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Cooperation on Environment and
Development (CCICED)**

Investment, Trade, and Environment

**Main Topics Report by the CCICED Task Force on
Investment, Trade, and Environment**

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Background

Significant progress has been made in achieving sustainable development in China, but there are still many challenges ahead. In this study we examine the impact of international investment and trade on the environment and analyze how China could leverage its international trade and investment activities to advance a “green shift” of the economy.

The China Council for International Cooperation on Environment and Development (CCICED) has carried out numerous related studies over the years, including research into the illegal trade of endangered species in China; China’s application for accession to the World Trade Organization (WTO) and its impact on the environment; international environmental certification standards; environment-related non-tariff trade barriers; and an environmental analysis of the value chain of certain commodities.

However, as the country increases its global presence, the nature of its trade is evolving. China must carefully measure how it can mitigate the current and potential environmental impacts of this changing landscape. China must also manage a rapidly growing volume of goods traded and produced through its investment activities. The impacts on the environment are continuously changing, and the role of these activities vis-à-vis sustainable development is becoming more complex to understand by the day.

The rules of the game must also be constantly examined; the non-stop review of regulations and their environmental provisions has made compliance more challenging. It is important to pay close attention to this rule-making process as some of the new measures could lead to new rounds of green protectionism. Following these changing policy dynamics is essential for a country like China, which is not only a late-comer to the business of international investment and trade, but has become one of the major players in international trade and investment. In such a dynamic context, China must rapidly identify the changing opportunities to implement new trading and investment policies that will help accelerate its shift towards the green development goals it has established for itself.

As energy and natural resources become increasingly scarce and expensive, it is imperative that China make use of its strategic position as a large emerging economy in transition to engage in the green transformation process. This engagement will help the country achieve clean, sustainable, and competitive economic development. As it engages in the process of “going global,” China must embrace its responsibilities as a leading player and become a proactive actor in promoting its environmental programs both at home and abroad.

China’s policies for absorbing foreign direct investment (FDI) have started to change.

However, a much greater research effort is needed to understand the principles, measures, and effects of its actions in terms of hosting FDI and making foreign investments (outward direct investment – ODI). The process has already started as China has taken some actions to regulate ODI, and some Chinese firms going abroad are adopting voluntary corporate social responsibility (CSR)¹ measures that conform to international investment standards. Nevertheless there is still much to do. China should carefully study existing international practices in order to select, improve, adapt, and adopt those that will help the country excel in environmental stewardship.

The Task Force explored the green shift in FDI in China, China's ODI, and China's international trade. In terms of FDI and the environment, the main issue is determining what sort of investment should be encouraged and what policy measures should be adopted to ensure that FDI contributes to the green shift and sustainable development. With respect to ODI, the main question revolves around what policies China should develop to strengthen its CSR and environmental performance, and improve the reputation of its overseas enterprises and the country itself. In an effort to arrive at reliable conclusions and sound recommendations, the Task Force endeavoured to obtain first-hand information and materials, carrying out field trips in countries where China's ODI and trade are more concentrated, specifically Indonesia, South Africa, and Zambia.

Over and above the need to manage domestic policies on the subject, China should evaluate rules and standards relating to international investment, trade, and the environment and help redesign them as necessary to promote a green transformation. China should not only safeguard its own economic and environmental interests, but through active engagement and leadership, the country should contribute to the improvement of global governance. How to balance self-interest with global needs is an important question for China to resolve. With the promotion of globalization and China's continuous emergence as a major economic power, the country will assume ever larger responsibilities and face growing pressure from the international community. Therefore, China should become proactive and help develop the international rules on investment, trade, and environment. It should voice its position on behalf of the interests of developing countries, and work towards playing a role in the development of the latter. In this sense, the Task Force has focused on studying how and where China can participate in the making of international rules, as it tries to promote better international cooperation.

This research project seeks to describe the current state of Chinese international trade and investment activities, and understand how they will affect the drive toward its sustainable development and green shift goals. The study aims to provide realistic and user-friendly recommendations that can be implemented to accelerate and expand the positive contribution of investment and trade to the environment while the economy

¹ Canada's Department of Foreign Affairs and International Trade defines corporate social responsibility (CSR) as "the way companies integrate social, environmental, and economic concerns into their values and operations in a transparent and accountable manner."

evolves. In this process, the Task Force also explored how China could cooperate with trading partners and investment rivals to promote bilateral green shift opportunities. Finally, the Task Force focused on how China could carry out multilateral cooperation with the international community in the fields of investment and trade, helping establish and improve relevant systems and mechanisms to promote a global green shift.

The Investment, Trade and Environment Task Force, formally launched in June 2010, held four plenary working meetings, three Chinese member meetings, and two overseas field trips. It participated in the November 2010 CCICED Annual General Meeting where it submitted an interim report; and participated in three CCICED Secretariat and Chief Advisors Joint Working Meetings and reported on the progress of the project. The five special topic reports of the main research document have been subject to three revisions, forming five special topic reports, one summary report, one policy suggestion, and two overseas research reports. Through the 18 months of research and writing by the Chinese and overseas teams, the project report is being submitted to the 2011 CCICED Annual General Meeting in the form of research reports and policy recommendations.

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Chapter 1 Investment, Trade and Environment: Overview

1.1 Introduction

1.1.1 Overall Framework of the report

In the past three decades of reform and opening up to the rest of the world, China has achieved a remarkable development success that has gained worldwide attention. China's GDP is now the second largest in the world, while total import and export volumes puts it in first place globally. However, high energy-consumption industries have continued to develop through industrialization, and high costs and high pollution have continued to accompany low output, low technology, and low profitability. Furthermore, with the deepening of the economic globalization, global environmental problems have become increasingly prominent, thereby posing severe challenges for the achievement of sustainable development and human well-being. Pollution, climate change, and ongoing energy crisis have prompted discussions worldwide and have significant implications for research into investment, trade and environment.

The relationship between trade and environment is a complex matter that involves many dimensions. Generally speaking, trade liberalization will influence the environment in the following five ways (OECD, 1994):

Scale Effects

Scale effects refer to the impact that the change of economic scale has on the environment as a result of trade liberalization. It is believed that trade liberalization will promote economic growth, leading to an expansion of economic scale. On the one hand, this may accelerate energy consumption and the excessive emission of pollutants, thereby creating more pressure on the environment; on the other hand, it may also bring forth an increase of national wealth and the improvement of people's living standards, and hence enhance people's awareness of, and commitment to, environmental improvement.

Structural Effects

Structural effects refer to the impact that trade liberalization has on the environment through its influence on the economic structure. Trade liberalization facilitates specialization in the division of labour, which brings about the transformation of economic structures, as countries have to fall on their respective specialties to participate in international competition. Trade liberalization may encourage the industrial structure to evolve from being dominated by the high-pollution first and second tier industries to being driven by the third tier industry, which produces relatively few pollutants. Actually, trade liberalization has brought forth tremendous

environmental improvement in many developing countries. However, trade liberalization may also result in the misuse of resources in some countries, as they might export end to export excess amounts of natural resources and depend too much on high-pollution industries, which can lead to environmental degradation. For instance, many developing countries have blindly expanded the export volume of natural resources and have supplied raw materials to developed countries without considering fully the related environmental costs in the pricing of the materials.

Technology Effects

Trade liberalization has accelerated the spread of technology among countries. New technologies usually bring forth increased productivity and produce the same output with fewer inputs and less pollution. However, it might also facilitate the transfer of outdated, hazardous technologies and techniques from developed countries to developing ones.

Product Effects

As with technology effects, trade liberalization accelerates the flow of products among countries. A country might have access to more environmentally friendly products through its trade, and make up for the domestic scarcity of natural resources. Meanwhile, trade liberalization may also cause the opposite effect. For instance, developed countries sometimes transfer unwanted waste to developing countries.

Regulatory Effects

Regulatory effects refer to the impact that trade liberalization has on the environment due to its influence on the environmental policy, measures, and the formulation and implementation of related standards. Trade liberalization might prompt a country to improve its environmental performance by perfecting its environmental regulation, strengthening its environmental measures, and enhancing its environmental standards. Meanwhile, global trade regulation that comes with trade liberation may also impose certain limits on the freedom and ability of a country to implement environmental policies based on its own circumstances. In order to be more competitive internationally, certain countries may seek to lower their environmental standards and fall prey to the “prisoner’s dilemma.”

The five effects described above could lead to environmental improvement or degradation, depending to a great degree on whether there is a developed market and proper, effective regulation.

The relationship between investment and the environment is also complex and multi-faceted. The environmental impact of foreign direct investment (FDI), in particular, is a hot topic that has attracted extensive attention. On the one hand, FDI

may result in a rise of pollution in the host country, and the flow of FDI from countries or areas with strict environmental regulations to those with relatively loose regulations may result in a transfer of high-pollution industries and hence aggravate the pollution problems in the countries that receive FDI. On the other hand, the advanced technologies that FDI brings to the host countries often enhance the resource utilization efficiency and promote the recycling of resources. As a result, fewer inputs are required to produce the same output with less pollution.

This first section of this report report divides its exploration of the complex relationship among trade, investment, and the environment into the following subsections: first, an analysis is presented on the current status of foreign trade and international investment in China; in the second subsection, embedded pollutants in foreign trade are analyzed on the basis of the input-output model, so as to gain an insight into the relationship between foreign trade and the environment; and finally, a computable general equilibrium (CGE)-based simulation is conducted to comprehensively investigate how to implement policies to facilitate the optimization of industrial, foreign trade, and investment structures to achieve environmental improvement.

1.1.2 Current Status of Import & Export Trade and the Environment in China

Since reforming and opening up to the rest of the world, China has scored remarkable achievements in foreign trade, with import and export volume soaring from USD 20.64 billion in 1978 to USD 2,972.8 billion in 2010², representing an annual growth rate of 16.8%. With the rapid development of foreign trade, the ratio of China's dependence on foreign trade has also been on the rise, amounting to 49.45% in 2010.

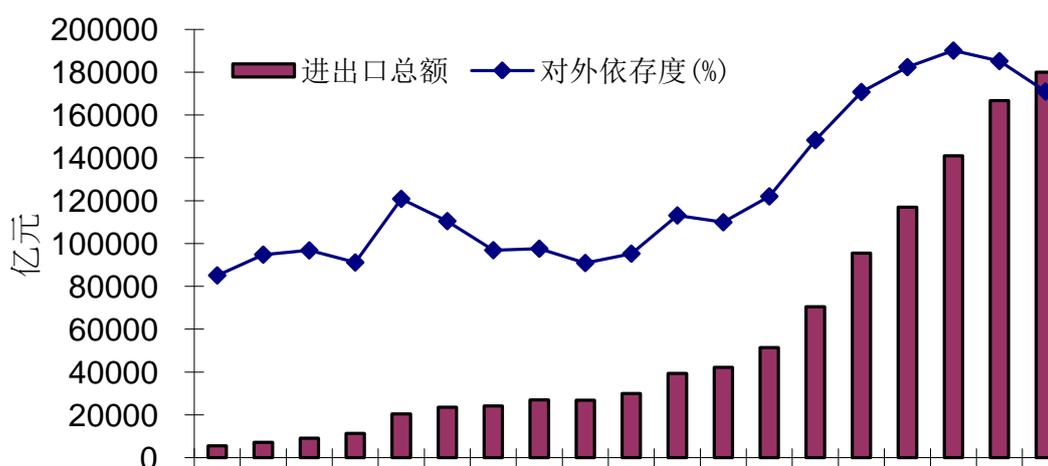


Figure 1.1 Total Imports & Exports and Ratio of Dependence on Foreign Trade in China

² Note: Ratio of dependence on foreign trade in China=Total imports & exports/GDP*100%, calculated at the current prices.

¹ Note: Ratio of dependence on foreign trade in China=Total imports & exports/GDP*100%, calculated at the current prices.

Source: Statistical Yearbook of China 2010.

进出口总额 Total Imports & Exports

对外依存度 Ratio of Dependence on Foreign Trade

纵轴:

亿元 100,000,000 RMB

Considering the availability of data, we mainly referred to the input-output table of 34 sectors and the energy consumption statistics of related sectors in 2002 and 2007, and divided the sectors into high, medium, and low energy-consumption sectors according to the energy consumption intensity of the industry.

As is shown in Table 1.1, high energy-consumption sectors accounted for USD 197.168 billion of exports in 2007, which represented 16.21% of the total volume. The exports of medium and low energy-consumption sectors were USD 275.65 billion and USD 743.87 billion, which respectively accounted for 22.66% and 61.14% of the total export volume. Compared with 2002, the proportion of high energy-consumption exports in the total volume increased from 15.95% in 2002 to 16.21% in 2007; that of medium energy-consumption exports dropped from 28.03% in 2002 to 22.66% in 2007; and that of low energy-consumption exports rose from 56.92% in 2002 to 61.14% in 2007.

Table 1.1 Distribution of Energy Consumption in Export Sectors (2002 and 2007)

(Unit: USD 100,000,000)

Sectors	2002		2007	
	Exports	Percentage(%)	Exports	Percentage(%)
High Energy-Consumption Sector	487.65	15.05	1,971.68	16.21
Medium Energy-Consumption Sector	908.42	28.03	2,756.50	22.66
Low Energy-Consumption Sector	1,844.70	56.92	7,438.70	61.14
Total	3,240.77	100.00	12,166.88	100.00

Source: The present authors' calculation.

As shown in Table 1.2, high energy-consumption sectors accounted for USD 283.171 billion of imports in 2007, which represented 29.70% of the total volume. The imports of medium and low energy-consumption sectors were USD 171.408 billion and USD 499.028 billion, which accounted for 17.97% and 52.33% of the total import volume respectively. Compared with 2002, the proportion of high energy-consumption imports in the total volume increased from 27.81% in 2002 to 29.69% in 2007, while that of medium energy-consumption imports rose from 17.55% in 2002 to 17.97% in 2007, and that of low energy-consumption imports dropped from 54.65% in 2002 to 52.33% in 2007.

Table 1.2 Distribution of Energy Consumption in Imports (2002 and 2007)
(Unit: USD 100 million)

	2002		2007	
	Imports	Percentage(%)	Imports	Percentage(%)
High Energy-Consumption Sector	811.50	27.81	2,831.71	29.69
Medium Energy-Consumption Sector	512.05	17.55	1,714.08	17.97
Low Energy-Consumption Sector	1594.77	54.65	4,990.28	52.33
Total	2,918.32	100.00	9,536.07	100.00

Source: input-output tables of China in 2002 and 2007, calculated by Li Shantong and the team for topic 1 of the Task Force

1.1.3 Foreign Direct Investment (FDI) and Outward Direct Investment (ODI)

1.1.3.1 Foreign Direct Investment (FDI) in China

The actual utilization of foreign investment in China began to grow rapidly at the beginning of the 1990s, but declined somewhat towards the end of the 1990s due to the financial crisis in Asia. It has been steadily on the rise since 2000. By 2008, the country had utilized USD 95.25 billion of foreign capital. In 2009, the figure dropped a little to USD 91.8 billion due to the repercussions of the global financial crisis. Of all the foreign capital China has received so far, foreign direct investment has made up an overwhelming proportion (see Figure 1.2).

