for construction of waste treatment facilities and pollution prevention from industry and livestock. Payments are transferred from central to provincial governments based on a formula, and projects are determined and managed by provincial governments.

Air Pollution. In 2013 the Ministry of Construction consolidated various funds for air pollution control into a single special fund. RMB 5 billion (USD 0.8 billion) was granted for controlling atmospheric pollution in Beijing, Tianjin, Hebei, Shandong and neighbouring areas. In 2014 the central treasury allocated a further RMB 10 billion (USD 1.6 billion) to the fund (People’s Republic of China, 2014). Many local governments are planning to establish local funds. Beijing is establishing a fund of RMB 1.25 billion; Hebei is establishing a fund of RMB 0.1 billion; and Shandong is establishing a fund of RMB 1.2 billion.

Rivers and lakes. In November 2013 the Ministry of Finance and the Ministry of Environmental Protection released Provisions for Management of Funds for Ecological Environment Protection Projects of Rivers and Lakes. It established a special fund to support and reinforce the guidance and supervision of local government work to protect rivers and lakes. The fund applies to every level, from local to provincial governments. Industry is also encouraged to participate in investment.

Agriculture and rural environment. Pollutant run-off from agricultural sources reached 11.538 million tonnes, accounting for 48 per cent of the total organic matter discharge. Particularly, livestock and poultry breeding is a significant contributor to the problem. In 2011 the Central Treasury arranged a special fund of RMB 8 billion for comprehensive improvement of the rural environment. Local governments also contributed around RMB 15 billion through special funds and by attracting industry investment (Jun, Huiyuan, & Bo, 2012).

Green Energy. In 2011 the Energy Administration, the Ministry of Finance and the Ministry of Agriculture released Interim Provisions for Management of Subsidy Fund for Model Counties for Green Energy to promote rural use of green energy and regularize management of subsidy funding for constructing “model counties” for green energy. The subsidy funding is allocated from the central fiscal budget and used to support methane, biomass gasification, biomass and other renewable energy development, utilization projects and energy service systems in rural areas. Funds are provided in the form of subsidies, awards and discounted loans.

Special funds play an important guiding role in strengthening environmental investment at the local level. As well as providing direct resources, they play a guiding role for local governments, enterprises and society. They provide a partial subsidy but require local governments and enterprises to also provide inputs. For example, the Central Treasury allocated RMB 25 million to the special fund for environmental protection in rural areas from 2008–2014, to support environmental improvements in 59,000 villages, with a population of over 110 million people (Ministry of Environmental Protection, 2014b). This mobilized active inputs from

local treasury and self-raised funds by villages and towns for rural environmental protection. In some cases, funding allocation is performance-based, linking the release of funds to actual achieved reductions in pollution levels.

3.4 FISCAL FUNDING: ANALYSIS OF CHALLENGES

Fiscal inputs into environmental protection are increasing annually, and special funds have played a key role in mobilizing additional funding from local government. However, key issues emerging are:

- 1. Fragmentation of funding channels:** There are a variety of channels supporting different but overlapping priorities, so there is the possibility of repetitive investment. Special funds for environmental protection are fragmented and the total amount of funds is small, so it is hard to form an effective joint force between national and local funds.
- 2. Funding is mainly reactive and lacks of long-term strategy:** At present, the establishment and scope of special funds tends to be emergency oriented, focusing on solving major environmental problems as they emerge, such as the Three Rivers and Three Lakes clean up. In terms of source of funding, there is no stable funding and therefore management of the funds is characterized by contingency, provisionality and isolation rather than long-term and systematic consideration of environmental protection.
- 3. The use of funds and performance of projects is not well supervised:** The implementation and performance of projects supported by special funds is not routinely assessed, meaning that funds are not used in a cost-effective way. Priority is placed on releasing funds for investment. But without adequate supervision, projects may not be fully funded, and it is common for construction to be delayed and operations ineffective.

4

FINANCIAL INSTRUMENTS AND POLICIES

In recent years, attention has turned to the role of financial institutions and markets in supporting environmental protection and industrial transformation. Starting in the 1990s, China has developed policies to establish systems for carbon markets as well as green credit, green securities and green insurance.

4.1 CARBON FINANCE

Carbon finance refers to investment and financing activities related to carbon trading, which has been fostered initially by the Kyoto Protocol to the United Nations Framework Convention on Climate Change. It includes direct investment and financing, emissions trading and bank loans directed at preventing greenhouse gas (GHG) emissions and monetizing these emission reductions.

The Kyoto Protocol established mechanisms for international emissions trading (IET), the Clean Development Mechanism (CDM) and joint implementation (JI) to enable signatory states to achieve emission reduction targets in a flexible manner. Carbon finance includes both direct trading of various emissions quotas on the spot market and associated financial derivatives, such as options and futures.

China's carbon finance market is still at the initial stage. Exchanges have been established in Beijing, Shanghai, Tianjin and Shenzhen, where they are mainly trading certified emissions reductions (CERs) based on CDM projects. China has accounts for over half of the projects developed under the global CDM market. By August 2013, the NDRC had approved a total of 4,934 CDM projects, among which 3,699 projects had been successfully registered with the CDM Executive Board, accounting for 51.3 per cent of global CDM projects (Manyi & Yanjiao, 2015).

The outlook for China's carbon finance market is promising, as China's industrial restructuring and economic transformation are continuing in the direction of reduced carbon intensity. The Chinese government has also committed to reducing the emissions intensity of the economy by 40–45 per cent between 2005 and 2020, which is included in the mid- to long-term plan for national development, as well as being an international pledge under the Copenhagen Climate Accord.

Along with the deepening of the emissions market, emissions rights will be increasingly monetized and further evolve into a financial derivative with stronger liquidity. Monetizing emissions rights offers an exit for investors and enables market players to carry out active and effective carbon asset management and enhance the attractiveness of the green finance sector for investors.

Since 2007 the Ministry of Finance has successively approved 11 provinces and cities including Tianjin, Jiangsu, Zhejiang and Shaanxi as the national pilot regions for exploring an emissions quota trading scheme. Starting in 2014 the Ministry of Finance will promote the establishment of emissions quotas and trading across the whole country, striving to set up pilots in all major provinces and cities within 2–3 years. By 2014 China had established carbon emissions trading markets in Shenzhen, Shanghai, Beijing, Guangdong, Tianjin, Hubei and Chongqing (Tao, Li, & Maosheng, 2014).

The Guiding Opinions of the General Office of the State Council on Further Advancing the Pilot Work for the Paid Use and Trading of Emission Rights issued by the State Council in 2014 calls for the gradual roll out of pollutant permits and charges. Relevant departments under the State Council shall study the formulation of financial and taxation policies encouraging emissions trading and financing, and encourage the participation of the private sector in pollutant discharge reduction and emissions trading.

4.2 GREEN CREDIT

China's financial landscape is dominated by banking. In 2013 aggregate bank financing to the real economy was RMB 17.29 trillion, making up 55 per cent of RMB and foreign currency-denominated loans (People's Bank of China, 2013). However, banks directly or indirectly also control financing and transactions in the bond, trust and shadow banking markets, so their overall ratio of financing is likely to be even higher. The main focus on green finance has therefore been on banking through "green credit."

In May 2006 China Industrial Bank (CIB) cooperated with the International Finance Corporation (IFC) to develop the first "green credit" product in China—a loan product for energy conservation and emission reduction projects. By the end of 2012, the financing balance for green finance by CIB amounted to RMB 113 billion (USD 18 billion), including a loan balance for green finance of RMB 71 billion (USD 11 billion). By the end of 2012, the energy savings of the projects financed by CIB amounted to 256 million tonnes of coal per year, and an annual carbon dioxide emission reduction of 67 million tonnes; an annual Chemical Oxygen Demand (COD) reduction of 887,000 tonnes; an annual ammonia nitrogen emission reduction of 15,000 tonnes; an annual sulphur dioxide emission reduction of 44,000 tonnes; and an annual nitrogen oxide emission reduction of 6,900 tonnes (Renjie, 2013).

In July 2007, in order to curb the expansion of energy-intensive and high-pollution industries, the former State Environmental Protection Administration, the People's Bank of China (PBC) and the China Banking Regulatory Commission jointly released the Opinions on Implementing Environmental Protection Policies and Regulations and Preventing Credit Risk, stipulating that banks should regulate credit on the basis of environmental compliance and establish necessary risk assessments as part of their process for loan approval. The Notice on Several Issues about Implementing the Credit Policy and Strengthening Environmental Protection Work issued by the PBC sets out requirements for environmental issues to be integrated into loan review, origination, monitoring and management of loans.

The Guiding Opinions on the Credit Work for Energy Conservation and Emission Reduction and the Guidelines on the Risk Management of M&A Loans of Commercial Banks issued by CBRC urge banking financial institutions to carefully implement national macroeconomic control policy, fulfill the social responsibilities of the financial sector, innovate in loan provision services, develop "green credit" business, reduce credit origination to energy-intensive and high-emission industries, and support industrial restructuring.

The Green Credit Guidelines issued by CBRC in 2008 require banks to increase the support to the green, low-carbon and circular economies and identify the directions and priority areas for green credit support. They should customize credit-granting guidelines, adopt differentiated underwriting policies and implement risk management.

Green credit policies have also been adopted for key areas. For example, in order to strengthen prevention and control of watersheds pollution, the State Council has organized banks to originate special funds for prevention and control of water pollution in the Huaihe River basin to support the construction of sewage treatment plants and prevention and control of major pollution source within the basin. Fujian has developed the Guidelines on Financial Support for Energy Conservation and Emission Reduction in Fujian requiring a streamlined loan procedure, preferential interest rate and prioritized credit support for "encouraged" energy conservation and emission reduction projects.

4.3 ENVIRONMENTAL INSURANCE

Environmental insurance, or green insurance, is a financial instrument that gives prominence to facilitating environmental risk management, enabling the hidden cost of pollution and other negative externalities to be internalized into decision making. The most common green insurance vehicle is environmental liability insurance to address environmental pollution accident risk. In some countries, industries of a polluting nature are mandated to buy this insurance. If pollution incidents occur, indemnities from the insurance company not only include the sum required to clean up the pollution, but also include fines, loss of real estate value, related legal expenses and medical expenses. The insurance mechanism makes the environmental cost explicit and encourages a reduction in investment behaviours involving excessive environmental risk. In addition, green insurance can also provide an effective mechanism for building resilience to long-term risks, such as natural disaster risks, exacerbated by climate change, including sea-level rise, floods and windstorms.

As early as the beginning of the 1990s, environmental protection departments, including in Dalian, Shenyang and Changchun, had started to explore the use of such insurance instruments. In 2007 the former State Environmental Protection Administration and CIRC jointly released the Guiding Opinions on Environmental Pollution Liability Insurance to actively promote environmental pollution liability insurance. In 2008 pilots of national environmental pollution liability insurance started in Jiangsu, Hubei, Hunan, Chongqing and Shenzhen.

In February 2013, the Ministry of Environmental Protection and CIRC jointly released the Guiding Opinions on Carrying out Pilots of Compulsory Environmental Pollution Liability Insurance to guide local governments to promote the pilot work of compulsory environmental pollution liability insurance in heavy-metal-related industries and industries with high environmental risks like petrochemical.

4.4 GREEN SECURITIES

Efforts towards green securities include establishing requirements for environmental audits as part of the process of issuing Initial Public Offerings (IPOs), additional issues and ongoing performance reporting. On the basis of research and pilots of green securities market, a set of auditing standards for securities market entry and environmental performance assessment methods has been set up for high-pollution and energy-intensive enterprises.

In February 2008, the former State Environmental Protection Administration together with the China Securities Regulatory Commission and other departments released the Guiding Opinions on Strengthening Supervision and Management of Environmental Protection by Listed Companies, that is to say the “guiding opinions on green securities,” which made environmental auditing a compulsory IPO requirement.

4.5 PUBLIC-PRIVATE PARTNERSHIPS

At the end of 2002, the former Ministry of Construction introduced the Opinions on Accelerating the Marketization Process of Urban Public Utilities, which called for market-oriented reform of urban public utilities. This heralded the breaking up of exclusive monopolies of SOEs and public institutions, opening them up to private investment in water, gas and heat, sewage and waste disposal services.

Since 2003 relevant departments have introduced a series of policies to encourage private and foreign capital to enter the urban public utilities sector. In 2004 the former Ministry of Construction introduced the Measures for Administration on the Franchise of Urban Public Utilities, which opened up the sector to private concessions and separated plant and network operations. For example, the Chishui River basin, which has

been designated a national nature reserve for rare and endemic fishes, in the upper reaches of Yangtze River, has been polluted by coal mining and electricity, brewing, chemical and paper making industries. RMB 2.6 billion has been allocated for pollution prevention and control by the relevant authorities. However, out-of-date environmental infrastructure, incompetent environmental supervision and inadequacy of funding remain major challenges. In 2014 Guizhou Province launched the pilot project of ecological progress system reform in the Chishui River basin and introduced the Work Plan for Pilot of Ecological Progress System Reform in Chishui River Basin in Guizhou. It estimated that funding demand for construction projects to protect the river basin had exceeded RMB 5 billion and is seeking to attract green private investment, including through the development of a payment for ecosystem services system within the river basin, and improve the investment and financing system for ecological environment preservation.

4.6 FINANCIAL INSTRUMENTS: ANALYSIS OF CHALLENGES

Financial institutions have developed policies and products to support environmental protection in response to these policies. But some challenges and limitations have also been revealed:

1. **Unattractive risk: return rates for green investments.** Besides social responsibility, the drive for investors and lenders to be concerned with environmental protection is to avoid risks (such as risk of pollution fines or of destroying one's own assets), and to seize the opportunity to make returns through efficiency savings, and premiums for environmental services and green products. However, due to system and technology factors such as low pollution fees, in practice many of the risks and costs are not borne by the enterprise. Meanwhile, these enterprises causing pollution may outperform due to avoidance of the pollution control costs. Moreover, some environmental protection projects have long investment durations and high operation costs compared to the economic benefits to investors; therefore, under the pressure of profitability and market share, the commercial banks lack the momentum to support environmental protection.
2. **Lack of environmental competency within commercial banks.** Technical expertise involved in originating green finance is very complex and continuously evolving. But with only a few technical specialists, the commercial banks have limited capabilities in technical identification and risk assessment in specialized areas; therefore, there is a tendency towards directing loans towards more readily understood traditional economic areas. Green credit criteria are mainly broad and principle-based, rather than providing specific guidance that can be directly implemented in relation to particular industries.
3. **Green finance is overly dependent on the government.** Though commercial loans make up a large share of green investment, users of these commercial loans, or subjects of green investment, are largely SOEs or investment and financing platform companies that are guaranteed through government fiscal support. Such types of commercial loans are characterized by high financial risks, ultimately borne by the public balance sheet. Although most of the investments will generate good ecological effects and make great contributions to the goal of green development, solvencies of these investment projects are always linked with fiscal strength of local governments.
4. **Lack of diverse funding channels.** In China, the investment fund in environmental protection is largely dependent on bank loans, which are not ideal for long-term investment. The lack of adequate alternative financing channels and financial instruments is not caused by a preference of credit-users for bank loans, but by system constraints imposed on other financing channels such as bonds, equities and trusts.

Industrial policy is a key feature of China's economic development model, implemented through investment, fiscal, taxation, financial, land, import and export policies. Its aim is to upgrade and restructure traditional industries and foster and develop strategic emerging industries. The key document is the *Guiding Catalogue for the Adjustment of Industrial Structure*, which was issued in 2005, and then updated in 2011 and 2013.

The catalogue provides the focus for upgrading and optimization of industrial structure and improving the competitiveness of industries, and divides industries into “encouraged,” “restricted” and “to-be-eliminated” categories.