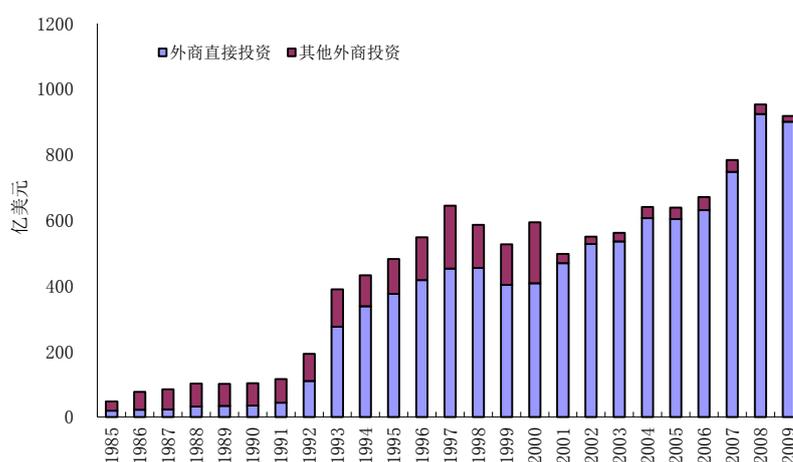


Figure 1.2 China's Utilization of Foreign Capital

Source: Statistical Yearbook of China 2010. 外商直接投资 FDI

其他外商投资 Other Forms of Foreign Investment

纵轴:

亿美元 USD 100,000,000

In terms of sectoral distribution, FDI is mainly concentrated in manufacturing. In 2009, USD 46.8 billion went into manufacturing, accounting for 51.95% of total FDI. The second biggest investment target is the real estate industry, which attracted USD 16.8 billion of FDI, accounting for 18.65% of the total FDI. The FDI that went into power, gas, and water production and supply reached USD 2.112 billion, accounting for 2.34% of the total FDI.

In terms of the utilized FDI in 2008³, mining (USD 572 million), textiles (USD 1.823 billion), chemical materials and products manufacturing (USD 4.123 billion), and power, gas, and water production and supply (USD 1.696 billion) represented USD 8.214 of FDI in total, accounting for 8.89% of the total (USD 92.4 billion), and all of these are high energy-consumption sectors. In 2007, mining (489 million USD), textiles (1.843 billion USD), chemical materials and products manufacturing (USD 2.886 billion), and power, gas, and water production and supply (USD 1.072 billion) utilized USD 6.29 billion of FDI in total, accounting for 8.41% of the total (USD 74.77 billion). Compared with 2007, 2008 saw an increase of utilized FDI in all the above sectors in various degrees except for textile industry. However, the four sectors occupied a lower percentage of the total FDI in 2008.

1.1.3.2 China's ODI

China's outward direct investment (ODI) has developed rapidly in recent years (see Table 1.3). While non-financial ODI was a mere USD 2.85 billion in 2003, the figure rose sharply to USD 26.506 billion in 2007 and doubled in 2008 to USD 55.907 billion. Financial ODI also grew rapidly. In 2009, the total volume of ODI reached USD 56.53 billion, ranking first among developing countries and fifth globally⁴. In terms of the total volume, the 120,000 Chinese investors overseas had set up 130,000 ODI enterprises in 177 countries and areas around the world by the end of 2009, with the net cumulative ODI representing USD 245.75 billion and the overseas asset value over USD 1 trillion.

Table 1.3 China's ODI (2003–2009)

(Unit: USD 100 million)

	Non-financial ODI	Financial ODI	ODI	Total
2003	28.5	-	-	332
2004	55.3	-	-	448
2005	69.2	-	-	517.2*
2006	161.3	-	161.3	733.3
2007	248.4	16.7	265.06	1,179.1

³ See Appendix 3 for the specific data.

⁴ Source: 2009 Statistical Bulletin of China's Outward Foreign Direct Investment, Ministry of Commerce.

2008	418.6	140.5	559.07	1,839.7
2009	478	87.3	565.3	2,457.5

Source: Annual Statistics Express (2003–2006) and Statistical Bulletin (2007–2009), Department of Foreign Economic Cooperation (China’s overseas investment and economic cooperation).

* estimated value.

In terms of the ownership of Chinese ODI enterprises, 90% of the enterprises are state-owned and limited liability companies. 80.2% of the enterprises that receive non-financial ODI are central enterprises and units.

In terms of geographical distribution, most of China’s ODI is located in Asia and Latin America, while a mere 7.4% of the total ODI goes into developed countries and areas. Africa and especially Asia have the widest coverage of China’s ODI. By the end of 2009, more than 13,000 Chinese overseas enterprises in 177 countries and areas around the globe had covered 90% and 81.4% of the Asian and African areas respectively. Compared with 2007, 2008 saw a reduction of Chinese overseas investment in Europe, North America, and Latin America, while direct investment in Asia (especially Hong Kong) and Africa nearly doubled (see Table 1.4). In 2009, China’s investment in Europe, North America, and Latin America grew rapidly, with USD 3.35 billion of ODI in Europe, up by 282.8%; USD 1.52 billion of ODI in North America, up by 320%; and USD 7.33 billion of ODI in Latin America, up by 100%.

In terms of sectoral distribution (see Table 1.5), the five sectors with the highest ODI in 2007 were wholesale and retail (24.9% of the total ODI), rental and business services (21.2%), mining (15.3%), communications, warehousing and postal service (15.3%), and manufacturing (8.0%). This distribution pattern was slightly different in 2008, as the order of the five sectors with the highest ODI changed to rental and business services (38.8%), finance (25.1%), wholesale and retail (11.7%), mining (10.4%), and warehousing, communications, and postal service (4.75%) (see Table 1.6). In 2009, the five sectors with the highest ODI percentage were rental and business services (36.22%), mining (23.60%), finance (15.45%), wholesale and retail (10.85%), and manufacturing (3.96%). These recent years can be characterized by the following: (1) rental and business services have attracted the largest amount of ODI; (2) mining has taken up a higher percentage of ODI; (3) finance has attracted an increasingly large share of ODI; and (4) wholesale and retail have declined in their occupation of ODI.

Table 1.4 Geographical Distribution of China's ODI

(Unit: USD 100 million)

Country/Area	Net Investment in 2007	Net Investment in 2008	Direct Investment Stock in 2009
Asia	165.93	435.48	404.08
#Hong Kong	137.32	386.40	356
Africa	15.74	54.91	14.39
#South Africa	4.54	48.08	4.16
Europe	15.40	8.76	33.52
#Russia	4.77	3.95	22.20
Latin America	49.02	36.77	73.28
North America	11.26	3.64	15.22
#USA	1.96	4.62	9.09
Oceania	7.70	19.52	24.80
#Australia	5.32	18.92	24.36
Total	265.06	559.07	565.29

Source: Statistical Yearbook of China 2009 and Statistical Yearbook of China 2010.

Table 1.5 Sectoral Distribution of China's ODI

(Unit: USD 10,000)

Sectors	2007		2008		2009	
	Amount	Percentage (%)	Amount	Percentage (%)	Amount	Percentage (%)
Total	2,650,609	100.00	5,590,717	100.00	5,652,899	100.00
Agriculture, Forestry, Herding, and Fishing	27,171	1.03	17,183	0.31	34,279	0.61
Mining	406,277	15.33	582,351	10.42	1,334,309	23.60
Manufacturing	212,650	8.02	176,603	3.16	224,097	3.96
Power, Gas, and Water Production and Supply	15,138	0.57	131,349	2.35	46,807	0.83
Construction	32,943	1.24	73,299	1.31	36,022	0.64
Communications, Warehousing, and Postal Service	406,548	15.34	265,574	4.75	206,752	3.66
Information Transmission, Computer Service, and Software	30,384	1.15	29,875	0.53	27,813	0.49
Wholesale and Retail	660,418	24.92	651,413	11.65	613,575	10.85
Lodging and Catering	955	0.04	2,950	0.05	7,487	0.13
Finance	166,780	6.29	1,404,800	25.13	873,374	15.45
Real Estate	90,852	3.43	33,901	0.61	93,814	1.66
Rental and Business Service	560,734	21.15	2,171,723	38.85	2,047,378	36.22
Scientific Research, Technological Services, and Geological Exploration	30,390	1.15	16,681	0.30	77,573	1.37
Public Irrigation, Environment, and	271	0.01	14,145	0.25	434	0.01

Sectors	2007		2008		2009	
	Amount	Percentage (%)	Amount	Percentage (%)	Amount	Percentage (%)
Public Facility Administration						
Resident Services and Other Services	7,621	0.29	16,536	0.30	26,773	0.47
Education	892	0.03	154	0.00	245	0.00
Public Health, Social Security, and Social Welfare	75	0.00			191	0.00
Culture, Sports, and Entertainment	510	0.02	2,180	0.04	1,976	0.03
Public Administration and Social Organization	0	0.00	0	0.00	0	0.00

Source: Statistical Yearbook of China 2009 and Statistical Yearbook of China 2010.

1.1.4 Discharge and Treatment of Major Pollutants

1.1.4.1 Discharge of Major Pollutants

While total wastewater discharged increased in China, industrial wastewater discharge remained steady. Specifically, chemical oxygen demand (COD) stabilized, soot emission (including industrial soot emission) and industrial dust discharge declined steadily, and industrial solid waste discharge decreased dramatically (see Figure 1.3). Consequently, the intensity of the energy consumption and pollutant discharge (e.g., energy, industrial wastewater discharge, SO₂ emissions, and CO₂ emissions from burning fossil fuels) has continued to decline steadily (see Figure 1.4).

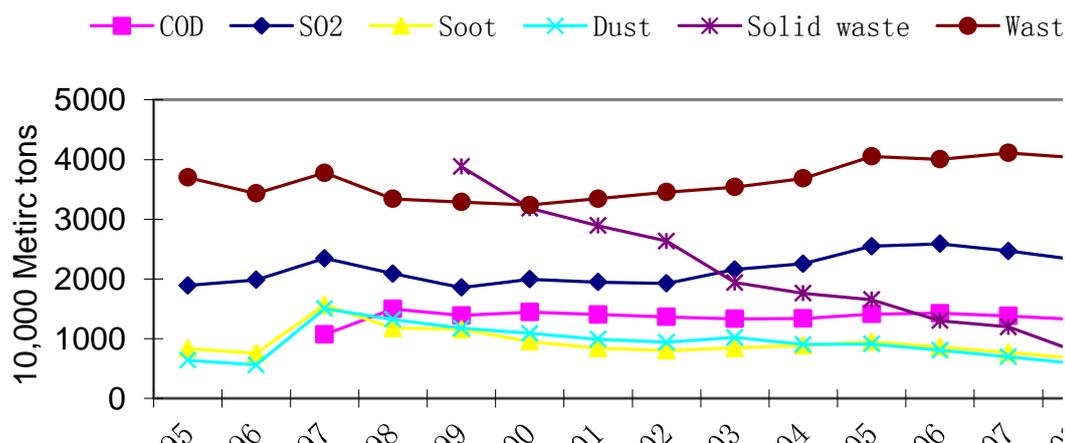


Figure 1.3 Pollutant Discharge in China, 1995–2008

Left Axis: COD, SO₂ Emissions, Industrial Soot Discharge (Soot), Industrial Dust Discharge (Dust), and Industrial Solid Waste Discharge (Solid waste). Unit: 10,000 tons. Right Axis:

Industrial Wastewater Discharge. Unit: 100 million Metric Tons.

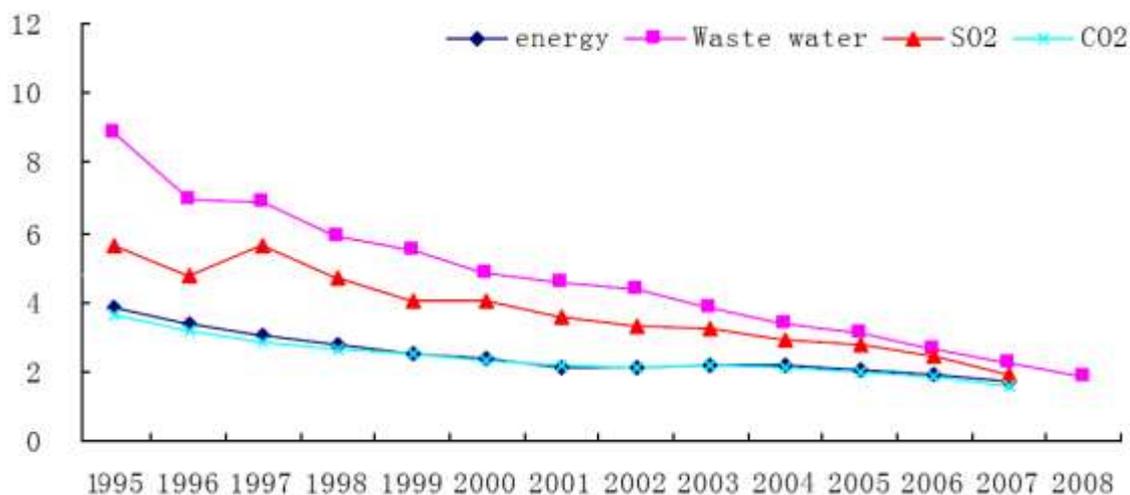


Figure 1.4 Intensity of Resource Consumption and Pollutant Discharge

Energy Intensity (energy): Consumption of standard coal per 100 million RMB of industrial output, calculated on the basis of 10,000 tons. The industrial output and industrial energy consumption data are cited from the Statistical Yearbooks of China. Intensity of Wastewater Discharge (wastewater): Wastewater discharge per 100 million RMB of industrial output, calculated on the basis of 10 tons. SO₂ emissions intensity: Emission of SO₂ per 100 million RMB of industrial output, calculated on the basis of 10 tons. CO₂ emissions intensity: Emission of CO₂ per 100 million RMB of industrial output, calculated on the basis of 10,000 tons. The wastewater discharge and SO₂ emissions data are cited from the Statistical Yearbooks of China and include only the industrial discharge. The CO₂ data came from Oak Ridge National Laboratory, and include the emissions of all fossil fuels.

1.1.4.2 CO₂ Emissions

With increasing industrialization and urbanization in China, the emission of greenhouse gases has also increased rapidly. According to the statistics of WRI-CAIT, the emission of greenhouse gases from fossil fuels reached 6.028 billion tons of carbon dioxide equivalent in China in 2007, representing 21.41% of newly added CO₂ equivalent around the world. In 2007, China had the biggest share of CO₂ emissions in the world, with the CO₂ emission per capita as high as 4.6 tons of CO₂ equivalent, which was above the global average of 4.3 tons per capita (see Figure 1.5)⁵.

⁵ Source: World Resources Institute-CAIT database. Retrieved from <http://cait.wri.org/cait.php?page=yearly&mode=view&sort=val-desc&pHints=shut&url=form&year=2007§or=energ&co2=1&update=Update>. Accessed on March 28, 2011.

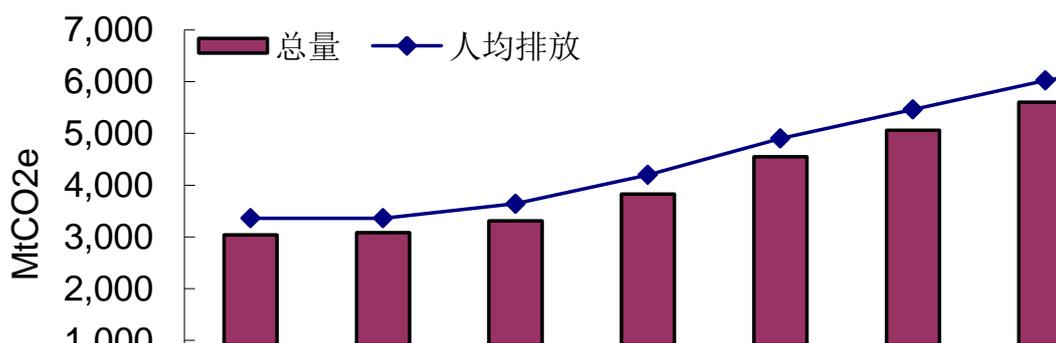


Figure 1.5 China's CO₂ Emissions from Fossil Fuels, 2000-2007

Source: Collected from World Resources Institute-CAIT database.

总量 Total Emissions

人均排放 Emissions Per Capita

1.1.4.3 Pollution Treatment Investment

Consistent with a scientific understanding of development, China has rapidly increased its investment in environmental pollution treatment from 110.66 billion RMB in 2001 to 449.03 billion RMB in 2008. As a result, the discharge of major pollutants in China declined in various degrees during the first three years of the Tenth and the Eleventh Five-Year Plans (see Figure 1.6).

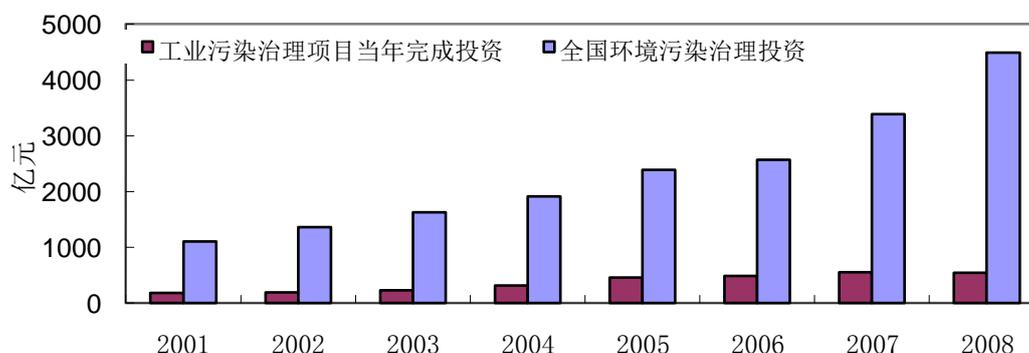


Figure 1.6 China's Investment in Pollution Control, 2001-2008

工业污染治理项目当年完成投资 Investment Completed in Anti-pollution Projects

全国环境污染治理投资 Total Investment in Environmental Pollution Treatment

1.2 Environmental Impact of Trade: Analysis based on Input-output Model

Foreign trade opens the domestic market to the international commerce, realizes the more effective allocation of resources on a broader scale, and facilitates the

development of the domestic economy. However, international trade also brings with it international allocation of resource consumption and pollutant discharge, which is reflected in the possible resource (energy) consumption and pollutant discharge in every link of the manufacturing process of the exported commodities. For instance, when China exports steel to another country, the steel is consumed in that country, but the manufacturing process of the steel causes water and energy consumption and pollution discharge in China, all of which are related to direct consumption and discharge; meanwhile, the supply of minerals and the manufacturing of the equipment necessary for the manufacturing of the steel also demand resource (energy) consumption and pollution discharge, which fall into the category of indirect consumption and discharge. Therefore, the process by which China exports steel to signifies not only the international flow of commodities, but also the international allocation of energy consumption and pollution discharge, for the importing country will have to consume its own energy and discharge the pollution domestically if it chooses to manufacture the steel rather than import it from China.

Attention needs to be paid to both the driving role of foreign trade for domestic economy and the impact of foreign trade on domestic resource (energy) consumption and pollution discharge. On the other hand, foreign trade covers up the responsible party for environmental pollution, as the traded goods embed the international transfer of pollutants, or the environmental cost. Although the principle of “consumer responsibility” dictates that the costs of the discharged pollutants in the manufacturing process should fall on the shoulders of the consumers of the goods, in foreign trade it is the manufacturing countries that have shouldered the costs of pollution discharge without enjoying the benefit of the goods. Therefore, foreign trade not only reflects the imbalance in economic volume and structure across countries, but also shows the imbalance in pollutant discharge and covers up the real parties that are responsible for environmental impact. As the “World’s Factory”, China has largely played the role of the manufacturer, which has significant implications for the assessment of embedded pollutants in foreign trade and of the sectoral distribution of the pollutants. This section, therefore, is an attempt to assess and analyze the sectoral distribution of pollutant discharge in China, and to assess the embedded pollutants in China’s foreign trade by adopting the multinational input-output model.

1.2.1 Sectoral Distribution of Pollutant Discharge

1.2.1.1 Sectoral Distribution of CO₂ Emissions

Many researchers today assess CO₂ emissions by multiplying the energy consumption with a fixed CO₂ emission coefficient. However, different types of energy (coal, oil, and gas, etc.) vary greatly in their CO₂ emissions. To minimize errors in the assessment, this report assesses the sectoral distribution of CO₂ emissions by considering each sector’s consumption of fossil fuels such as coal, oil, and gas and the

CO₂ emission coefficient⁶ of the fuels. This is also one of the objectives of this report. The data of the sectoral consumption of fossil energy (coal, oil and gas, etc.) are cited from *Energy Statistics Yearbook* and *Statistical Yearbook of China*. On the basis of the data, CO₂ emissions from coal, oil, and gas in each sector can be calculated, and the sum total of the CO₂ emissions of all the fossil fuels is then taken for the CO₂ emission of the sector as a whole.

(1) Analysis of CO₂ Emission from Fossil Fuels

Table 1.6 CO₂ Emission from Fossil Fuels

(Unit: 10,000 tons)

Type of Fossil Fuels	2002 年		2007 年	
	CO ₂ Emission	Percentage(%)	CO ₂ Emission	Percentage (%)
Coal	257,668.3719	69.81	414,914.56	66.51
Crude Oil	7,041.167	1.91	15,349.47	2.46
Processed Oil	92,118.9	24.96	173,537.73	27.81
Gas	12,273.47	3.32	20,107.17	3.22
Total	369,101.9	100	623,908.93	100

Source: input-output Tables of China in 2002 and 2007, calculated by Li Shantong and the team for topic 1 of the Task Force

The present author's calculation⁷.

As the figures in Table 1.6 show, with the expansion of economic scale in China, CO₂ emissions have risen sharply (by 2.548 billion tons) from 2002 to 2007. Emissions were 3.691 billion tons in 2002 and 6.239 billion tons in 2007, an annual growth rate of 13.81%, a much higher growth rate than that of GDP. In terms of energy structure, CO₂ from coal burning represented an overwhelming proportion of over two thirds of total emissions. However, the percentage of CO₂ emissions from coal had been declining in the past five years, whereas emissions from crude and processed oil, especially crude oil, rose from 70.41167 million tons in 2002 to 153.4947 million tons in 2007. The percentage of CO₂ emissions from crude and processed oil also rose from 1.92% to 2.46%.

(2) Sectoral Distribution of CO₂ Emissions⁸

In terms of the sectoral distribution of CO₂ emissions⁹, the ten sectors with the highest carbon emissions in 2007 were power and heat production and supply (48.94%),

⁶ According to the IEA data, the CO₂ emission coefficient of various fossil fuels (tons of CO₂/standard coal): raw coal (2.908), washery coal (2.772), coke (3.17), crude oil (2.149), natural gas (1.644), and petroleum (2.031).

⁷ Note: Unless notified otherwise, the data presented in the tables and figures of this report are based on the present author's calculation.

⁸ As the released statistics do not include the consumption of fossil fuels of social services, education, and public health, this report subtracted the known CO₂ emissions of these sectors from the total and allocated the remaining amount proportionately to the aforementioned sectors according to the intermediate input data of fossil fuels in the input-output table.

⁹ For specific statistics, see Appendix 6.

metal smelting and pressing (16.66%), communications (6.24%), non-metallic mineral processing (6.07%), household consumption (4.39%), chemical industry (3.88%), agriculture (1.87%), coal mining, washing, and dressing (1.78%), oil processing and coking, and nuclear fuel processing (1.75%), and construction (1.05%).

Several conclusions can be drawn from a comparison of the above table data with the sectoral distribution of CO₂ emissions in 2002. First, CO₂ emissions were concentrated in power and heat production and supply as well as metal smelting and pressing, which accounted for over 57% of total emissions. Second, carbon emissions from communications leapt from fifth in 2002 to third in 2007. Third, CO₂ emissions in China tended to be more and more concentrated, as the percentage of carbon emissions of power and heat production and supply rose from 45.58% in 2002 to 48.94% in 2007, and the figure for metal smelting and pressing rose from 12.31% in 2002 to 16.66% in 2007.

1.2.1.2 Sectoral Distribution of SO₂ Emissions

Data about sectoral distribution of SO₂ emissions re cited from the statistics released in China Statistical Yearbook on Environment. As the released statistics do not include SO₂ emissions data from agriculture, social services, education, public health, etc., this report subtracted the emission figures of the industrial sectors from the total emissions and proportionately allocated the remaining part in the above-mentioned sectors according to the intermediate input of the fossil fuels in the input-output table¹⁰.

In 2007, China emitted 24.681 million tons of SO₂, which marked an increase of 5.415 million tons compared with 19.266 million tons in 2002. The fact that the annual growth rate at 5.62% was remarkably lower than the GDP growth rate indicates that the policies and measures that China adopted to curb SO₂ emissions during this period were effective to a certain degree. However, SO₂ emissions of power supply increased from 6.6578 million tons in 2002 to 11.4712 million tons in 2007, with an annual growth rate at 14.45%. Further, SO₂ emissions from power and heat production and supply made up as much as 46.48% of the total emission in 2007, whereas in 2002 the figure was 34.56%. As a result, power and heat production and supply obviously made up a bigger share of SO₂ emissions in 2007. Meanwhile, SO₂ emissions from agriculture declined from 255,800 tons in 2002 to 73,400 tons in 2007, with an annual decline rate at 14.26%. The percentage of SO₂ emissions of agriculture in the total emissions also declined from 1.32% in 2002 to 0.3% in 2007. SO₂ emissions from household consumption also dropped from 3.646 million tons in 2002 to 3.281 million tons in 2007, representing a drop from 18.9% to 13.29% of total emissions,

¹⁰ For specific assessment results, see Appendix 7.

The ten sectors with the highest SO₂ emissions in 2007 were power and heat production and supply (46.47%), household consumption (13.29%), metal smelting and pressing (9.35%), non-metallic mineral product processing (7.39%), chemical industry (5.61%), communications (4.28%), oil processing (2.65%), paper-making and printing (2.01%), food industry (1.72%), and textiles (1.12%).

The following conclusions can be drawn from the shift in the sectoral distribution pattern of SO₂ emissions from 2002 to 2007. First, SO₂ emissions were concentrated in power and heat production and supply, as well as household consumption, which made up over 60% of the total SO₂ emission in 2007, and over 53% of total SO₂ emissions in 2002. Second, SO₂ emissions from power and heat production and supply increased from 2002 to 2007, whereas emissions from household consumption decreased over the same period. This might be explained by the following factors: The abrupt increase of demand for power in recent years caused the rapid increase of power production, whereas more and more residents burn coal for fuel, resulting in a reduction of the SO₂ emissions. Further, SO₂ emissions in China have tended to be concentrated, as the percentage of SO₂ emissions from power and heat production and supply rose from 34.56% in 2002 to 46.47% in 2007.

1.2.2 Analysis of Embedded CO₂ in China's Foreign Trade

This report adopts the multinational (multiregional) input-output model to assess embedded CO₂. For the specific assessment method, see the Appendix.

1.2.2.1 Embedded CO₂ in China's Imports and Exports in 2007 and 2002

In 2007, embedded CO₂ emissions in China's exports reached 1.984 billion tons, whereas the figure for China's imports was 603 million tons, making the CO₂ surplus embedded in China's foreign trade 1.381 billion tons in 2007¹¹. The CO₂ surplus and the embedded CO₂ in exports are equivalent respectively to 23% and 33.26% of total CO₂ emissions in 2007. In terms of the comparative relation between imports and exports, exports in 2007 were 27.59% higher than imports, whereas the embedded CO₂ in the exports was 3.29 times higher than the CO₂ in imports. In terms of the discharge intensity of the embedded CO₂, the embedded CO₂ in exports was as high as 16.31 tons per USD 10,000, whereas the embedded CO₂ in imports was only 6.33 tons per USD 10,000. In other words, the discharge intensity of the embedded CO₂ in exports was 2.58 times higher than in imports.

¹¹ The difference between the embedded CO₂ in exports and imports is the "embedded" surplus of CO₂ emission.

Table 1.7 Embedded CO₂ in China's Foreign Trade in 2007 and 2002

(Unit: Million tons)

Year	Embedded CO ₂ in Exports	Embedded CO ₂ in Imports	Surplus
2007	1,984.3	603.2	1,381.1
2002	770.5	149.4	621

Data Source: Input-Output Tables of China in 2002 and 2007, calculated by Li Shantong and the team for topic 1 of the Task Force

In terms of total imports and exports, embedded CO₂ emissions in exports in 2002 reached 770.5 million tons, and only 149.4 million tons in imports, resulting in a CO₂ surplus of 621 million tons. The embedded CO₂ surplus was equivalent to 18% of total CO₂ emissions in 2002. In terms of the comparative relation between imports and exports, exports were only 11.05% higher than imports in 2002, but the embedded CO₂ in exports was 5.16 times higher than in imports. In terms of the emission intensity of the embedded CO₂, the embedded CO₂ in exports per USD 10,000 was 23.77 tons, but only 5.11 tons in imports. In other words, the embedded CO₂ emission intensity in exports was 4.64 times higher than in imports.

Significantly, some other Chinese researchers calculated the embedded CO₂ in imports on the basis of the input-output table, and CO₂ emissions per unit of industrial output value in China, rather than the input-output table and CO₂ emission coefficient in the exporting countries. As countries vary greatly in industrial structure and emission intensity, there may be significant variations in the assessment results.

On the basis of the calculation method adopted in this report, namely, on the basis of the input-output table and emission intensity of the exporters, the embedded CO₂ in China's imports was 603 million tons. However, the figure would be 1.694 billion tons if the assessment were based on the input-output table and emission intensity in China. As embedded CO₂ emissions in exports in 2007 reached 1.984 billion tons, the embedded CO₂ surpluses that the two methods yielded were respectively 1.381 billion tons and 290.8 million tons, with a gap of 1.0902 billion tons between them. The reason for such a wide gap is that there exists a wide gap not only between the industrial structure, but also between the CO₂ emissions per unit of industrial output value across different sectors in China and in corresponding sectors in the rest of the world¹². For instance, the CO₂ emission intensity per unit of industrial output value in machinery and equipment manufacturing in China (0.918 ton/USD 10,000) was 5.74 times higher than in Japan (0.5196 ton/USD 10,000), 2.72 times higher than in the US (0.1911 ton/USD 10,000), 2.86 higher than in UK (0.1814 ton/USD 10,000), and 5.66 times higher than in Germany (0.0917 ton/USD 10,000). The CO₂ emission intensity per unit of industrial output value in the chemical industry in China (2.935 tons/USD 10,000) was 4.04 times higher than in Japan (0.7268 ton/ USD 10,000), 1.31 times higher than in the US (2.2444 tons/USD 10,000), 2.8326 higher than in the UK (1.036 ton/USD 10,000), and 3.67 higher than in Germany (0.7992 ton/USD 10,000).

¹² For the specific data of the CO₂ emission intensity per unit industrial output value of different sectors, see Appendix 10.

1.2.2.2 Sectoral Distribution of Embedded CO₂ in China's Exports

On the basis of the computation formula of embedded CO₂, we can calculate the embedded CO₂ emissions in the exports of various sectors and hence the sectoral distribution of the embedded CO₂ in China's exports. As this report assessed the embedded CO₂ in the foreign trade in 2002 and 2007, a vertical comparison of the sectoral distribution of embedded CO₂ in the two years under discussion was also provided.