The catalogue is updated periodically to reflect technological innovation, and to provide greater detail and boundaries where needed. For example, some technologies encouraged by the 2005 version have become sophisticated and widespread, so there is no need for them to be included on the “encouraged” list in future editions. Some varieties encouraged in the 2005 catalogue within steel, nonferrous metal and building materials have seen serious overcapacity, and in later versions consolidation is encouraged. For textiles, where the industry is concentrated in the East, the catalogue encourages elimination of out-of-date capacity and upgrading in the East at an accelerated pace, and the shifting of textile production capacity to the central and western regions. In the 2011 catalogue, 14 categories are newly added to the encouraged category, including new energy, urban mass transit equipment, comprehensive transportation, public security and contingency products. The 2013 update included new products under combined heat and power and offshore wind.

5.1 ENCOURAGEMENT OF NEW INDUSTRIES

Strategic new industries to be encouraged include energy conservation and environmental protection, biotechnology, new energy, new materials and new-energy automobiles. The largest distinction between the 2011 and 2005 versions of the catalogue is that new energy covering solar, wind, biomass, ocean and geothermal energy is included in the “encouraged” category for the first time in the newer edition.

Fiscal subsidies are a key public policy measure to encourage the development of green industries. For example, in 2013 a subsidy was developed to promote the uptake of energy-efficient and low-emission vehicles. This is aimed both at improving air quality and supporting strategic emerging industries in China. In the short term, new-energy-vehicle-related industries are expected to obtain excessive return under the stimulus policy. Moreover, with continuous increase of the market size, mid- to long-term investment value may also be improved.

Wind power is another industry that has received significant subsidy that enabled it to benefit from the global increased demand for wind power technology, bringing down prices through localization, scale and technology advances. Many believe that wind power in China will be profitable without subsidies by 2015. Wind farm building, grid-connected power generation and wind-power equipment manufacturing are hot spots for investment with promising outlook, while offshore wind power is potentially the next growth engine (which was added to the “encouraged” category the 2013 catalogue).

China is also pursuing the development of shale gas, signing the Memorandum of Cooperation with the United States in 2009 and including shale gas development in the 12th Five-Year Plan. The official document, titled *Policy for the Shale Gas Industry*, stipulates that the shale gas industry shall be totally open for private (local and foreign) investment and adopt market-based pricing.

“Encouraged” green industries have traditionally focused on end-of-pipe pollution control, but have expanded into ecosystem restoration and preservation in agriculture, water, nature reserves, petroleum and natural gas development, urbanization, mining and eco-tourism. In agriculture, for example, the working session of national agricultural policies and regulations held in April 2014 put forward to study eco-friendly agriculture, carry out pilots of agricultural resource rehabilitation and reinforce subsidies for natural resource protection. At the same time, stress is placed on restricting development in ecologically vulnerable areas.

In terms of encouraging environmental protection industries, policy guidance has been continuously expanded to advance financing and investment. On October 24, 2014, an executive meeting of the State Council chaired by Premier Li Keqiang decided to innovate the investment and financing mechanism in key areas and create more room for effective investment from the industry. The results include plans to further introduce social capital to participate in hydropower and nuclear power projects and build cross-regional power transmission passage, regional main grid, distributed power grid interconnection projects and electric vehicle charging and battery swap facilities, while encouraging social capital to invest in urban water and heat supply, and sewage and waste disposal.

5.2 REFORM OF EXISTING INDUSTRIES

“Restricted” industries and products are mainly production capacity, techniques, equipment and products that are out of date and need to be transformed or prohibited from new installation and production. By setting up the limits via “to-be-eliminated” techniques and products, the purpose is mainly to prevent low-level repetitive construction and avoid vicious competition caused by excessive oversupply of capacity, so as to promote a healthier environment for industrial development.

Specific standards support environmental protection and resource conservation in existing industries. For example, in the steel industry, the National Development and Reform Commission, the Ministry of Environmental Protection and Ministry of Industry and Information Technology released the Clean Production Evaluation Index System for Steel and Cement Industries (NDRC No. 3 Announcement in 2014), guiding and promoting the implementation of clean production of steel and cement companies.

In the 2011 version of the *Guiding Catalogue for the Adjustment of Industrial Structure*, the section on the nonferrous metal industry encourages innovation in smelting techniques and new material production for information, new energy industry, transportation and advanced manufacturing.

The catalogue also encourages consolidation of small-scale production in industries such as coal, electricity, steel, building materials, petrochemical, nonferrous metal, gold, light-industry and textile industries into larger enterprises, where efficiency is greater and environmental impacts can be more closely managed. This is also in line with environmental policy such as the Action Plan for Atmospheric Pollution Prevention and Control, released by the State Council in September 2013, which requires small coal-fired boilers to be eliminated and replaced with larger more efficient central heat and power cogeneration units.

In some cases, advances in technology can result in changes in the environmental basis for products and processes to be included in the catalogue. For example, disposable polystyrene tableware was included in the “to-be-eliminated” category in the 2005 version, but in the 2013 update it was removed because of advances in recycling this material. Meanwhile electro-plating using toxic and harmful cyanide was added to the “to-be-eliminated” category because a substitute process using gold potassium citrate had been found. After treatment, this results in a non-toxic chemical, which meets the Pollutant Discharge Standards for Electroplating, solving the pollution problem faced in the gold plating industry.

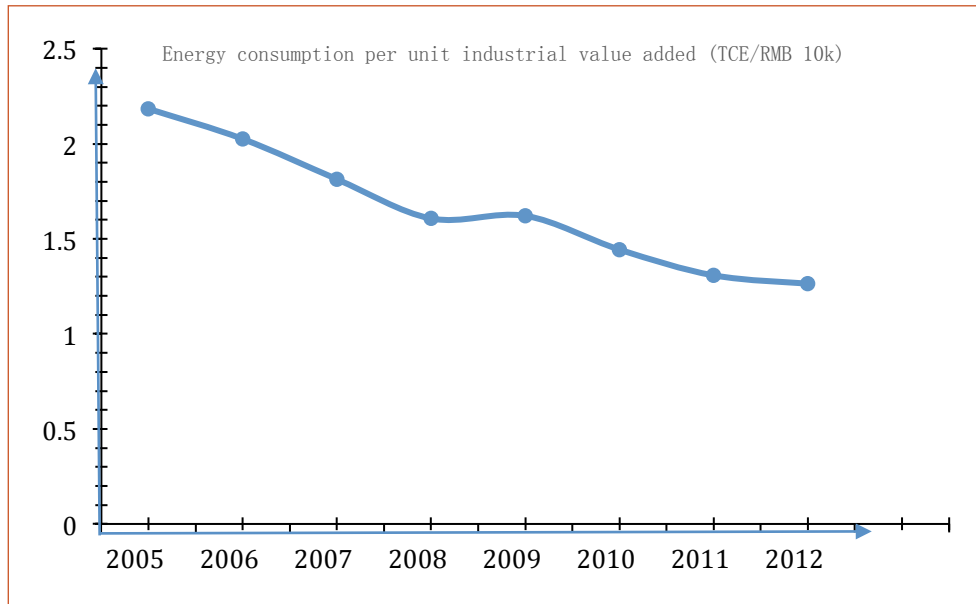
However, gaps in environmental policy, such as the lack of clear standards for environmental impact assessments make it difficult or impossible to prevent and control environmental problems. This can be seen in the National Economic and Social Development Plan for the 12th Five-year Plan period, which shows that China's industry is still oriented towards energy-intensive chemical and basic materials and lags in efficiency.

5.3 INDUSTRIAL POLICY: ANALYSIS OF CHALLENGES

China's industrial policy has imposed restrictions on the development of high-pollution and energy-intensive industries, but in practice these industries have continued to grow. China's industrial development is faced with the dilemma of gradually decreasing production levels, rising energy consumption and pollution, and reduced room for energy conservation and emission reduction, which pose an unprecedented challenge for green development.