Table 1.8 **Sectoral Distribution of Embedded CO₂ in Exports in 2002 and 2007**¹³

Sectors	2007				2002			
	Embedded CO ₂ (million tons)	Percentage (%)	Export Value (USD 100 million)	Percentage(%)	Embedded CO ₂ (million tons)	Percentage(%)	Export Value (USD 100 million)	Percentage (%)
Agriculture	7.92	0.4	109.94	0.9	6.73	0.87	65.39	2.02
Mining	23.78	1.2	110.37	0.91	18.27	2.37	60.32	1.86
Food and Tobacco Processing	22.63	1.14	247.62	2.04	16.93	2.20	110.33	3.40
Textile and Clothing	225.12	11.34	1896	15.58	127.70	16.57	717.82	22.15
Wood and Furniture Processing	38.69	1.95	287.52	2.36	15.96	2.07	79.73	2.46
Paper-making, Printing, and Stationery Manufacturing	61.19	3.08	396.44	3.26	33.18	4.31	151.14	4.66
Oil Processing, Coal Coking, and Nuclear Fuel Processing	24.61	1.24	127.08	1.04	12.11	1.57	35.24	1.09
Chemical Industry	218.36	11.00	1,034.32	8.50	94.22	12.23	290.72	8.97
Non-metallic Mineral Processing	61.93	3.12	186.10	1.53	36.59	4.75	55.40	1.71
Metal Smelting and Pressing	201.51	10.16	560.54	4.61	36.11	4.69	59.88	1.85
Metal Processing	166.40	8.39	675.32	5.55	54.90	7.12	148.16	4.57
Machinery, and Instrument, and Meter Manufacturing	490.80	24.73	2,686.85	22.08	171.44	22.25	663.57	20.48
Communications Equipment, Computers and Other Electronic Equipment	319.48	16.10	3,080.5	25.32	95.90	12.45	622.6	19.21
Communication Equipment Manufacturing	88.15	4.44	571.78	4.70	23.85	3.10	104.43	3.22
Other Manufacturing	16.94	0.85	171.01	1.41	10.77	1.4	64.12	1.98
Power, Heat,	15.89	0.80	14.12	0.12	15.46	2.01	8.7	0.27

¹³ Considering the data availability of the input-output tables of other countries, this report unified the sectors of various countries into 19 major sectors in the assessment of the embedded energy consumption in foreign trade and calculated the consumption coefficient matrix of the pollutants in the years in question (i.e., consumption coefficient or discharge intensity per unit of industrial output value).

Gas and Water Production and Supply								
Construction	0	0	0	0	0	0	0	0
Communications and Warehousing	0	0	0	0	0	0	0	0
Other Services	0.87	0.04	11.38	0.09	0.39	0.05	3.23	0.1
Total	1,984.3	100	12,166.88	100	770.53	100	3,240.78	100

Data Source: Input-Output Tables of China in 2002 and 2007, calculated by Li Shantong and the team for topic 1 of the Task Force

The four leading sectors in exports in 2007 were communications equipment, computers and other electronic equipment (25.32%), machinery, instrument and meter manufacturing (22.08%), textiles and clothing (15.58%), and the chemical industry (8.5%). These were also the four sectors with the largest embedded CO₂ in exports, making up as much as 63.18% of the total embedded CO₂ in exports in 2007. Specifically, machinery, instrument, and meter manufacturing made up 24.73% of the total embedded CO₂ in exports, and communications equipment, computers and other electronic equipment, textiles and clothing, and the chemical industry made up a percentage of 16.10%, 11.34% and 11% respectively.

The distribution pattern in 2007 is largely similar to that of 2002. Most of the embedded CO₂ in exports was concentrated in textiles and clothing, machinery, instrument, and meter manufacturing, communications equipment, computers, and other electronic equipment, and the chemical industry. However, the import structure changed from 2002 to 2007. Judging from the change in the distribution pattern of embedded CO₂ in exports, the following sectors saw an increase of percentage of the embedded CO₂ in exports: metal smelting and pressing; metal processing; machinery and instrument processing; communications equipment; computers and other electronic equipment; and communications equipment manufacturing. The percentage of embedded CO₂ in exports in the rest of the sectors declined generally. The main reason behind this is that the percentage of exports of the sectors listed above rose dramatically in the total exports.

1.2.3 Analysis of Embedded SO₂ in China's Foreign Trade

The assessment method of embedded SO₂ is basically the same as that of embedded CO₂.

1.2.3.1 Embedded SO₂ in China's Imports and Exports in 2007 and 2002

In 2007, embedded SO₂ emissions in China's exports reached 7.1398 million tons, whereas the figure for China's imports was 394,400 tons, constituting a SO₂ surplus embedded in China's foreign trade of 6.7454 million tons in 2007. In other words, China imported a net volume of 6.7454 million tons of SO₂ from abroad in 2007. The embedded SO₂ surplus in the foreign trade and embedded SO₂ in exports were equivalent respectively to 31.52% and 33.36% of total SO₂ emissions in 2007. In

comparing imports and exports, exports in 2007 were higher than the imports by 27.59%, but the embedded SO₂ in the exports was 18.10 times higher than in the imports. In terms of the discharge intensity of the embedded SO₂, the embedded SO₂ in exports was as high as 0.0587 ton per USD 10,000, whereas the embedded SO₂ in imports was only 0.0041 ton per USD 10,000. In other words, the discharge intensity of the embedded SO₂ in exports was 14.19 times than in in imports.

Table 1.9 Embedded SO₂ in China's Foreign Trade in 2007 and 2002

(Unit: 10,000 tons)

Year	Embedded SO ₂ in Exports	Embedded SO ₂ in Imports	Surplus
2007	713.98	39.44	674.54
2002	334.95	10.96	323.99

Data Source: Input-Output Tables of China in 2002 and 2007, calculated by Li Shantong and the team for topic 1 of the Task Force

In terms of total volume, embedded SO₂ emissions in exports in 2002 reached 3.3495 million tons, while embedded SO₂ emissions in imports was 109,600 tons, resulting in a SO₂ surplus of 3.2399 million tons. In other words, China imported a net volume of 3.2399 million tons of SO₂ in 2002. The embedded SO₂ surplus was equivalent to 52% of total SO₂ emissions in 2002. In comparison, exports were only 11.05% higher than the imports in 2002, but the embedded SO₂ in exports was 33.55 times higher than in imports.

In terms of the emission intensity, embedded SO₂ in exports was 0.1033 ton per USD 10,000, whereas in imports it was only 0.0038 ton. In other words, the embedded SO₂ emission intensity in exports was 27.51 times higher than in imports. Compared with the emission intensity of embedded SO₂ in exports in 2007 (0.0587 ton/USD 10,000), the figure in 2002 was twice as much, while the embedded SO₂ in exports remained the same in the two years under discussion.

1.2.3.2 Sectoral Distribution of Embedded SO₂ Emission in Exports

On the basis of the computation formula of embedded SO₂, we can calculate the sectoral distribution of embedded SO₂ in China's exports. As this report assessed the embedded SO₂ in exports in 2002 and 2007, a vertical comparison of the sectoral distribution of embedded SO₂ in the two years under discussion was also provided.

Table 1.10 Sectoral Distribution of Embedded SO₂ in Exports in 2007 and 2002

Sectors	2007				2002			
	Embedded SO ₂ (10,000 tons)	Percentage (%)	Export Value (USD 100 million)	Percentage (%)	Embedded SO ₂ (10,000 tons)	Percentage (%)	Export Value (USD 100 million)	Percentage (%)
Agriculture	2.33	0.33	109.94	0.9	3.08	0.92	65.39	2.02
Mining	8.26	1.16	110.37	0.91	6.9	2.06	60.32	1.86
Food and Tobacco Processing	9.09	1.27	247.62	2.04	8.49	2.53	110.33	3.40
Textile and Clothing	92.02	12.89	1896	15.58	59.92	17.89	717.82	22.15
Wood and Furniture Processing	14.49	2.03	287.52	2.36	7.01	2.09	79.73	2.46
Paper-making, Printing, and Stationery Manufacturing	32.34	4.53	396.44	3.26	18.75	5.6	151.14	4.66
Oil Processing, Coal Coking, and Nuclear Fuel Processing	10.00	1.40	127.08	1.04	5.25	1.57	35.24	1.09
Chemical Industry	90.60	12.69	1,034.32	8.50	43.01	12.84	290.72	8.97
Non-metallic Mineral Processing	25.94	3.63	186.10	1.53	19.23	5.74	55.40	1.71
Metal Smelting and Pressing	58.76	8.23	560.54	4.61	13.22	3.95	59.88	1.85
Metal Processing	54.86	7.68	675.32	5.55	20.88	6.23	148.16	4.57
Machinery, and Instrument, and Meter Manufacturing	158.72	22.23	2,686.85	22.08	68.00	20.30	663.57	20.48
Communication Equipment, Computers and Other Electronic Equipment	115.45	16.17	3,080.5	25.32	41.40	12.36	622.6	19.21
Communications Equipment Manufacturing	29.05	4.07	571.78	4.70	9.37	2.80	104.43	3.22
Other Manufacturing	5.79	0.81	171.01	1.41	4.11	1.23	64.12	1.98
Power, Heat, Gas and Water Production and Supply	5.94	0.83	14.12	0.12	6.14	1.83	8.7	0.27
Construction	0	0	0	0	0	0	0	0
Communications and Warehousing	0	0	0	0	0	0	0	0
Other Services	0.32	0.04	11.38	0.09	0.1786	0.05	3.23	0.1
Total	713.98	100	12,166.88	100	334.95	100	3,240.78	100

Data Source: Input-Output Tables of China in 2002 and 2007, calculated by Li Shantong and the

team for topic 1 of the Task Force

In 2007, the five leading sectors in exports were communications equipment, computers, and other electronic equipment (25.32%), machinery, instrument, and meter manufacturing (22.08%), textiles and clothing (15.58%), the chemical industry (8.5%), and metal processing (5.5%). These were also the five sectors with the largest embedded SO₂ in exports, making up as much as 71.66% of the total embedded SO₂ in exports in 2007. Specifically, machinery, instrument, and meter manufacturing made up 22.23% of the total embedded SO₂ in exports, and communications equipment, computers, and other electronic equipment; textiles and clothing; chemical industry; and metal processing took up a percentage of 16.17%, 12.89%, 12.69%, and 7.68% respectively.

The distribution pattern in 2007 was somewhat similar to that in 2002. However, the following sectors saw an increase in percentage of embedded SO₂ in exports: metal smelting and pressing; metal processing; machinery, instrument, and meter manufacturing; communications equipment computers, and other electronic equipment ; and communications equipment manufacturing. The percentage of the embedded SO₂ in exports in the rest of the sectors generally declined. The main reason behind this change is that the percentage of exports of the sectors listed above rose dramatically within total exports.

1.3 Impact of Environmental Policy on Investment and Trade: on the basis of CGE Model

1.3.1 Introduction to the CGE Model

There are four models generally adopted in the empirical research on environment and energy policies (Li Shantong & Zhai Fan, 2001): project-scale model (such as LEAP model, etc.); partial equilibrium model; computable general equilibrium model (CGE model); and integrated evaluation model. Since the outbreak of the first oil crisis in the 1970s, Hudson & Jorgenson (1975) developed the first CGE model applicable to energy policy analysis. Later, the CGE model began to be adopted in the analysis of energy and environmental policy (such as Bergman, 1990; Burniaux, 1992; Kopp, 1990; Manne, 1977, and others). The advantage of the CGE model lies in its consistency with the microeconomic theory, the detailed structural characteristics, and the general equilibrium characteristics. Its general equilibrium framework enables it to describe the interaction among multiple markets and institutions and to assess the direct and indirect impacts of a specific policy, as well as the impact of the policy in question on the overall economy. Another characteristic of the CGE model is that it usually represents the actual policy mechanism in a relatively detailed way, which is convenient for the analysis of many actual issues in policy-making. In recent years, the CGE model has become the primary choice in the analysis of energy and environmental tax policies.

The CGE model for China adopted in this report is the 2009 version of the DRCCGE model (hereinafter referred to as DRCCGE2009) developed by the Development Research Center of the State Council of PRC. DRCCGE2009 includes 34 production sectors, two resident types (i.e., rural and urban households), and five primary factors of production, namely, rural land, capital, farm labour, unskilled and skilled labour, and special factors¹⁴.

(1) Production Structure and Productive Factor Market. The model describes the production process through multi-layered constant elasticity of substitution (CES) production function (see Figure 3.1). On the first layer, the ultimate output is determined by the combination of intermediate non-energy inputs and the value added and energy composite. On the second layer, the non-energy intermediate inputs are described with the Leontief structure, i.e. no substitution is assumed among all the inputs. The value added and energy composite is further broken down into the total labour input and the capital and energy composite. The labour demand is broken down into the demand for three types of labour according to the labourers' skills, and the capital and energy composite is broken down into energy and the capital, land, and special factors composite. Finally, energy is further divided into three different types, while the capital, land, and special factors composite is divided into capital, land, and special factors in the agricultural sector. Let us take the first layer for example. The CES production function is run on various inputs, and the manufacturer may select the combination of inputs on the basis of the principle of cost minimization:

$$\min c_i = PND_{i,z} ND_{i,z} + PKEL_{i,z} KEL_{i,z}$$

$$s.t. \quad XP_{i,z} = A \left[\alpha_{i,z}^{nd} ND_{i,z}^{(\sigma_{i,z}-1)/\sigma_{i,z}} + \alpha_{i,z}^{kel} KEL_{i,z}^{(\sigma_{i,z}-1)/\sigma_{i,z}} \right]^{\sigma_{i,z}/(\sigma_{i,z}-1)}$$

In the above formula, $XP_{i,z}$ ¹⁵, $ND_{i,z}$ and $KEL_{i,z}$ respectively represent the total output, the non-energy intermediate inputs, and the energy and value added composite; $\alpha_{i,z}^{nd}$ and $\alpha_{i,z}^{kel}$ represent respectively the share coefficient of the two types of inputs; $\sigma_{i,z}$ is the elasticity of substitution of the two types of inputs; $PND_{i,z}$ and $PKEL_{i,z}$ are the non-energy intermediate inputs and the price of the energy and value

¹⁴ The special factors are mainly those factors in the natural resource production sectors, such as the stock of oil and coal.

¹⁵ i, z refer to the sector type and capital type (new and old) respectively.

added composite. The non-energy intermediate inputs and the demand for the energy and value added composite can be derived through the Lagrange multiplier:

$$ND_{i,z} = \alpha_{i,z}^{nd} \left(\frac{PX_{i,z}}{PND_{i,z}} \right)^{\sigma_{i,z}} XP_{i,z}, \quad KEL_{i,z} = \alpha_{i,z}^{kel} \left(\frac{PX_{i,z}}{PKEL_{i,z}} \right)^{\sigma_{i,z}} XP_{i,z},$$

Meanwhile, the shadow price of the production constraint, or the unit production cost, can be derived as follows:

$$PX_{i,z} = \left[\alpha_{i,z}^{nd} PND_{i,z}^{1-\sigma_{i,z}} + \alpha_{i,z}^{kel} PKEL_{i,z}^{1-\sigma_{i,z}} \right]^{1/(1-\sigma_{i,z})}$$

The model differentiates new capital from old capital. The assumption of Vintage structure allows the elasticity of substitution in the production function to vary according to the vintage of the capital. The model also reflects the adjusting rigidity of the capital market. It assumes that every type of labour can flow across the sectors fully¹⁶. By assuming partial fluidity¹⁷ among rural labour and manufacturing workers, the model reflects the division of the labour market. The fluidity is dependent on the relative salaries of rural labour and manufacturing labour, as well as the constant elasticity of transformation.

(2) Pollutant Discharge and Environmental Tax. We introduced three pollutants into the model, namely, CO₂, SO₂ and COD. On the basis of the findings of Dessus and other researchers (O'Connor et al., 2003), we divided the overall pollutant discharge into three parts (see Figure 3.1): pollutant discharge from intermediate inputs (energy); pollutant discharge from manufacturing processes; and the pollutant discharge from ultimate consumption. The model used the following pollutant discharge formula:

$$E = \underbrace{\sum_i \sum_j \alpha_{i,j} XA P_{i,j}}_{\mathbf{I}} + \underbrace{\sum_j \beta_j X P_j}_{\mathbf{II}} + \underbrace{\sum_i \gamma_i X F D_i}_{\mathbf{III}}$$

译者注：上图文字从左至右依次为：

Pollutant discharge from intermediate inputs

Pollutant discharge from manufacturing processes

Pollutant discharge from ultimate consumption

¹⁶ Rural labour works only in agricultural sectors, while manufacturing labour works only in non-agricultural sectors. In the production function, the two types of labour cannot substitute each other.