- **Energy, resource- and pollution-intensive sectors continue to dominate the economy.** Driven by the pace and pattern of urbanization, and the associated demand for construction materials and automobiles, resource-hungry sectors such as metals, chemicals and minerals continue to maintain their dominance in the economy. Most of the fastest-growing sectors are those included in the "restricted" industries prescribed by industrial policy, such as coal mining and dressing, nonmetal mineral products, ferrous metal smelting and extrusion, chemical materials and chemical product manufacturing, and ferrous metal mining and dressing.
- **The demand for these sectors is likely to continue.** In the 2014 *Report on the Work of the Government*, Premier Li Keqiang indicated three tasks to focus on, each concerning 100 million people: granting urban residency to around 100 million rural people, rebuilding rundown city neighbourhoods where around 100 million people live and guiding the urbanization of around 100 million rural residents of the central and western regions. At the same time, according to Medium and Long-Term Railway Network Plan (revised in 2008) the operational mileage of railways will reach over 120,000 km by 2020, including 12,000 km of express lines. By the end of the 11th Five-Year Plan period, China's automobile output had amounted to 18 million units, almost a quarter of world total output. According to the forecast in the 12th Five-Year Plan, by end of the 12th Five-year Plan period (2017), China's automobile output will reach 25 million units. Development of these industries has created huge demands for the development of heavy industry in China.
- **China's traditional economic model is increasingly vulnerable.** Economic dependence on a heavy industry base has not only brought about large resource-environmental pressure, but also left the economy vulnerable to the volatility of international resource prices, and placed it at the lower end of the industrial value chain with low added value. China's low-cost model for economic competitiveness is also becoming hard to sustain as labour, land, environment and other factor costs have risen rapidly. Although the low-cost advantage will not disappear completely within the short term, a new competitive advantage must be developed. Between 2005 and 2012, gross industrial profits grew by 320 per cent, but between 2010 and 2012 they only increased by 0.8 per cent (National Bureau of Statistics of China, 2006–2013).
- **Further reductions in energy intensity will be harder to achieve.** As is seen in Figure 4, although energy consumption per unit of industrial value added has decreased from 2.18 all lower case: tonnes of carbon equivalent (TCE) emitted per CNY 10,000 in 2005 to 1.26 TCE per CNY 10,000 in 2012, the room for further reduction has been very limited. Average annual reduction of industrial energy consumption level was 8.7 per cent during 2005–2008, while the corresponding figure is only 5.4 per cent during 2008–2012. The reduction of industrial energy consumption level only decreased by 3.8 per cent in 2012. Energy conservation and consumption reduction under the traditional industrial development model is reaching its limits and a change of gear is needed.

FIGURE 2. CHINA'S INDUSTRIAL ENERGY CONSUMPTION LEVEL, 2005-2012



National Bureau of Statistics of China (2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013)

This analysis highlights the complementary nexus between environmental policy, public investment, mechanisms for encouraging private finance and industrial policy. The following recommendations are complementary for promoting the development of green finance to serve demand for green investment.

6.1 ENVIRONMENTAL POLICY

Laws and regulations are the basis for environmental management, and to be effective, existing laws related to environmental protection require comprehensive amendment. The *National 12th Five-Year Plan for Environmental Protection* puts forward the need for amendments to the environmental quality and pollutant discharge standards and the norms for setting, managing and monitoring standards. Areas where the frameworks of environmental policy should be strengthened include:

- **Remove ambiguous policy objectives:** The objectives of promoting economic and social development and adapting to the requirements of national economic and social development should be removed from environmental protection laws. They create ambiguity and may become the rationale for promoting economic development at the cost of damaging the resource environment.
- **Base standards and fees on environmental criteria:** The stipulations to “consider economic and technical conditions” or “consider affordability of pollutant discharge” while formulating pollutant discharge standards and levies should be removed. These should be replaced with a clear principle of “user pays” and “polluter pays,” requiring enterprises to shoulder total resource environment costs. Pollutant discharge standards should be formulated for different regions based on the local environment and environmental quality standards, and set at a level that prevents degradation. Levies for breaching the discharge standard should fully reflect market supply and demand, resource scarcity, costs of ecological environment damage and benefits of restoration. Competitive markets should be encouraged to maximize efficiency and realize the triple benefits of saving resources, reducing emissions and cutting costs.
- **Strengthen supervision and management of compliance with discharge standards:** Tighten the standards and define the responsibilities of enterprises. For example, in order to implement the Action Plan for Atmospheric Pollution Prevention and Control, at the end of 2013 the Ministry of Environmental Protection and General Administration of Quality Supervision jointly released three standards on air pollution related to cement manufacturing. This led to 400 cement companies needing to go through renovation. Investment in dedusting and denitration facilities for a single cement company can cost up to RMB 19 million. Merely improving the pollutant discharge standard in the cement industry therefore brought about investment of nearly RMB 8 billion (Xiong, 2013).
- **Tighten discharge standards and implementation:** If the discharge standard was improved and the sewage discharge fee increased, higher fees could be collected on non-compliant enterprises. This would effectively increase the price of environmental damage to them and incentivize resource saving and reduction of pollutant discharge, so as to further technological advancement and improve efficiency. Tightening the standard does not mean an inevitable increase in production costs, but it encourages high efficiency, improved environment and resource saving. Under such preconditions, demands for environmental investment will be enhanced.
- **Strengthen regional pollution caps and system of discharge permits:** The system of regional pollution caps and discharge permits is one of the major management means to cascade and implement pollution cutting. This should be based on environmental quality standards, with discharge permits issued and supervised. Implementing the discharge permit system would support the elimination of backward production capacity, the upgrading and renovating of existing production facilities and the standard of newly built production facilities.

- **Reinforce pollutant discharge control in rural areas:** Pollutant discharge control from agriculture is of great urgency, in particular, pollution from livestock and poultry breeding. This has been addressed with special funds, and in the 12th Five-Year Plan for National Prevention and Control of Pollution from Livestock and Poultry Breeding, jointly issued by the Ministry of Environmental Protection and the Ministry of Agriculture, targets were set to reduce CDO and ammonia nitrogen discharge from livestock and poultry breeding by 8 per cent and 10 per cent, respectively, compared to 2010. Efforts should continue through fiscal funds and economic instruments, including taxation, credit and fees to attract industry investment in prevention, and control of pollution from livestock and poultry breeding.
- **Include more pollutants under control.** At present, types of pollutants under control are limited. Standards and targets have been introduced for pollutants such as PM_{2.5}, sludge, nitrogen oxide and heavy metals, which will require increased efforts and investment to meet.

6.2 FISCAL FUNDING

In order to advance the role of green finance and solve the current problem of insufficient environmental investment, investment can be supported through special fiscal funds, and through “polluter pays” regulations, so that these industrial enterprises become core users of green finance.

- **Coordinate between the different funding channels:** Special funds focus on national key ecological functional areas and basic environmental public services. Formulas used to determine ecological compensation should take these two factors into account. Meanwhile, when the state is making transfer payments to local governments, it should provide the source of supporting funds, specify the targeted use for environmental protection and strengthen supervision.
- **Provide performance-related guarantees on the provision of special fiscal funds:** The Ministry of Finance, the Ministry of Environmental Protection and relevant local governments should sign agreements for environment quality improvement or pollution control that specify timely targets. Funds should be allocated on the basis of those targets, with a timetable of monitoring the drawdown of funds based on achieving improvements. Where funds are provided in advance, there may be a provision for them to be returned if targets are not met.
- **Diversify environmental financing channels:** On the one hand, the existing system that provides drivers for green investment should be improved, for example through the “three synchronizations” of planning waste management alongside construction projects: implementing the deposit system for enterprises’ pollution control, ensuring pricing policy reflects environmental costs and implementing preferential fiscal and tax policy. On the other hand, listed companies should be actively encouraged to raise investment funds for pollution prevention and control via stock market financing.
- **Innovate financing models and actively roll out the public-private partnership model:** to make social and government investment complement each other. This follows the decision of the executive meeting of October 24, 2014, chaired by Premier Li Keqiang, which called for opening up private-public partnerships and breaking through unreasonable monopoly and market barriers to private investment. This private investment could be in hydropower and nuclear power projects, power transmission and electric vehicle charging, railways, harbours, inland waterway transport facilities, airports, urban utilities, public transport and in ecological construction projects like farmers’ cooperatives and family farms.