¹⁷ The fluidity is captured in the CET function.

In the above formula, j is the sector, i is the commodity that is put in or consumed, $XAp_{i,j}$ is the intermediate input, XP_j is the output of sectors, XFD_i represents the ultimate consumption, $\alpha_{i,j}$ is the pollutant discharge from the consumption of sector j of unit commodity i , β_j is the pollutant discharge directly resulting from unit output of sector j , and γ_i is the pollutant discharge from the consumption of unit commodity i . Therefore, the three items on the right of the equation represent respectively the pollutant discharge from intermediate inputs, sectoral output, and ultimate consumption.

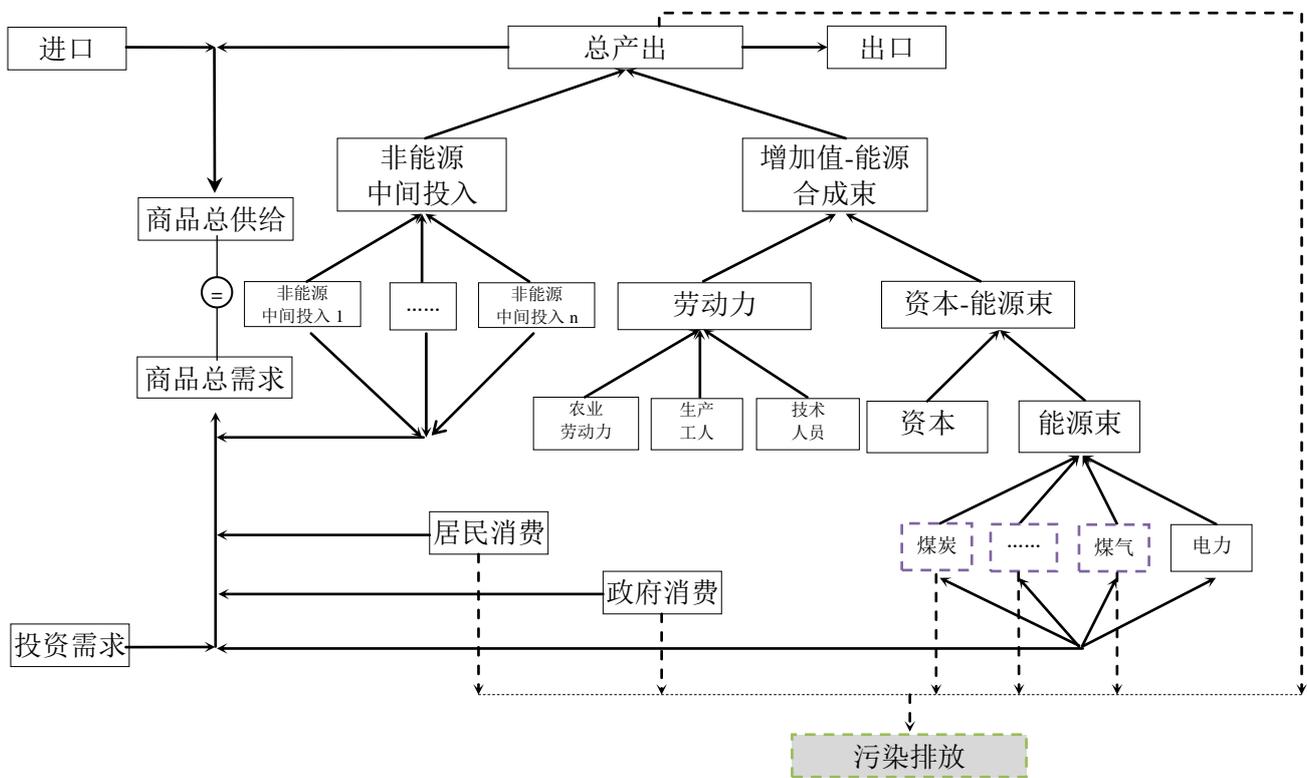


Figure 1.7 Commodity Flow, Production Factors and Pollutant Discharge in DRCCGE Model

进口 Import

总产出 Total Output

出口 Export

商品总供给 Total Commodity Supply

非能源中间投入 Non-energy Intermediate Inputs

增加值-能源合成束 Value Added and Energy Composite

非能源中间投入 1 Non-energy Intermediate Input 1
非能源中间投入 n Non-energy Intermediate Input n
劳动力 Labour
资本-能源束 Capital and Energy Composite
商品总需求 Total Commodity Demand
农业劳动力 Rural Labour
生产工人 Manufacturing Labour
技术人员 Technical Personnel
资本 Capital
能源束 Energy Composite
居民消费 Residential Consumption
煤炭 Coal
煤气 Gas
电力 Power

政府消费 Governmental Consumption

投资需求 Investment Demand

污染排放 Pollutant Discharge

Generally speaking, there are three methods to reduce the pollutant discharge in a certain sector: first, reduce the output scale of the sector; second, transform the input structure and adopt cleaner inputs; and third, adopt anti-pollutant measures or technologies in the process of pollutant discharge to reduce the pollutant discharge intensity (O'Connor et al., 2003). Therefore, pollutant discharge can be controlled by changing any of the three channels. From the perspective of taxation, a direct method is to collect taxes on the energy inputs or pollutant discharge, or the so-called front-end and terminal-end control. Taxes on the front end include petrol taxes and energy taxes, and those on the terminal end include carbon taxes and sulphur taxes, etc. The following section will present the simulation of different carbon tax scenarios.

(3) Foreign Trade. Although China has already occupied a large share in the international market of certain goods, the model adopted the “small country” assumption¹⁸ for China’s imports, as China has limited impact on the prices in the international market import-wise. As for the imports and domestic products, the model follows the Armington Assumption (Armington, 1969)¹⁹. The export demand is described with the demand curve of constant elasticity, in which the prices are highly elastic but not infinite. This means that China’s exports have limited influence over the pricing in the international market. The export supply is described through the CET function.

¹⁸ Here, exogenous import price at foreign currency (with infinite price elasticity) is assumed, i.e., the domestic import demand will not affect the international prices of the imports.

¹⁹ Heterogeneity between imports and domestic products is assumed.

(4) Income Distribution and Domestic Demand. Household income comes from capital, labour, and land income, as well as profit distributed by enterprises, and the transfer payments from the government and overseas parties. Residents' disposable income is spent on the consumption of goods and services and on savings. Different from the former DRCCGE models, this model adopts AIDADS consumption expenditure function in the place of ELES expenditure function. AIDADS function can be regarded as an extension of the LES function, or the latter as an exceptional case of the former. AIDADS function changes the constant marginal propensity to consume (MPC) in LES function into an income function, i.e., a function of the endogenous variable of MPC and income variable, which can better capture the impact of income variation on the structure/mode of consumption.

Revenue of enterprises comes from capital income. After deducting the taxes and the distributed profit to residents, the revenue turns into business savings for new investment and depreciation. Government revenue comes from various taxes. After deducting the subsidies and transfer payments, the revenue is used for governmental consumption and public investment. Governmental consumption and investment demand are described in fixed charge share function. The intermediate demand, household consumption and other ultimate demands constitute the total demand of Armington composite commodities.

(5) Market Equilibrium and Macro-closure. It is assumed that all commodity markets are cleared through prices. In the model, the actual governmental expenditure is exogenous, all the tax rates and transfer payments are fixed, and the actual governmental savings are endogenous. The sum total of all investment expenditure is equal to the sum total of all kinds of savings, including the retained profit of enterprises, household savings, governmental savings, and foreign capital inflow. The model adopts the neoclassic closure principle, i.e., the total investment is determined endogeneously by all the components of the savings; in other words, the model is driven by savings. The exchange rate is the price factor in the model, and the foreign accounts achieve equilibrium through the variations of actual exchange rates.

(6) Dynamic Feature and Model Data. DRCCGE2009 has a simple recursive dynamic structure²⁰. The dynamic feature is reflected in the following aspects: (1) the quantitative growth of production factors; (2) the increase of TFP and the propensity for technological progress; and (3) the vintage structure of capital. In the model, the growth rate of population, labour and productivity is exogenous, and the growth rate of capital is determined endogeneously by the relation between savings and investment in the model. The base year of the model is 2007, and the main source of the data is the Social Accounting Matrix, or SAM in 2007.

²⁰ It is assumed that economic subjects base their decisions on the static expectations of pricing and quantity.

1.3.2 Environmental Policy Scenarios

There are many kinds of environmental policy measures, such as taxation, trade of emission right, environmental standards, and administrative measures, etc. In the past, China usually adopted administrative measures. However, although these measures had immediate impact, they caused a significant loss of efficiency and lacked a long term solution. In the long run, market-based measures are a better choice. This study focuses on how to optimize industrial structure, investment and trade structure through environmental policies, and the environmental impact of the policies. The environmental policy under consideration is the carbon tax, and the analysis method is the scenario analysis of the CGE model as introduced in the previous sections. First, a scenario of benchmark growth is provided on the basis of the development history and the structural characteristics of the Chinese economy. The scenario of benchmark growth is based on the past and current development characteristics and arrives at the possible future scenario by considering the most likely changes, including changes in population, production factors, and technological progress. By reflecting the tendency of economic development and the future pollutant discharge tendency when no significant environmental policy is implemented, the scenario provides a framework of reference for other scenarios. On the basis of the scenario, this study designed several carbon tax²¹ scenarios where different tax rates are imposed. The specific scenario design is shown in Table 1.11.

Table 1.11 **Scenarios**

Scenario Types	Scenario Content
Scenario of Benchmark Growth	<ol style="list-style-type: none"> 1. Exogeneous population growth is assumed using the prediction data of Institute of Population and Labour Economics, Chinese Academy of Social Sciences. 2. The total labour supply will grow exogeneously and the rural land supply will change exogeneously. 3. Unless otherwise indicated, the existing tax rates and the transfer payments will be constant. 4. The balance of payments will achieve equilibrium from 2010 to 2030. 5. The urbanization level and urban and rural population will be exogeneous. The urbanization rate will grow annually by 0.9% from 2007 to 2020 and 0.7% from 2021 to 2030. 6. Governmental consumption growth rate will be exogeneous. 7. The TFP will be exogeneous. It is assumed that the growth rate of TFP will remain on the same level from 2005 to 2020, i.e., the growth rate will remain at around 2%. 8. Propensity for technological progress and the intermediate input rate will be exogeneous.
Carbon Tax Scenario	<p>The carbon tax will be implemented on all CO₂ emission from 2011, and the following are the four carbon tax scenarios.</p> <p>C1: The tax rate will remain constant at 10 RMB per ton until 2020.</p> <p>C2: The tax rate will have gradually increased from 10 RMB per ton to 50 RMB per ton by 2020.</p> <p>C3: The tax rate will have gradually increased from 10 RMB per ton to 100 RMB per ton by 2020.</p> <p>C4: The tax rate will have gradually increased from 10 RMB per ton to 200 RMB per ton by 2020.</p>

²¹ The taxation is levied per ton of CO₂ if not otherwise notified. Therefore, the carbon tax rate mentioned hereinafter is also calculated per ton of CO₂. Due to certain technical constraints of the model, this study adopted the carbon tax rather than any market-based environmental policy.

1.3.3 Analysis of Results of Environmental Policy Simulation

This study adopts the DRCCGE model to conduct a simulation analysis of the above scenarios. We will first introduce the result of the scenario of benchmark growth and provide the results of the carbon tax scenarios with reference to the scenario of benchmark growth.

1.3.3.1 Scenario of Benchmark Growth

In Figure 1.8, the tendency of economic growth from 2010 to 2020 under the scenario of benchmark growth is presented. Judging from the GDP growth under this scenario that the data in Figure 3.2 show, China will continue to grow at a relatively rapid speed in the next decade and maintain an annual growth rate of around 8%. However, the economic growth will slow down gradually.

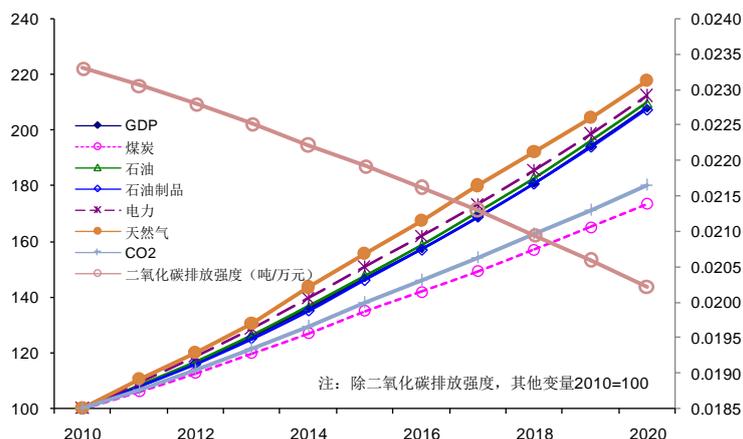


Figure 1.8 Future Tendencies of Major Variables under Scenario of Benchmark Growth

GDP GDP

煤炭 Coal

石油 Oil

石油贸易 Oil Products

电力 Power

天然气 Natural Gas

CO₂ CO₂

二氧化碳排放强度（吨/万元） CO₂ Emission Intensity (ton/10,000 RMB)

Note: Except for CO₂ emission intensity, the values of all variables take 100 for the data in 2010.

Besides the tendency of GDP growth, Figure 3.2 also provides the tendencies of energy consumption and CO₂ emissions in the next decade under the scenario of benchmark growth. As the data in Figure 3.2 show, energy consumption and CO₂ emissions will also maintain a rapid growth rate without the implementation of significant energy and environment-related policies. With the boost of economic

growth, the total volume of energy consumption will continue to grow rapidly, maintaining an annual growth rate of 6% in the next decade. In terms of the energy consumption structure, the growth rate of natural gas and power consumption will be faster than that of the consumption of other fossil fuels. However, due to the relatively abundant coal resources in China, renewable resources of energy (including water, nuclear, and solar) will not change the current mode of power production that is dominated by thermal power, although these resources will grow rapidly in the future. As a result, the demand for coal will also grow rapidly driven by the demand for power. As coal consumption is the major contributor to CO₂ emissions from energy consumption, CO₂ emission will continue to grow at an annual rate of 6% under the scenario where no significant energy and environment-related policy is implemented. In terms of the tendency of CO₂ emission intensity change, thanks to the upgrading of industrial structure, the improvement of energy efficiency, and the introduction of cleaner resources into the energy consumption structure, CO₂ emission intensity will tend to decline in the next decade. It can be estimated on the basis of the data that under the scenario of benchmark growth, CO₂ emission intensity in 2020 will decline by 33% compared with 2005.

1.3.3.2 Analysis of Impact of Environmental Policy on Macroeconomy

Generally speaking, most CO₂ emissions come from the use of fossil fuels, particularly from burning them as energy resources²². Therefore, from the perspective of taxation tools, a direct method is to levy a tax on pollutant discharge or energy consumption. This study designed four carbon tax scenarios where different carbon taxes were introduced on all CO₂ emissions in 2011, so as to analyze the impact of the carbon tax policy on the macroeconomy. All the four scenarios had the carbon taxes introduced in 2011 at the same initial rate of 10 RMB per ton of CO₂. They differ from each other in the degree of tax increase from 2011 to 2020. Under the first carbon tax scenario, the tax rate will remain at 10 RMB per ton from 2011 to 2020, whereas under the latter three scenarios the tax rates will be elevated to 50, 100, and 200 RMB respectively in the next decade²³.