6.3 FINANCIAL POLICIES

In general, bank loans and fiscal funding are not adequate means to realize the goal of green development. The need for investment in urban environmental infrastructure and industrial pollution prevention and control during the 13th Five-Year Plan period will require more diversified financing models.

The broad direction for environmental finance reform is to limit the direct use of government balance sheets and fiscal credit to provide financing while continuing to leverage fiscal, tax, price and land policies. This will encourage and support enterprises' green investment, to be met through increasingly market-oriented green finance supply.

The context in which China is developing green finance is different from other developed economies. As an emerging economy, China's financial system is at a critical stage of transformation and reform, and lacks the depth and sophistication of finance and credit systems. Therefore, green finance in China should not be developed by patching up the existing financial system, but by exploring a new financial development model.

- **Government should enable development of green capital markets.** The demands of green finance development cannot be satisfied by simply relying on green credit. China's financial system remains dominated by banking. In order to improve the operation, management and transaction risk management capabilities of the green financial system, the capacity for green investment through capital markets must be increased, including equities, bonds and derivatives, in order to multiply perspectives from a great number of institutional investors, intermediaries, risk investors and even Internet users to evaluate the outlook of green projects and realize an accurate pricing of project risks.
- **Government's intervention in green finance should shift from reliance on administrative instruments to enabling market forces.** In many areas, green industries are now at the technological frontier in China, which means that government does not have an information advantage on the innovation outlook of green projects. On the contrary, large-scale, high-speed and long-duration financial allocation of the kind that was used for industrial catch up may easily result in mismatching of funds at the industry level as well as the subsequent systematic financial risks. Providing support through discounted loans, differentiated structural reserve ratios and risk-based capital, weightings and environmental information disclosure can enable the market to play its role of price discovery, information identification and risk management.
- **The government's guarantee for green development should be transformed from implicit to explicit.** Green development projects such as new energy have tended to be supported by implicit guarantees, reflected in local bailouts. Such implicit guarantees may help companies get through hard times, but cut off the "creative disruption" mechanism of the market. The expectation of "last-resort" funding offered by the government implies a contingent liability that faces soft budget constraints, which is not good for the stability of green finance. By providing explicit guarantees for green projects through policy-based credit guarantee institutions, on-budget partial-credit guarantees and a re-guarantee system, the government could enhance credit availability while better sharing risk and maintaining stability.

6.4 INDUSTRIAL POLICY

Environmental-related industries are typically regulation- and policy-driven industries, and the key to promoting the development of the industry is getting this framework right. If environmental standards are well implemented, environmentally related industries have huge potential in terms of continuously expanded scale and significantly increased efficiency. On the other hand, weak execution of environmental protection and energy conservation policies leads to deformed development of industries and impedes the adjustment, transformation and upgrading of industrial structure. Industrial policy should:

- **Support and align with environmental policy.** This will promote the principle of eliminating backward and encouraging advanced industries (as emphasized in China's industrial policy strategy), leveraging complementary legal, economic and administrative instruments that incentivize energy conservation and emission reduction. Energy pricing and green taxation policies are important, as are mechanisms for encouraging market entry and the elimination of backward production capacity.
- **Encourage technology innovation.** Encouraging technological innovation is a key role for industrial policy. Chinese enterprises have weak technology development capacity, but key enterprises can become technology innovation and engineering centres to serve for the whole industry, mobilizing innovation along the industrial chain. Strategic alliances for developing technologies, knowledge, skills and production capacity together are crucial in generating breakthroughs in new industry. This was seen in the 1990s, in the United States with the industrial alliance for a new-energy vehicle, the U.S. Council for Automotive Research, which became the vehicle for government support (Zifeng, 2012).
- **Promote strategic environmental industries.** Industrial policy support for innovation should focus on environmental industries, with better effects on economic aggregates and structural adjustment; be significant to technological innovation; and have strong and sustained market demands favourable for sustainable development. Strengthening regulations on pollution prevention and control, as well as energy conservation, will also create opportunities for development of new service and support industries in areas such as urban sewage and waste disposal, industrial pollution control and environment remediation (see Annex III).
- **Require environmental impact assessments for industrial policy.** As China's economy is developing rapidly, addressing environmental problems caused by regional and industrial development policies is urgent. Industrial policy involves many areas with large uncertainties, and there are no clear procedures to assess and consider policy alternatives and impacts. Introducing clear requirements of environmental impact assessments for official policies, formal programs, action plans and specific projects would strengthen alignment with the environmental goals of industrial policy and would enable greater scientific and democratic inputs. To implement this, a full set of environmental impact assessment systems should be established. Environmental impact assessments on policies should consider natural environment impacts and constraints and also political, social and psychological impacts. A system and methodology for analysis should be developed involving both scientific analysis and public involvement, and should be applied with adequate support.

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ANNEX 1: LEGAL AND POLICY FRAMEWORK FOR ENVIRONMENTAL PROTECTION

ENVIRONMENTAL PROTECTION LAW

The **Environmental Protection Law** revised in 2014 forms the basic legal framework for environmental protection in China, and includes several provisions on the role of public finance as well as the use of economic levers to promote environmental protection:

- **Increase in government spending** on environmental protection and pollution control (Article 8).
- **Government bodies to make budget allocations** for rural drinking water protection, domestic sewage and other waste disposal, pollution control for the livestock industry, prevention of soil pollution, and treatment of industrial and mining pollution (Article 50).
- **Use of economic levers to support the development of environmental protection industries**, through targeted finance, taxation, price and government procurement (Article 21).
- **Use of economic levers to encourage enterprises to reduce pollution beyond basic compliance requirements**, through targeted finance, taxation, price and government procurement (Article 22).
- **Strengthening pollution fees** to prevent and control environmental pollution (Article 43).
- **Fiscal support for ecological protection** through a system of national and local fiscal support, and guidance from national to local level on the operation of a system of compensation for ecologically protected areas (Article 31).
- **Green procurement** where state authorities and other institutions financed by fiscal funds to target energy, water and material-saving products, equipment and facilities in their own operations (Article 36).
- **Encouragement for the use of environmental pollution liability insurance** (Article 52).

SPECIAL LAWS ON POLLUTION PREVENTION AND CONTROL

In addition to the basic framework, there are six special laws focused on pollution control in relation to freshwater, air and sea and to noise, radioactivity and solid waste. In each case the laws include provisions to (1) toughen fines and pollution pricing; (2) encourage the use of clean materials and processes in industrial production; (3) establish lists of backward production techniques and equipment, to be prohibited from use or sale within a time limit; and (4) set up ecological compensation mechanisms.

TABLE A1: KEY MEASURES UNDER EACH LAW.

Special Law	Key measures in relation to green finance and investment	Year
Water Pollution	<ul style="list-style-type: none"> • Compensation mechanism for preservation of water sources, rivers, lakes and reservoirs • Elimination of backward production capacity • Adoption of clean techniques by enterprises • Strengthen administration to reduce the generation of water pollutants 	2008
Atmospheric Pollution	<ul style="list-style-type: none"> • Elimination of backward production capacity • Measures to encourage adoption of clean production techniques by enterprises • Economic and technical policies to encourage clean utilization of coal • Measures to encourage the production and use of low-emissions motor vehicles and ships 	2000
Marine Environment	<ul style="list-style-type: none"> • Strengthen research and development on marine pollution control and environment • Elimination of backward production capacity • Development of oil pollution civil liability scheme requiring owners of vessels and cargoes to take out insurance covering their liability 	2000
Environmental Noise	<ul style="list-style-type: none"> • Elimination of backward production capacity and technologies 	1997
Radioactive Pollution	<ul style="list-style-type: none"> • Regulation of products to national standards on radioactive pollution • Requirements for plans on the decommissioning of uranium and thorium mines, to be included in the fiscal budget of the State 	2003
Solid Waste	<ul style="list-style-type: none"> • Support for the adoption of centralized treatment of solid wastes • Promotion of industrial development of the waste management industry • Research, development and promotion of production techniques and equipment for solid waste management • Elimination of backward production techniques and equipment. • Improve the composition of fuel, and develop coal gas, natural gas, liquefied gas and other clean energy sources for use in urban areas • Decommissioning expenses for facilities for disposal of hazardous wastes to be drawn in advance and incorporated into budget. 	2005

LAWS PROMOTING CIRCULAR ECONOMY AND CLEAN PRODUCTION

Circular economy is a strategy that has been adopted by the Chinese government that aims to improve the efficiency of materials and energy use in the economy. Relevant laws have formed a new branch in the legal framework of environmental protection. Currently, there are two main laws in this field: the Clean Production Promotion Law and the Circular Economy Promotion Law. Provisions on source of funding and expansion of financing in these laws include provisions for the State Council, the relevant administrative departments under it and the people's governments of provinces, autonomous regions and municipalities directly under the central government to:

1. **Formulate industrial, fiscal and taxation policies** promoting clean production and circular economy.
2. **Strengthen supervision on key polluting and high-resource industries** such as steel and other metals, coal, electricity, petroleum processing, chemicals, building materials, construction, paper mills, printing and dyeing.
3. **Encourage the development of technologies, techniques and equipment** for resource recycling, regeneration and comprehensive utilization.
4. **Require fiscal input from central and local governments** and encourage a local fiscal fund to guide private capital into the area of resources recycling and utilization.

LAWS RELATED TO ENERGY CONSERVATION AND RENEWABLE ENERGY

There are four laws related to energy conservation, emission reduction and renewable energy: the Law on Energy Conservation, the Renewable Energy Law, the Electric Power Law, and the Law on the Coal Industry.

The Law on Energy Conservation, effective since January 1998, provides for the state to implement industrial policies to encourage energy conservation and environmental protection, restrict the development of high-energy-consumption and high-pollution industries, and develop energy-saving and environmentally friendly industries. It requires governments at or above the county level to strengthen their energy conservation work in agriculture and rural areas, and increase investment into deployment of energy conservation technologies and products in agriculture and rural areas. Financial measures include:

1. **Establishment of energy conservation funds** by central and local treasuries.
2. **Preferential taxes and fiscal subsidies** for production and sale of energy-efficient products such as lighting.
3. **Trade-related tax and price policies** to encourage the import of advanced energy conservation technologies and control the export of highly energy-consuming and serious-pollution products.
4. **Guidance to financial institutions** to increase credit availability for energy conservation projects, and to encourage and guide relevant sectors to increase investment into energy conservation and accelerate technological transformation of energy conservation.

The Renewable Energy Law stipulates that the state shall give priority to the development and utilization of renewable energy in energy development, including through a national target for renewable energy use, and focus on rural areas. Financial measures include:

1. **A renewable energy fund** for supporting research, development and deployment of renewable energy and the development of local production of equipment.
2. **Fiscal support for financial institutions to give discounted loans** for renewables projects.
3. **Preferential tax policy** for projects that are listed in the renewable energy industry development guidance catalogue.

ADMINISTRATIVE REGULATIONS OF THE STATE COUNCIL

While the preceding laws provide overarching policy frameworks, detailed rules prescribe the specific measures for implementation. For example the Regulation on the Administration of the Recovery and Disposal of Waste Electrical and Electronic Products, which took effect in January 2011, includes provisions to establish a budgetary fund for the disposal of waste electrical and electronic products, and to subsidize the expenses for recovering and disposing of waste electrical and electronic products. The fund is managed by the public finance of the State Council in conjunction with the relevant departments.

The Regulation on the Prevention and Control of Pollution from Large-scale Breeding of Livestock and Poultry, effective January 2014, offers public funding, preferential taxation and subsidies for investments in prevention and control of pollution by livestock, the purchase and use of organic fertilizer and biogas generation.

The Regulation on Urban Drainage and Sewage Treatment, effective January 2014, encourages private investment construction and operation of urban drainage and sewage treatment facilities through government concessions and purchase of services. Sewage treatment costs should be provided for in local fiscal budgets, with fees sufficient to cover costs.

The Rules on Urban Water Supply, issued by the State Council in 1994, prescribe that urban water pricing should allow for cost recovery and a small profit for profit water utilities.

The Rules on Collection and Use of Pollutant Discharge Fee, effective July 2003, seeks to address the misappropriation of pollution fees and establish budget management. It says that pollution fees will be ringfenced for environmental protection, but requires that pollution fees be turned over to the treasury, with environmental protection costs budgeted for by environment authorities, with prices through national standards.

Specific regulation of drainage basins include Regulation on the Administration of the Taihu Lake Basin and Interim Regulations on the Prevention and Control of Water Pollution in the Huaihe River Valley, which require provincial governments to encourage and support enterprises to voluntarily shut down and relocate factories, change the line of production and carry out technical transformation for reducing water pollutant discharge through measures in terms of financial, credit and government procurement.

ENVIRONMENTAL STANDARDS

Standards for environmental quality are the basis and rationale for implementing a series of environment management systems, including the pollutant discharge standard, pollutant discharge fee, pollutant discharge permit, environmental impact evaluation, etc. It is prescribed in Article 9 of the Environmental Protection Law that “the competent department of environmental protection administration under the State Council shall conduct unified supervision and management of the environmental protection work throughout the country. The people’s governments of provinces, autonomous regions and municipalities directly under the Central Government may establish their local environmental quality standards for items not specified in the national standards for environmental quality and report to the competent department of environmental protection administration under the State Council for the record” (Article, 7, People’s Republic of China, 1989).

The Environmental Protection Law stipulates that national standards for environmental quality shall be established by the competent department of environmental protection administration under the State Council; local standards for environmental quality can be more stringent than national standards, and shall be enacted by local governments.

STANDARDS FOR POLLUTANT DISCHARGE

It is stipulated in the Environmental Protection Law (1989) national standards for pollutant discharge shall be established “in accordance with the national standards for environmental quality and the country’s economic and technological conditions. ... The people’s governments of provinces, autonomous regions and municipalities directly under the Central Government may establish their local standards more stringent than the national standards.” (Article 10).

Compliant discharge is a way imposed by the State to control pollutant discharge. Units discharging pollutants into the environment must comply with corresponding pollutant discharge control standards. There are relevant provisions in the Environmental Protection Law, the Law on Prevention and Control of Water Pollution, the Law on Prevention and Control of Atmospheric Pollution, and the Law on Prevention and Control of Environmental Pollution by Solid Waste, etc. Discharge standards shall be compulsorily imposed by law; however, in environment legislature, there is no provision about excessive discharge violating the law.

Standards for environmental quality and pollutant discharge are closely linked and form the basis for polluter levies and controls. For example, in 2010, in the Guiding Opinions on Pushing Forward the Joint

Prevention and Control of Atmospheric Pollution to Improve Regional Air Quality put forward to “develop and implement special emission limits for air pollutants for key industries in key regions” (State Council, 2010). In 2013 the Clean Air Alliance of China’s *12th Five-Year Plan on Air Pollution Prevention and Control in Key Regions* stipulated:

Newly built projects must be supported with advanced pollution control facilities; thermal power, steel works sinter machine and other projects shall be equipped with high-efficiency dedusting, desulfurization and denitration facilities; newly built cement production lines must adopt low-nitrogen combustion technique, install bag filters and fuel gas denitration devices; newly built coal-fired boilers must install high-efficiency dedusting and desulfurization facilities, adopt low-nitrogen combustion or denitration technique and meet the discharge standard requirement. Newly built heavy-pollution projects including thermal power, iron & steel, petrochemical, cement, ferrous metal, chemical projects and so on, and industrial boilers in key emission control areas must satisfy the special emission limit requirement in the discharge standard of air pollutants; such requirement will be applied to thermal power projects since the release of the Plan and for other industries, the time of implementation is in synchronization with the time of discharge standard release.