Figure 1.9 shows the impact of different carbon taxes on GDP. As shown in the data, the carbon tax will impact the GDP negatively to a certain degree. When the tax rate is 10, 50, 100, and 200 RMB per ton of CO₂, the GDP will have declined by 2020 by 0.03%, 0.16%, 0.37%, and 0.85% respectively. Specifically, when the carbon tax rate remains below 100 RMB per ton, it will have a relatively small impact on GDP²⁴; however, as the carbon tax rate is raised continually, its impact on GDP also increases. As energy efficiency in China is currently relatively low and the energy intensity and

²² Due to the availability of data, the CO₂ emitted in the manufacturing process is not included here.

²³ It needs to be pointed out that as the base year of the model is 2007, all the future tax rates are based on the prices in 2007.

²⁴ It needs to be pointed out that here the long-term impact is simulated. If we consider the short-term impact, the result will be obviously greater, as the manufacturing processes and structure of short-term enterprises cannot be transformed rapidly.

CO₂ emission intensity remain at a high level, the marginal carbon abatement cost is relatively low from the perspectives of energy substitution, technological substitution, and restructuring. Therefore, the carbon tax will create a limited impact on GDP on the whole.

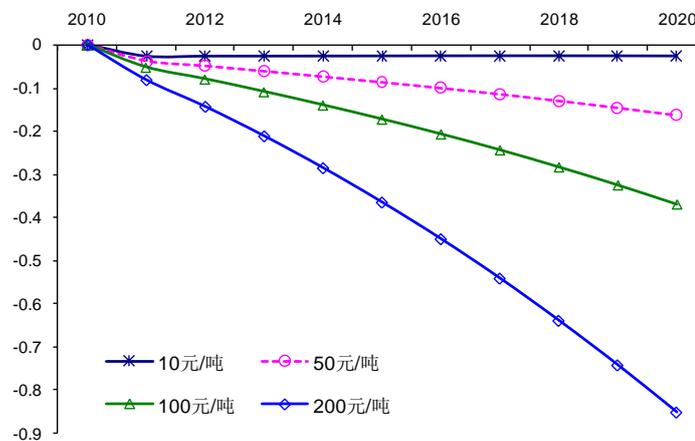


Figure 1.9 Impact on GDP of Different Carbon Taxes
(With Reference to Scenario of Benchmark Growth, %)

10 元/吨 10 RMB/ton 50 元/吨 50 RMB/ton
100 元/吨 100 RMB/ton 200 元/吨 200 RMB/ton

1.3.3.3 Impact of Environmental Policy on Industry and Investment

The introduction of carbon taxes will first of all impact the utilization costs of various energy products. The higher the carbon content of the products is, the higher their utilization costs are under the same carbon tax. The impact of the carbon tax will also spread to other industries through the rising costs of energy products and the extension of the production chain. Figure 1.10 describes the change of tax-inclusive prices²⁵ of the products of various sectors under the carbon tax of 100 RMB per ton, as compared with the prices under the scenario of benchmark growth. It can be concluded that energy products will be affected most greatly, particularly coal products. The carbon content of coal is higher than equivalent oil and natural gas by over 30% and 70% respectively. As revealed in the simulation results in Figure 6, when the carbon tax rate is set at 100 RMB per ton, the tax-inclusive price of coal will be 33% higher than that under the scenario of benchmark growth (without the carbon tax). Similarly, the carbon tax will cause the price of natural gas to rise by 17%, that of oil products by 7%, and that of crude oil by 1% or so. Meanwhile, thanks to the substitution of energy resources, the price of natural gas will rise by a greater degree than that of oil products, as natural gas is relatively clean. Although electricity itself is carbon-free, most of the power in China is coal-fired due to the abundance of coal

²⁵ The price here includes the carbon tax.

resources. As a result, electricity prices will also rise with the costs under the carbon tax. As shown in the data of Figure 4.7, the tax rate at 100 RMB per ton of CO₂ will cause the electricity prices to rise by 8.5% on the whole²⁶. Particularly, the tax rate at 100 RMB per ton of CO₂ will cause the costs of coal-fired power to rise by over 10%. Apart from energy products, the sector that will be most seriously affected by the carbon tax will be energy-intensive industries, such as metallurgy, construction materials, and metal processing. The three sectors will see an increase in price by 1 to 2% under the carbon tax of 100 RMB per ton of CO₂. The carbon tax will also cause an increase of price in such sectors as water supply, construction, chemical industry, electrical equipment industry, metallic mineral mining, machinery, non-metallic mineral mining, and communications equipment.

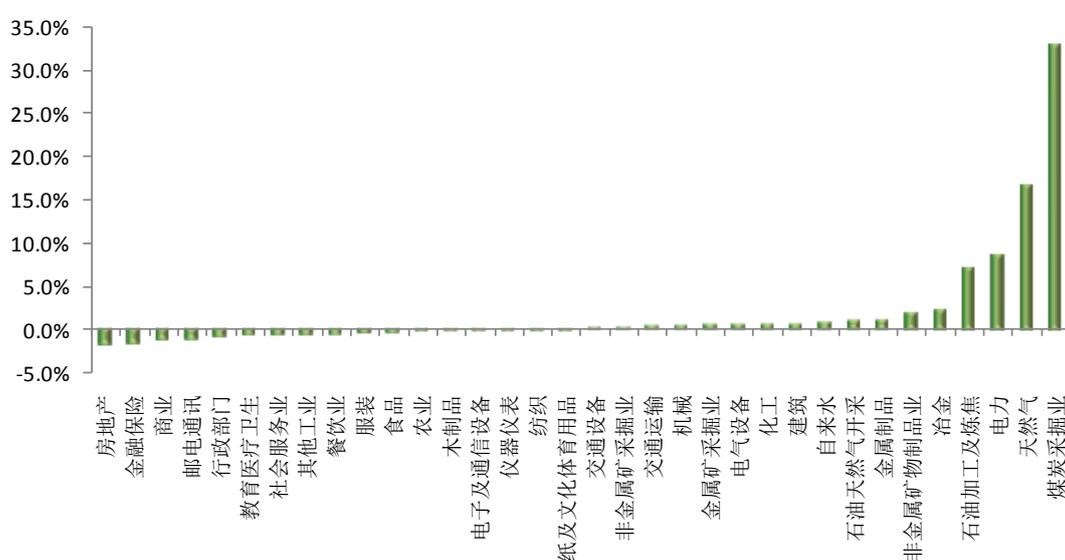


Figure 1.10 **Impact of Carbon Tax on Prices of Various Sectors**
(With reference to Scenario of Benchmark Growth, Tax-included, 100 RMB/ton, 2020)

- 房地产 Real Estate
- 金融保险 Finance and Insurance
- 商业 Commerce
- 邮电通讯 Post and Telecommunications
- 行政部门 Administrative Departments
- 教育医疗卫生 Education, Medical Care, and Public Health
- 社会服务业 Social Services
- 其他工业 Other Industries
- 餐饮业 Catering
- 服装 Clothing
- 食品 Food
- 农业 Agriculture

²⁶ It needs to be pointed out that the model classifies power production into coal-fired, oil- and gas-fired, water power, nuclear power, and renewable energy resources (solar, etc). As a result, here the comprehensive price for electricity is considered.

木制品 Wood Processing
 电子及通讯设备 Electronic and Telecommunication Equipment Manufacturing
 仪器仪表 Instrument and Meter Manufacturing
 纺织 Textiles
 纸及文化体育用品 Paper-making and Other Stationery Manufacturing
 交通设备 Communications Equipment
 非金属矿采掘业交通运输 Non-metallic Mineral Mining Communications
 机械 Machinery
 金属矿采掘业 Metallic Mineral Mining
 电气设备 Electric Equipment Manufacturing
 化工 Chemical Industry
 建筑 Construction
 自来水 Water Supply
 石油天然气开采 Oil and Gas Production
 金属制品 Metal Processing
 非金属矿物制品 Non-metallic Mineral Processing
 冶金 Metallurgy
 石油加工及炼焦 Oil Processing and Coking
 电力 Power
 天然气 Natural Gas
 煤炭采掘业 Coal Mining

On the other hand, the introduction of the carbon tax will cause a fall in the prices of such technology-intensive and labour-intensive manufacturing sectors as textiles, clothing, electronics, and food processing. The main reason behind this is that the decrease in the prices of production factors will cause the costs to drop. The carbon tax will trigger the income effect and result in a fall in demand, which will further trigger the decrease of the prices of production factors. When the falling level of the prices of the production factors compensates the rising level of the prices of the intermediate input products, the overall costs of these sectors will tend to decline. As all service sectors, with the exception of communications, are low in energy intensity, the costs of all services except communications will decline by various degrees. Last, the prices in the agricultural sector will also decrease, for the same reasons affecting the services and some manufacturing sectors.

Figure 1.11 shows the change of output (or the demand for the output) of various sectors when the carbon tax is set at 100 RMB per ton of CO₂, with reference to the scenario of benchmark growth. As the change in prices reflects the change in demand-supply relation of the products, the change of output of the sectors is largely similar to that of prices. First, the greatest impact will still be on the output of energy production sectors, but the impact will be manifested in two different directions. First, the output of fossil energy production and fossil-fuelled power production will plummet dramatically. As shown in the figure, the output of coal, gas, oil and oil products will decline by 13%, 9%, and 3% respectively under the scenario where a

carbon tax of 100 RMB per ton of CO₂ is imposed. The tax will also cause the output of coal-fired electricity to decline by 10%. Second, the output of all other power production sectors will increase rapidly. The carbon tax of 100 RMB per ton will have caused the output of renewable energy production, nuclear power production and water power production to grow by 21%, 17%, and 9% respectively by 2020. Besides, two changes can also be observed in manufacturing sectors other than energy production. First, the energy-intensive manufacturing sectors will see a drop in demand and output as a result of the carbon tax. For instance, the output of metallic mineral mining, metallurgy, electric equipment manufacturing, metal processing, water supply, machinery, and chemical industry will drop by 1% to 3% under the tax rate at 100 RMB per ton of CO₂. Second, the low energy-intensity manufacturing sectors will benefit from the carbon tax and see an increase in output, such as textiles, clothing, instrument and meter manufacturing, and electronics and telecommunications equipment manufacturing. The biggest rise in output lies in electronics and telecommunications equipment manufacturing, with a growth rate at 1.3%.

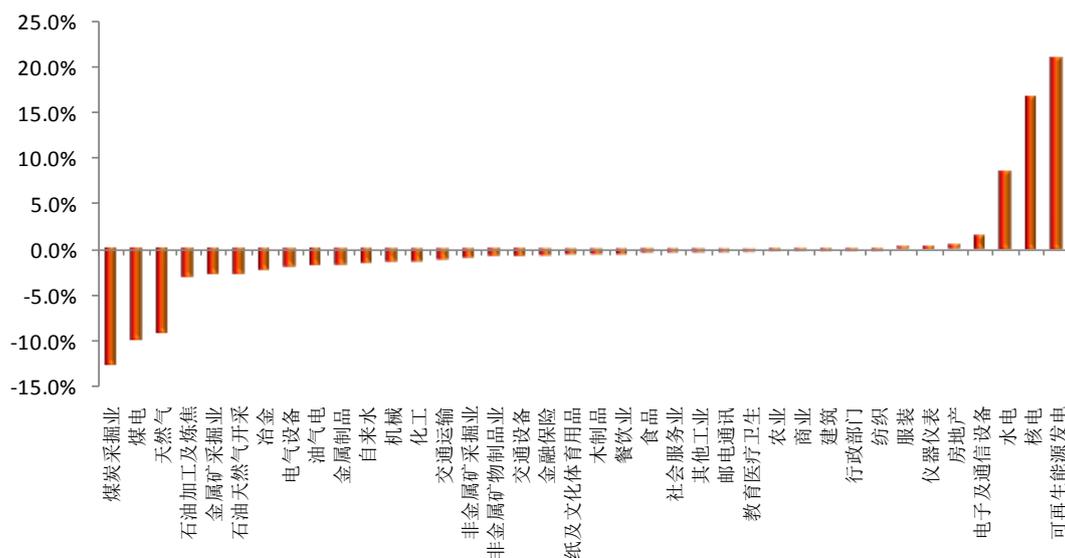


Figure 1.11 Impact of Carbon Tax on Output of Various Sectors

(With reference to Scenario of Benchmark Growth, 100 RMB per ton, 2020)

- 煤炭采掘业 Coal mining
- 煤电 Coal-fired Power
- 天然气 Natural Gas
- 石油加工及炼焦 Oil Processing and Coking
- 金属矿采掘业 Mineral Mining
- 石油天然气开采 Oil and Natural Gas Production
- 冶金 Metallurgy
- 电气设备 Electric Equipment Manufacturing
- 油气电 Oil and Gas Power

金属制品 Metal Processing
自来水 Water Supply
机械 Machinery
化工 Chemical Industry
交通运输 Communications
非金属矿采掘业 Non-metallic Mineral Mining
非金属矿物制品业 Non-metallic Mineral Processing
交通设备 Communications Equipment Manufacturing
金融保险 Finance and Insurance
纸及文化体育用品 Paper-making and Stationery Manufacturing
木制品 Wood Processing
餐饮业 Catering
食品 Food
社会服务业 Social Services
其他工业 Other Manufacturing
邮电通讯 Post & Telecommunications
教育医疗卫生 Education, Medical Care, and Public Health
农业 Agriculture
商业 Commerce
建筑 Construction
行政部门 Administrative Departments
纺织 Textile
服装 Clothing
仪器仪表 Instrument and Meter Manufacturing
房地产 Real Estate
电子及通讯设备 Electronics and Telecommunications Equipment Manufacturing
水电 Water Power
核电 Nuclear Power
可再生能源发电 Renewable Energy Resources

The majority of service and agricultural sectors, with the exception of real estate industry, will see a decrease of output as a result of the carbon tax. However, the impact on most of the sectors will be limited. A major reason for the impact is the income effect. As the carbon tax will lead to a decrease in actual household income, and the demand for services is relatively elastic, the drop in income will bring forth a decline in demand and ultimately in output of the sectors.