By implementing the new *Emission Standard of Air Pollutants for Cement Industry*, particulate matter (PM) emissions from the cement industry will be reduced by around 35 per cent and nitrogen oxide emissions will be reduced by 50 per cent (Ministry of Environmental Protection, 2013) .

ENVIRONMENTAL PRICES

Traditionally the pricing of water, coal, electricity, natural gas and urban heat supply has not reflected the true cost of scarcity of natural resources and has acted as a subsidy for resource use. Increasingly, reforms are seeking to bring these prices into line with market principles.

Resource	Pricing system
Water	According to the Notice of General Office of the State Council on Promoting Water Price Reform to Promote Water Saving and Water Resources Protection, released April 2004, the objective of implementing water price reform in China is to establish a water price mechanism that fully reflects the scarcity of water in China and focuses on water saving, reasonable allocation of water resources, an increase in water efficiency and the promotion of sustainable utilization of water resources. Integrated water prices include water resource fees paid by water supply operators to the government; water supply prices paid by water users to supply operators' sewage treatment fees paid by polluters and used for the construction and operation of sewage treatment plants; and sewage discharge fees collected from enterprises, public institutions and individual business owners discharging pollutants into the water body directly. Sewage discharge fees belong to a budgetary fund to be used for pollution prevention and control.
Coal	China's coal price mainly depends on supply and demand in the domestic market, the government's regulatory policies and impacts on coal production costs. The Notice on Doing a Good Job in Inter-Province Coal Production, Transportation and Demand Linkage in 2007, issued by the National Development and Reform Commission (NDRC), put forward three basic principles for coal product pricing: market-oriented reform based on supply and demand, quality-based pricing and electricity price reform that reflects the underlying cost of coal.
Electricity	Electricity prices have long been subsidized, which hampers energy efficiency. Recent reforms in residential electricity include peak load pricing and tiered pricing policy for high- and low-electricity-use households. For industrial energy, targeted pricing offers differentiated pricing between "to-be-eliminated," "restricted" and "encouraged" categories of energy production. The feed-in tariff for small thermal power units has been reduced to expedite their shutdown. The government offers subsidies for thermal power plants based on air pollution reduction
Natural gas	Currently, the government chiefly sets the natural gas price in China, at a lower rate than the international price, but the aim is for greater market and dynamic adjustment linked with alternative energy prices and scarcity. Factory gate and pipeline transmission prices are set by NDRC. The Opinions of NDRC on Priorities in Deepening Economic Structure Reform in 2013, endorsed by the State Council, promotes natural gas price reform where prices at the city level will be negotiated based on supply and demand, and managed by competent pricing authorities of the local government, within a capped range prescribed by the state. Subsidies shall be offered to natural gas prices for public transit and taxis, which play an important role in daily life of residents.
Urban heat supply	The price of urban heat is guided by the heat-price-setting authorities of the local government. Urban heat price is divided into factory gate price, pipeline transmission price and sales price. On June 3, 2007, NDRC and the former Ministry of Construction jointly released the Notice on Issuing the Interim Measures for the Price Control of Urban Heat Supply, which stipulates that market supply and demand for heat supply and use shall be established by following the principle of market economy. The commercialized mechanism is applied for heat use. Heat price shall be able to cover all reasonable costs, ensure profit for investors and realize profit making for whoever invests in it. Price at a loss can neither attract market capital nor promote marketization of the heat supply industry.

ANNEX II: DATA ON INDUSTRIAL SECTORS

TABLE A2: CHINA'S TOP 10 INDUSTRIAL SECTORS, 2005 AND 2011

Rank	Top 10 industrial sectors in 2005	Ratio to all sectors (measured by gross industrial output value) in 2005	Top 10 industrial sectors in 2011	Ratio to all sectors (measured by gross industrial output value) in 2011
1	Communications devices, computers and other electronics manufacturing	10.73%	Ferrous metal smelting and extrusion	7.59%
2	Ferrous metal smelting and extrusion	8.53%	Communications devices, computers and other electronics manufacturing	7.56%
3	Production and supply of electric power and heat	7.07%	Transportation equipment manufacturing	7.49%
4	Chemical materials and chemical products manufacturing	6.50%	Chemical materials and chemical products manufacturing	7.20%
5	Transportation equipment manufacturing	6.25%	Electrical machinery and equipment manufacturing	6.09%
6	Electrical machinery and equipment manufacturing	5.52%	Production and supply of electric power and heat	5.61%
7	Textiles	5.04%	Agricultural and sideline food processing	5.23%
8	Petroleum processing, coking and nuclear fuel processing	4.77%	General equipment manufacturing	4.86%
9	Agricultural and sideline food processing	4.22%	Nonmetal mineral products	4.76%
10	General equipment manufacturing	4.22%	Petroleum processing, coking and nuclear fuel processing	4.37%

Source: National Bureau of Statistics of China (2006, 2012).

TABLE A3: TOP 10 INDUSTRIAL SECTORS SHOWING THE FASTEST GROWTH DURING 2005–2011

	Ratio to all industrial sectors (measured by industrial output value) in 2005	Ratio to all industrial sectors (measured by industrial output value) in 2011	Increase
Transportation equipment manufacturing	6.25%	7.49%	1.24%
Coal mining and dressing	2.27%	3.43%	1.16%
Nonmetal mineral products	3.65%	4.76%	1.11%
Ferrous metal smelting and extrusion	3.15%	4.25%	1.10%
Agricultural and sideline food processing	4.22%	5.23%	1.01%
Chemical materials and chemical products manufacturing	6.50%	7.20%	0.70%
Special equipment manufacturing	2.42%	3.10%	0.68%
General equipment manufacturing	4.22%	4.86%	0.64%
Electrical machinery and equipment manufacturing	5.52%	6.09%	0.57%
Ferrous metal mining and dressing	0.39%	0.94%	0.55%

Source: National Bureau of Statistics of China (2006, 2012).

ANNEX III: KEY GREEN INDUSTRIAL DEVELOPMENT OPPORTUNITIES

China's environmental challenges are also opportunities for green industrial development. Key areas include:

Environment remediation. Before 2010 there were less than 20 enterprises involved in heavy metal pollution and soil restoration, but in 2013 the number exceeded 300. Since 2009 the number of land restoration projects has experienced exponential growth. There were less than 20 land restoration projects in 2010, but the number was more than 100 in 2013. The overall size of China's land restoration market is expected to reach over RMB 1 trillion by 2020 and the relevant third party environmental monitoring market size is expected to be between RMB 5 billion and RMB10 billion. The central treasury will allocate RMB 30 billion for contaminated soil restoration across the country; for legacy-polluted land in cities, the central government will offer 30-45 per cent fiscal subsidies.¹

In recent years, mine ecological restoration has experienced rapid growth in China. During the 11th Five-Year Plan period, the central treasury made a total investment of RMB 12.9 billion and brought along inputs of RMB 50 billion from local treasury, enterprises and social capital (Han, 2011). During the 12th Five-Year Plan period, average funds invested in ecological restoration for mining area annually amounted to RMB 85.78 billion (National Bureau of Statistics of China, 2012).

Various types of contaminated sites that originated from petroleum, chemical, coal, steel and iron industries, as well as landfills, farms and slaughterhouses, are in urgent need of reclamation for reuse. If over RMB 100 million needs to be invested in the reclamation of one contaminated site, it is estimated that the overall investment for site reclamation in China could reach RMB 500 billion–600 billion.