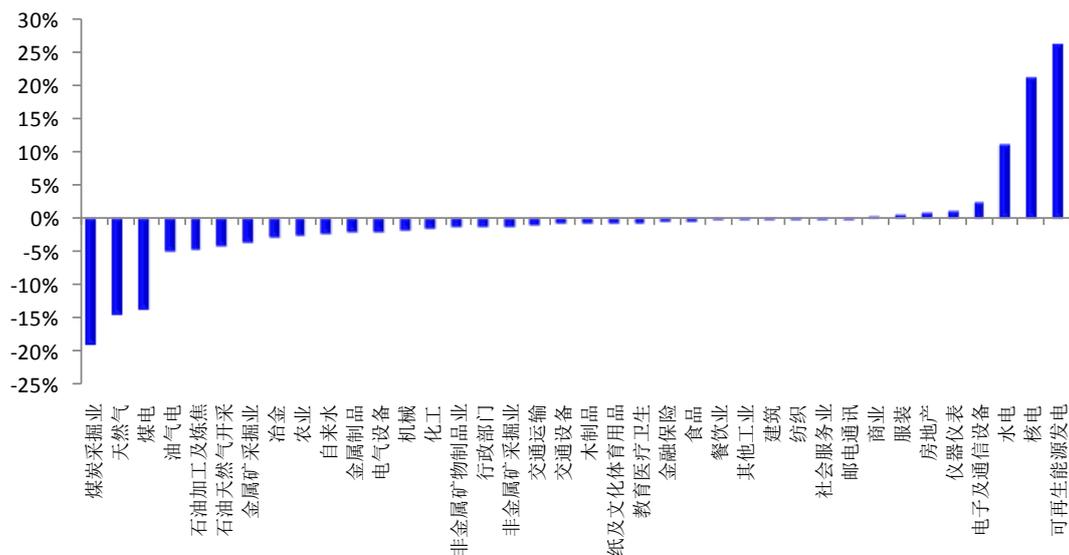


Figure 1.12 Impact of Carbon Tax on New Investment of Various Sectors
(With reference to Scenario of Benchmark Growth, 100 RMB per ton, 2020)

煤炭采掘业 Coal mining

天然气 Natural Gas

煤电 Coal-fired Power

油气电 Oil and Gas Power

石油加工及炼焦 Oil Processing and Coking

石油天然气开采 Metallic Mineral Mining

石油天然气开采 Oil and Natural Gas Production

金属矿采掘业 Metallic Mineral Mining

冶金 Metallurgy

农业 Agriculture

自来水 Water Supply

金属制品 Metal Processing

电气设备 Electric Equipment Manufacturing

机械 Machinery

化工 Chemical Industry

非金属矿制品 Non-metallic Mineral Processing

行政部门 Administrative Departments

非金属矿采掘业 Non-metallic Mineral Mining

交通运输 Communications

交通设备 Communications Equipment Manufacturing

木制品 Wood Processing

纸及文化体育用品 Paper-making and Stationery Manufacturing

教育医疗卫生 Education, Medical Care, and Public Health

金融保险 Finance and Insurance

食品 Food

餐饮 Catering

其他产业 Other Manufacturing
建筑 Construction
纺织 Textile
社会服务 Social Services
邮电通讯 Post and Telecommunications
商业 Commerce
服装 Clothing
房地产 Real Estate
仪器仪表 Instrument and Meter Manufacturing
电子及通讯设备 Electronics and Telecommunications Equipment Manufacturing
水电 Water Power
核电 Nuclear Power
可再生能源发电 Renewable Energy Resources

The change of product demand triggers a change in the demand for capital and investment of various sectors. Figure 1.12 shows the change of new investments of various sectors when the tax is levied at 100 RMB per ton of CO₂ in 2020, with reference to the scenario of benchmark growth. As shown in Figure 3.6, the change of new investments in various sectors is largely similar to the change of output/demand of the sectors, but there are certain variations due to the fact that the change in investment is not only related to product demand of the sectors, but also to the change of the relative pricing of the other production factors. The carbon tax will lead to a reallocation of capital and investment across various sectors on the whole. First, similar to the case with sectoral output, the greatest impact of the carbon tax will be on energy production sectors, which is also reflected in two aspects. First, the new investment in the fossil energy production and fossil-fuelled power production will plummet dramatically compared with the carbon-tax-free situation. As shown in the figure, the output of coal, gas, and oil and oil processing production sectors will decrease by 19%, 15%, and 4% respectively when the carbon tax is levied at 100 RMB per ton of CO₂. Specifically, the demand for new investment in these three sectors will decline by 5 billion, 4 billion, and 2 billion RMB respectively²⁷, and coal-fired power production will see a decline of demand for new investment by 14% as a result of the carbon tax. On the other hand, all the other power production sectors will usher in tremendous investment opportunities and see a rapid increase in demand for new investment. By 2020, the carbon tax at 100 RMB per ton of CO₂ will lead to an increase in demand for new investment of 26%, 21%, and 11% in renewable energy resources, nuclear power, and water power respectively, and the non-fossil-fuelled power production sectors as a whole will usher in a demand for new investment of nearly 40 billion RMB. Second, those manufacturing sectors apart from energy production will also develop in two directions. First, the energy intensive manufacturing sectors will see a decline in demand for new investment as a result of the carbon tax, such as metallic mineral mining, metallurgy, water supply, metal processing, electric equipment manufacturing, machinery, chemical industry,

²⁷ Prices in 2007.

non-metallic mineral processing, non-metallic mineral mining, and so forth. Under the carbon tax rate of 100 RMB per ton of CO₂, demand for new investment in these sectors will decrease by 1% to 4%. On the other hand, those manufacturing sectors with low energy intensity will benefit from the carbon tax and see an increase of demand for new investment, such as clothing, instrument and meter manufacturing, and electronics and telecommunications equipment manufacturing. Electronics and telecommunications equipment manufacturing will see the biggest rise in output, scoring a growth rate of 2.4%. It is also worth pointing out that for certain labour-intensive manufacturing sectors such as textile, the drop in labour cost will lead to the substitution of capital by labour, which will result in a drop in demand for new investment to a certain degree.

According to the simulation result, most service sectors and the agricultural sectors, with the exception of commerce and real estate, will see a decrease in demand for new investment. Apart from the decline of product demand, the decrease of labour cost due to the drop in total demand is also a significant contributing factor.

The impact of the carbon tax on future FDI can be assessed in the following two ways. On the one hand, it will depend on how strictly China and other countries will implement their future environmental policies. If China implements a relatively strict environmental policy, e.g., the simulated carbon tax policy presented in this study, whereas the other developing countries or some developed countries do not implement similar policies, FDI will inevitably flow into those countries with looser environmental policies (in other words, lower environmental costs). Certainly, this transfer is not only dependent on the environmental policy, but also on many other factors, such as investment environment, human resource costs, and others. On the other hand, the environmental policy will also affect the domestic allocation of FDI, i.e., the policy will result in a reallocation of FDI across different sectors. For instance, the FDI in the sectors with a drop in the demand for new investment is likely to flow into those sectors with an increase in the demand for new investment. Due to the unavailability of data of the difference in energy consumption and pollutant discharge between enterprises with FDI and domestically-funded enterprises, we cannot conduct a specific analysis of the impact of the environmental policy on the FDI of a certain sector. Another point worth of our attention is that even in those sectors with high energy intensity and pollutant discharge intensity, environmental policy will bring forth opportunities of development for those FDI-funded enterprises that perform better than domestically-funded enterprises in energy efficiency and pollutant discharge reduction.

1.3.3.4 Impact of Environmental Policy on Foreign Trade

In regards to foreign trade, the carbon tax will change the cost of domestic products, affect their competitiveness in the international market, and ultimately affect imports and exports. In terms of the total imports and exports, the simulation results indicate

that the carbon tax will lead to a drop in imports and exports to a certain degree, but the impact on exports will be greater than on imports. For instance, when the carbon tax is set at 100 RMB per ton of CO₂, the exports and imports in 2020 will drop by 0.54% and 0.47% respectively as compared with the figures under the scenario of benchmark growth.

Figure 1.13 shows the impact of the carbon tax on the exports of various sectors. In terms of sectoral distribution, the greatest impact of the carbon tax is on energy production sectors and energy-intensive manufacturing sectors. For instance, coal, oil products and crude oil will see a decline in export by 10%, 3.5%, and 2% respectively when the carbon tax is imposed at 100 RMB per ton of CO₂. The export volume of such energy-intensive sectors as metallurgy, non-metallic mineral processing, metallic mineral mining, and metal processing will decline by 4% to 9%. Metallurgy will suffer the biggest loss in export from the carbon tax, declining by 9%. Such energy-intensive sectors as electric equipment manufacturing, machinery, chemical industry, construction, non-metallic mineral mining, and communications equipment manufacturing will also see a downturn in exports, dropping by 1% to 3%. On the other hand, those capital-intensive and labour-intensive sectors, as well as the service sectors, as they are low in pollutant discharge intensity, will see a decline in costs of production factors (mainly labour and capital) due to the drop in total demand, which will lead to a drop of costs and a rise in export competitiveness. Therefore, the exports in these sectors will increase by 0.5% to 4% as a result of the carbon tax.

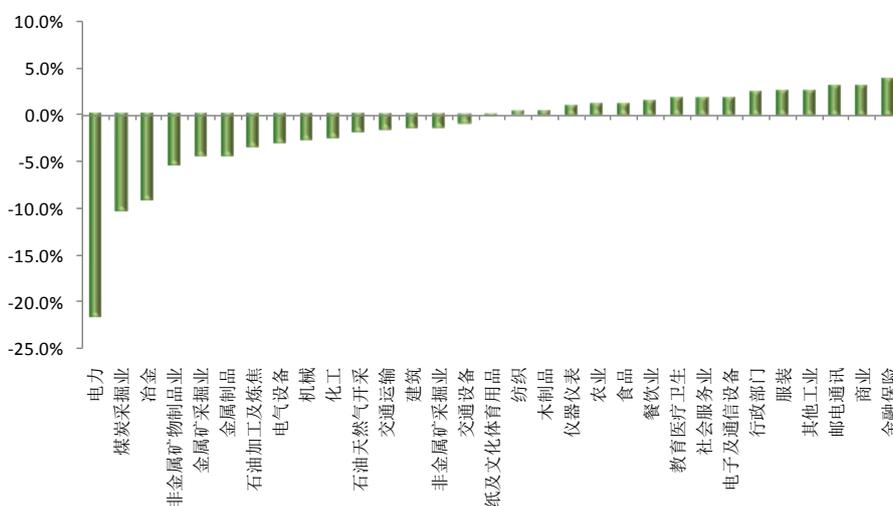


Figure 1.13 Impact of Carbon Tax on Export Volume of Various Sectors
(With reference to Scenario of Benchmark Growth, 100 RMB per ton, 2020)

电力 Power

煤炭采掘业 Coal mining

冶金 Metallurgy

非金属矿制品 Non-metallic Mineral Processing

金属矿采掘业 Metallic Mineral Mining

金属矿采掘业 Metal Processing

石油加工及炼焦 Oil Processing and Coking
电气设备 Electric Equipment Manufacturing
机械 Machinery
化工 Chemical Industry
石油天然气开采 Oil and Natural Gas Production
交通运输 Communications
建筑 Construction
非金属矿采掘业 Non-metallic Mineral Mining
交通设备 Communications Equipment Manufacturing
纸及文化体育用品 Paper-making and Stationery Manufacturing
纺织 Textiles
木制品 Wood Processing
仪器仪表 Instrument and Meter Manufacturing
农业 Agriculture
食品 Food
餐饮 Catering
教育医疗卫生 Education, Medical Care, and Public Health
社会服务业 Social Services
电子及通讯设备 Electronics and Telecommunications Equipment Manufacturing
行政部门 Administrative Departments
服装 Clothing
其他工业 Other Manufacturing
邮电通讯 Post and Telecommunications
商业 Commerce
金融保险 Finance and Insurance

As revealed in the simulation results, the impact of the carbon tax on imports seems to be the mirror reflection of that on exports. Figure 1.14 shows the impact of the carbon tax on the imports of various sectors. First, the impact of the carbon tax on the import of fossil-fuelled energy production sectors is somewhat similar to that on the export, but the underlying reasons are different. As imported fossil energy resources will result in CO₂ emissions in the same way as domestic fossil energy resources, the carbon tax will be imposed on the utilization of both without distinction. As a result, the domestic demand for fossil energy resources will drastically decline due to the carbon tax, leading to a dive in the import of these resources. When the carbon tax is levied at the rate of 100 RMB per ton of CO₂, the import volume of coal, crude oil and oil products will decline by 10%, 3%, and 2% respectively. Secondly, the import volume of energy-intensive sectors will rise. For instance, the import volume of metallurgy, non-metallic mineral processing, and metal processing will increase by over 2%. Last, the import of the low energy intensive manufacturing sectors, service sectors and agricultural sectors will decline as a result of the carbon tax, but the impact will be generally limited. The main reason for the decline in import is that the domestic goods in these sectors will be more competitive than imported goods as the production factors become cheaper domestically.

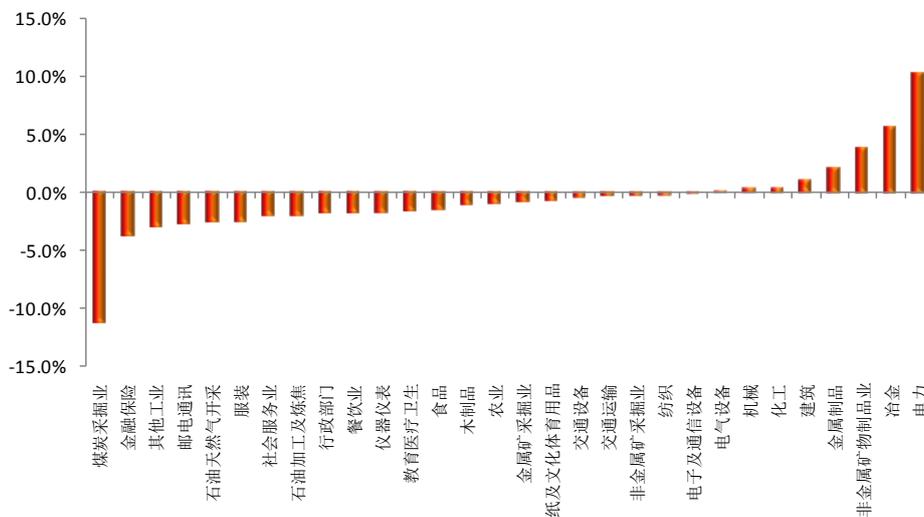


Figure 1.14 Impact of Carbon Tax on Import Volume of Various Sectors
(With reference to Scenario of Benchmark Growth, 100 RMB per ton, 2020)

煤炭采掘业 Coal Mining

金融保险 Finance and Insurance

其他工业 Other Manufacturing

邮电通讯 Post and Telecommunications

石油天然气开采 Oil and Natural Gas Production

服装 Clothing

社会服务业 Social Services

石油加工及炼焦 Oil Processing and Coking

行政部门 Administrative Departments

餐饮业 Catering

仪器仪表 Instrument and Meter Manufacturing

教育医疗卫生 Education, Medical Care, and Public Health

食品 Food

木制品 Wood Processing

农业 Agriculture

金属矿采掘业 Metallic Mineral Mining

纸及文化体育用品 Paper-making and Stationery Manufacturing

交通设备 Communications Equipment Manufacturing

交通运输 Communications

非金属矿采掘业 Non-metallic Mineral Mining

纺织 Textile

电子及通讯设备 Electronics and Telecommunications Equipment Manufacturing

电气设备 Electric Equipment Manufacturing

机械 Machinery
 化工 Chemical Industry
 建筑 Construction
 金属制品 Metal Processing
 非金属矿物制品业 Non-metallic Mineral Processing
 冶金 Metallurgy
 电力 Power

1.3.3.5 Impact of Environmental Policy on CO₂ Emissions

It can be observed from the above results that the carbon tax will lead to a reallocation of capital and investment, and a change in the industrial structure and foreign trade structure, and ultimately create an impact on CO₂ emissions. On the whole, the carbon tax will elevate the utilization cost of carbonaceous energy. On the one hand, less carbonaceous energy will be utilized and the energy efficiency will be enhanced; on the other hand, the energy demand will shift from carbon-intensive energy to low-carbon or carbon-free energy, which will ultimately bring down carbon emissions. Figure 1.15 describes the impact of different carbon taxes on CO₂ emissions. It can be observed that the carbon tax will produce a remarkable effect in the reduction of carbon emissions. Under the carbon tax rates of 10, 50, 100, and 200 RMB per ton of CO₂, CO₂ emissions will have been reduced by 2020 by 300 million, 2.2 billion, 3.8 billion, and 5.9 billion tons respectively, marking a decrease of 1.95%, 8.63%, 14.9%, and 23.91% respectively as compared with carbon emissions under the benchmark growth scenario. Meanwhile, the marginal carbon abatement effect of the carbon tax decreases with the rise of carbon tax, which means that the marginal carbon abatement cost is steadily on the rise.