Large areas of arable land are contaminated. Given the existing over 0.7 million hectares of contaminated arable land, their funding demands are especially huge. However, compared to the potentially generous return from real estate development based on site reclamation, remediation of arable land generally involves a long cycle. As the income from crop planting is limited, to remediate one hectare of arable land, it may need to take dozens of years to recover the cost, which makes it difficult to attract social capital inputs.

Green mining is an emerging innovative concept of ecological restoration that considers resource efficiency and environmental impact in a comprehensive manner. It follows the principle of green industry to develop a kind of mining technology in alignment with the environment with low impacts, high utilization and low emissions.

Underground water supplies nearly 70 per cent of the Chinese population's drinking water and 40 per cent of farmland irrigation. Remediation expenses for underground water pollution are huge. The California Underground Storage Tank Cleanup Fund, for example, offers USD 1.5 million for underground water remediation of a contaminated site related to a fuel station. For other sources of pollution, for example from refineries, military bases, waste yards etc., the remediation expenses for underground water pollution are significantly larger. In the future, China will make a total investment of RMB 34.66 billion in six types of projects for prevention and control of underground water pollution, including:

¹ Source: data provided by Chinese Professional Committee for Prevention of Heavy Metal Pollution and Solid Remediation of the China Association of Environmental Protection Industry

- An underground water pollution survey,
- A demonstration of prevention and control of pollution for underground sources of drinking water
- A demonstration of prevention and control of underground water pollution in typical sites
- A demonstration of remediation of underground water pollution
- A demonstration of prevention and control of non-point source pollution in agriculture and underground water environment supervision capability building

The National Groundwater Pollution Prevention and Control Plan (2011–2020) provides for some RMB 1.43 billion for demonstration projects (Ministry of Environmental Protection, 2011). The National 12th Five-Year Technological Development Plan for Environmental Protection states in the investment in technological development plan for the environment, that RMB 5 billion will be used for prevention and control of water pollution. In future decades, various segments, including underground water quality monitoring, industrial sewage treatment etc., will enter the underground water remediation market and generate huge demands for funding.

Innovation in new energy technology is accelerating and energy conversion efficiency is substantially improved. New energy has entered the stage of scaled and accelerated development, which plays a vital role in additional energy supply and has gradually transformed into the major alternative energy from the original status of supplementary energy. China has abundant renewable energy resources. Technically feasible installed capacity for hydropower resources is 0.54 billion kilowatt hours (kWh), ranking number one in the world. Onshore available wind energy capacity is 0.3 billion kWh, and when combined with the available wind energy capacity in offshore area, the total capacity is about 1 billion kW. Solar power resources are plentiful and for about two thirds of the national territory area, annual average sunshine hours exceed 2,200. The potential for biomass resources to be converted into energy is about 1 billion tonnes of coal equivalent (TCE) (Jingyi, 2013). In 2012 total development and utilization of renewable energy, including wind, solar, biomass energy etc., only accounted for less than 1 per cent of overall energy consumption. In the long run, China's new energy industry is poised with the conditions, market and policy environment of rapid development.

Green building materials are an effective measure and path for the building materials industry to vigorously solve overcapacity and prevent and control atmospheric pollution. MIIT and Ministry of Housing and Urban-Rural Construction have established the cross-ministry coordination mechanism for green building materials promotion and application. Meanwhile, technical requirements for major varieties of green building materials are being researched. MIIT and Ministry of Housing and Urban-Rural Construction will issue *Action Plan for Development of Green Building Materials and Methods for Administration of Green Building Materials Evaluation and Labeling*. This document will formulate the technical requirements for green building materials to be promoted in the first batch, carry out green building material evaluations and release a catalogue of green building materials. The green building materials industry will surely make tremendous progress in the future.

Electric vehicles may not only be an important means of economic stimulation, but also realize the multiple goals of guaranteeing energy security and responding to climate change. China has the basis and conditions to accelerate and promote the research, development and industrialization of electric vehicles. If the strategic objective is clearly defined and policies and measures are properly put into place, China may experience technological leapfrogging and create a competitive edge in electric vehicles, similar to Japan's experience in establishing global competitive advantage with energy-efficient compact vehicles after the oil crisis.

Bio-technology is a strategic industry of mid- to long-term significance. The Organisation for Economic Co-operation and Development point out in their report, *The Bioeconomy to 2030: Designing a Policy Agenda*, that by 2030, industrial application will account for 39 per cent of gross output of bio-technology; 36 per cent

for agricultural application and 25 per cent for pharmaceutical and healthcare application, among which industrial application has the largest potential. China's bio-industry has undergone faster development in the hi-tech area in terms of technology, talent and scientific research base and has abundant bio resources, making it the most promising area to realize the leapfrog development. As seen by industrial maturity, China's bio-agriculture takes the lead and its industrialization may be accelerated if genetically modified technology policy can be properly adjusted in good time. Bio-medicine takes the second place; all told, bio-industry (including bio-energy, bio manufacturing etc.) has great potential.

Energy performance contracting shall be earnestly promoted. After signing a technology and energy management service contract with the client, the energy service company will be responsible for financing, shouldering the technological and financial risks, implementing and managing energy conservation projects on behalf of the client and sharing the benefits of energy conservation with the client according to contract provisions within the contract term. Energy performance contracting, on the one hand, enables enterprises to accelerate the implementation energy-efficient projects with good economic benefits that currently exist in the enterprises under the precondition of zero input. On the other hand, energy service companies will seek for customers to implement energy conservation projects. As advance payment is needed for all investment, the major bottleneck for energy performance contracting is a shortage of funds, which also demands for the development of green finance.

Recycling industry. The State Council printed and distributed the *Circular Economy Development Strategy and Near-term Action Plan* in January 2013. It states that the total output value of the resource-recycling industry shall substantially increase to RMB 1.8 trillion in 2015 from RMB 1.0 trillion in 2010. However, by the end of 2013, the corresponding figure was only RMB 1.3 trillion. Demands for green finance from the circular economy cannot be underestimated. Through promoting circular production of the enterprise, circular development of industrial parks and circular combination of industries, and creating the circular industrial system, by 2015, energy consumption per unit of industrial value added and water consumption shall be reduced by 21 per cent and 30 per cent respectively compared to 2010. The comprehensive utilization rate of industrial solid wastes will reach 72 per cent, and over 50 per cent of national industrial parks and over 30 per cent of provincial industrial parks will implement circular-oriented renovation.

High-efficiency energy is an area of huge potential. In 2013 total consumption of primary energy reached 3.75 billion TCE, where coal consumption amounted to 2.475 billion TCE and its ratio in total primary energy consumption was still as high as 66 per cent, in spite of a 0.6 percentage point decrease compared to 2012. Gross power generation in China was 5.32 trillion kWh in 2013, including 4.2 trillion kWh from thermal power, while hydropower, nuclear power, wind power, solar power and biogas generation totalled 1.163 trillion kWh². Several decades into the future, the ratio of coal and petroleum in the primary energy structure will be gradually reduced, but they shall still be dominant. Therefore, efficient and clean use of fossil energy is of immediate significance. High-efficiency and low-pollution use of coal resources is strategically important for securing the stability of the energy structure for a coal-reliant nation like China, as well as future application of carbon capture and storage technology.

In the working session for the national 13th Five-Year Energy Plan in 2014, it was put forward that the position of coal as a principal energy will not change, and that clean and efficient use of coal is the important cornerstone to guaranteeing energy security. Consequently, China shall continue to increase the ratio of coal use in power generation and implement the action plan for energy conservation, emission reduction, upgrading and renovation of coal power. For newly built coal-fired units, net coal consumption is lower than 300 grams standard coal/kWh and the level of pollutant emission is similar to that of a gas generator. For 600,000 kWh and above units in active service, China will strive to reduce the net coal consumption to 300 grams standard coal/kWh. Therefore, developing high-efficiency energy through clean coal and clean thermal power will create a huge market demand for green finance.

² Source: National Bureau of Statistics of the P. R. China: <http://www.stats.gov.cn/>.