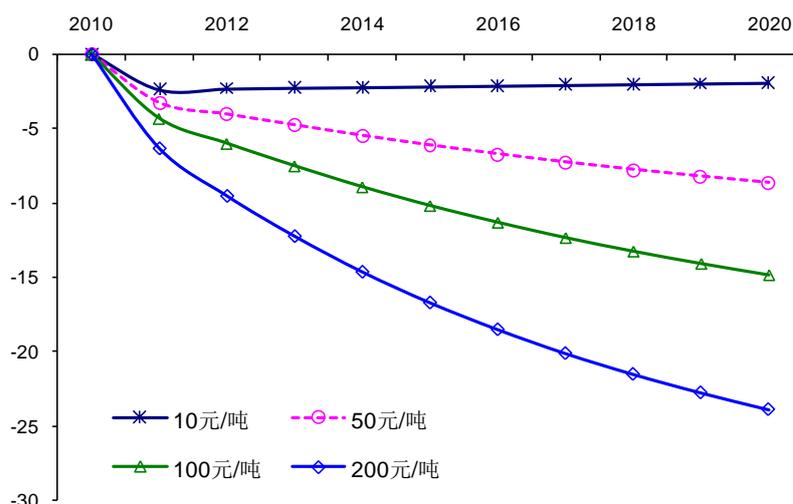


Figure 1.15 Impact of Different Carbon Taxes on CO₂ Emissions

(With reference to Scenario of Benchmark Growth, %)

10 元/吨 10 RMB/ton 50 元/吨 50 RMB/ton
 100 元/吨 100 RMB/ton 200 元/吨 200 RMB/ton

Besides a drop of CO₂ emissions, carbon taxes will also lead to the reduction of CO₂ emission intensity. As the simulation shows, when the carbon tax is set at 10, 50, 100, and 200 RMB per ton of CO₂, CO₂ emission intensity will have dropped by 2020 by 1.9%, 8.5%, 14.6%, and 23.3% respectively as compared with the CO₂ emission intensity under the benchmark growth scenario (see Figure 1.16).

Figure 1.17 presents the change of CO₂ emission intensity under different carbon tax scenarios as compared with 2005. The result shows that when the carbon tax rate is set at 10, 50, 100, and 200 RMB per ton of CO₂, by 2020 the CO₂ emission intensity will have dropped by 31%, 36%, 40%, and 46% compared with 2005.

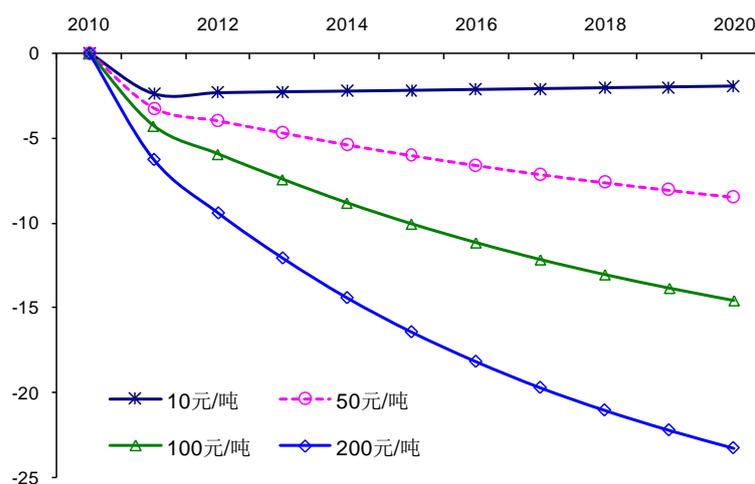


Figure 1.16 Impact of Different Carbon Taxes on CO₂ Emission Intensity
 (With reference to Scenario of Benchmark Growth, %)

10 元/吨 10 RMB/ton 50 元/吨 50 RMB/ton
 100 元/吨 100 RMB/ton 200 元/吨 200 RMB/ton

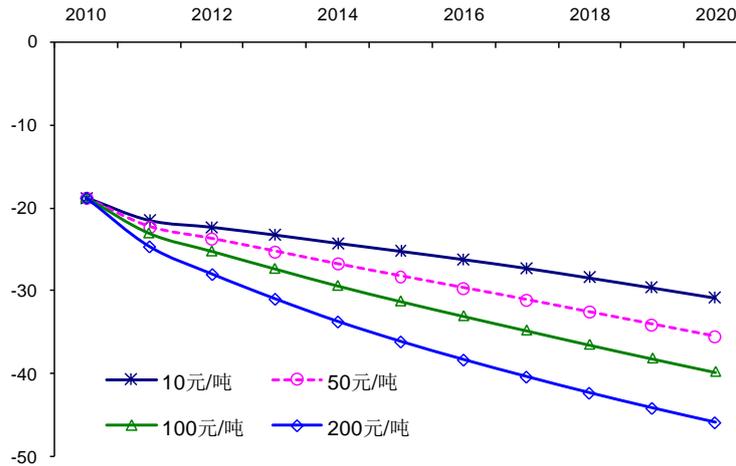


Figure 1.17 Impact of Different Carbon Taxes on CO₂ Emission Intensity (Compared with CO₂ Emission Intensity in 2005, %)

10 元/吨 10 RMB/ton 50 元/吨 50 RMB/ton
 100 元/吨 100 RMB/ton 200 元/吨 200 RMB/ton

1.3.3.6 Major Findings

It can be concluded from the CGE simulation that, on the whole, the carbon tax will have a limited impact on China's GDP. In terms of investment, the introduction of carbon tax will result in a reallocation of capital and investment. The greatest impact of the carbon tax will be on energy production sectors, where the demand for new investment will decline remarkably as compared with the carbon-tax-free scenario. In terms of foreign trade, the introduction of a carbon tax will change the costs of domestic products, affect their competitiveness in the international market, and ultimately affect imports and exports. In terms of the total exports and imports, the simulation reveals that the carbon tax will cause the imports and exports to decline by certain degrees, while the impact on exports will be greater than that on imports. In terms of sectoral distribution, the greatest impact of the carbon tax will be on energy production sectors and energy intensive manufacturing sectors, which will lead to a low-carbon shift in foreign trade structure.

The impact of the carbon tax on future FDI can be assessed in the following two ways. On the one hand, it will depend on how strictly China and other countries will implement their future environmental policies. If China implements a relatively strict environmental policy, e.g., the simulated carbon tax policy presented in this study, while other developing countries or some developed countries do not implement similar policies, FDI will inevitably flow into those countries with looser environmental policies (in other words, lower environmental costs). Certainly, the transfer is not only dependent on the environmental policy, but also on many other

factors, such as investment environment and human resource costs, among others. On the other hand, the environmental policy will also affect the domestic allocation of FDI, i.e., the policy will result in a reallocation of FDI across different sectors. For instance, the FDI in the sectors with a drop in the demand for new investment is likely to flow into those sectors with an increase in the demand for new investment. Due to the unavailability of data of the difference in energy consumption and pollutant discharge between enterprises with FDI and domestically-funded enterprises, we cannot conduct a specific analysis of the impact of the environmental policy on the FDI in a certain sector. Another point worthy of our attention is that even in those sectors with high energy intensity and high pollutant discharge intensity, the environmental policy will bring forth opportunities of development for those FDI-funded enterprises that perform better than domestically-funded enterprises in energy efficiency and pollutant discharge reduction.

The carbon tax will create a remarkable effect in the reduction of carbon emission. Under the carbon tax rates of 10, 50, 100, and 200 RMB per ton of CO₂, CO₂ emissions will have been reduced by 2020 by 300 million, 2.2 billion, 3.8 billion, and 5.9 billion tons respectively, marking a decrease of 1.95%, 8.63%, 14.9%, and 23.91% respectively as compared with the carbon emissions under the scenario of benchmark growth. Besides a drop in CO₂ emissions, carbon taxes will also lead to the reduction of CO₂ emission intensity. As the simulation shows, when the carbon tax is set at 10, 50, 100, and 200 RMB per ton of CO₂, CO₂ emission intensity will have dropped by 2020 by 1.9%, 8.5%, 14.6%, and 23.3% respectively as compared with the CO₂ emission intensity under the benchmark growth scenario.

In conclusion, the introduction of a carbon tax will not impact China's macroeconomy to a significant degree, but may promote the investment and trade to develop in a way that is conducive to environmental improvement.

Chapter 2 A Study on the Environmental Impact of Foreign Direct Investment

2.1 Introduction

2.1.1 Background Introduction

Accelerated economic globalization has brought the world economy into the era of global competition. As a form of international capital flow, international direct investment is one of the important channels for optimizing resource allocation and promoting the improvement of productivity worldwide. With the rapid and healthy development of the Chinese economy and deepening of reform and opening up to the rest of the world, attracting foreign capital has become an important aspect of China's participation in economic globalization. By the end of December 2009, China had approved over 660 thousand foreign-invested enterprises in total and the amount of foreign direct investment absorbed had reached USD 997.4 billion, remaining the developing country absorbing the largest amount of foreign investment for 17 years in a row²⁸. Even in 2008 and 2009, when the world was swept by the financial crisis, the size of foreign direct investment in China just dropped only slightly.

Investment by foreign enterprises in China is a win-win situation. As an important funding source of fixed assets in China, foreign direct investment promotes, to varying degrees, economic development, expansion of employment opportunities, improvement of employment quality, and an increase of government income in China. At the same time, foreign enterprises also enjoy the benefits resulting from China's rapid development. According to a survey report published by the US-China Business Council in 2011, nearly 90% of US companies acknowledge that their earning performance in China is equal to or higher than their overall global earning performance.

However, China is currently faced with a series of environmental problems. The current economic growth trend features huge demand for energy and resources while the ecosystems are losing their capacity to support this due to the compression and compounding of the demand. The strategic adjustment of the industrial structure, trade structure, and market structure in China is imperative. Under the emissions reduction objective of the "Twelfth Five-Year Plan", the total control objectives of four constraining indexes of chemical oxygen demand, sulfur dioxide, ammonia nitrogen,

²⁸ Source of data: Ministry of Commerce website.

and nitric oxide have been reduced by 8%, 8%, 10%, and 10% respectively from those of 2010. Compared with the “Double 10” objective in the “Eleventh Five-Year Plan”, the emissions reduction reality in the next five years will be tougher. Due to the complexity of the pollution problems, enterprises—especially pollution-intensive enterprises—as major contributors to pollution, should be responsible for reducing pollution so as to promote sustainable development in China. Most foreign enterprises, especially large transnational corporations, as important driving forces for economic development in China, have more advanced management experience, environmentally-friendly technology, and environmental management ideas, and are fully able to play a more active role in China’s green transformation. Against such a backdrop, foreign-invested enterprises should also re-examine and re-orient their mode of investment and operation, so as to grasp the huge space and strategic opportunities presented by China’s future development.

2.1.2 Objectives

Foreign direct investment is a “double-edged sword” for host countries. With the large-scale inflow of foreign direct investment into sectors such as manufacturing, natural resources, and infrastructure construction, the environmental pressure incurred by foreign direct investment is also further expanding. What impact has foreign investment exerted on China’s environment? Compared with other countries, is China’s current environmental policy more lenient? The focus of study in this paper will be in terms of foreign capital utilization, how China should grasp opportunities to promote domestic industrial structural adjustment and realize shift to a green economy through measures such as policy guidance and the development of environmental standards. The major objectives in this section of this paper include:

1. To systematically review and examine the sustainability of China’s policy for attracting foreign investment over three decades of reform and opening up to the rest of the world.

2. To analyze how to further guide foreign investment flow through policy orientation so as to maximize the positive role foreign investment can play in China’s shift to a green economy against the backdrop of green development and economic structural adjustment in China.

3. Study how to take advantage of the halo effect and the spillover effect of foreign investment, so as to improve the upgrading of Chinese enterprises’ environmental management and deployment of environmentally-friendly technologies,

and help China improve the development of the market system for sustainable development.

2.1.3 Literature Review

When people first faced the issue of trade and environment in the 1970s, the main analyses mostly focused on how environmental policies would affect free trade. With the trend toward economic globalization, the globalization of environmental problems was significant. In the 1990s, the relationship between FDI and the environment became a popular research focus (Pearson, 1993). In view of the current research literature, the studies on FDI and environment mainly focus on the following issues:

(1) Whether FDI's environmental impact and "Inverse U Curve" hypothesis can be validated in practice; whether economic benefit brought to the host country by the introduction of FDI must be realized at the cost of the environment of the host country.

(2) Whether FDI and the "Pollution Havens" hypothesis holds, and whether developing countries have become the "Havens" for developed countries to transfer their pollution-intensive industries.

(3) Whether developing countries' "racing towards the environmental standard baseline" will lead to further deterioration of their ecological environment, giving rise to the dilemma of "immiserizing growth".

(4) Whether there is positive correlation between the stringency of environmental regulations of a country and the entry of FDI.

(5) The relationship between strategic environmental policy and the international flow of FDI.

2.1.3.1 FDI and the "Inverse U Curve" Hypothesis

In the mid-1950s, Simon Kuznets, in his study of economic growth and income difference, proposed the following hypothesis (Kuznets, 1955)²⁹: economic inequality increases over time while a country is developing, and then after a certain average income is attained, inequality begins to decrease. This hypothesis represents an inverse U relationship, which has been subsequently validated by a large amount of

²⁹ Kuznets, S. Economic Growth and Income Inequality. American Economic Review, 1955, 45 (1).

statistical data in empirical research, and is generally called the Kuznets curve. Grossman and Krueger (1991), while analyzing the environmental effects of the NAFTA Agreement, studied the inverse U relationship between the environment and income, which is similar to the inverse U curve representing the relationship between economic growth and income inequality proposed by Kuznets (1955).³⁰ Panayotou (1993) calls this discovery the Environmental Kuznets Curve (EKC) (Figure 2.1). On the basis of empirical research, environmental economists have proposed the “Environmental Kuznets Theory,” i.e., on a lower level, environmental pollution rises with the rise of income (the left side of the highest point A on the inverse U curve), and then after income exceeds a certain point (Point A in the figure) pollution begins to decrease with the increase of income.

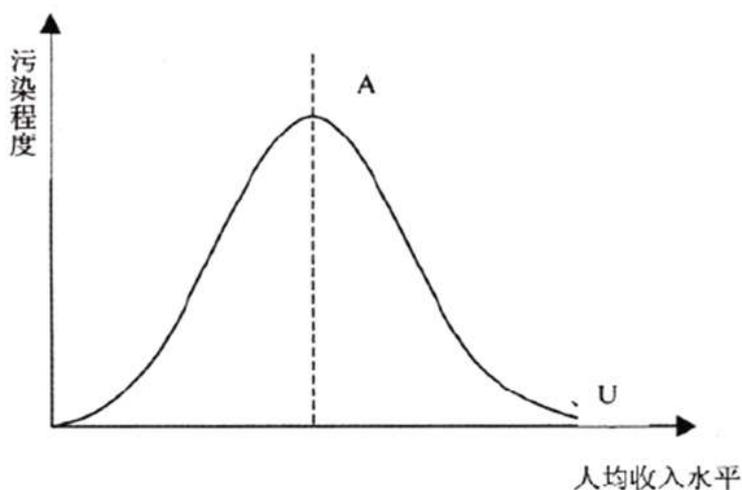


Figure 2.1 Environmental Kuznets Curve

In recent years, some researchers in China, with respect to the economic development and environmental problems in some developed cities in China, have carried out empirical analytical study on the Environmental Kuznets Curve. In this research, some hold that the Environmental Kuznets Curve of the cities under study is mostly characterized by U curve, while the Environmental Kuznets Curve of environmental pollutant discharge in a few cities have passed the turning point; while some researchers hold that the curve is a U curve or other compound forms, or is not consistent with the Environmental Kuznets Curve (Ling Kang, Wang Huanchen, and Liu Tao, 2001³¹; Chen Yanying, 2002³²; Yang Kai, Ye Mao, and Xu Qixin, 2003³³;

³⁰ Grossman G, Krueger A. Economic Growth and the Environment, *Quarterly Journal of Economics*, 1995, 110(2):353-337.

³¹ Ling Kang, Wan Huanchen, and Liu Tao, “Statistical Study of the Relationship between Urban Economic Development and Environmental Pollution—Take Nanjing for Example,” *Statistical Studies*, 2001,(10):32-36.

³² Chen Yanying, “Scale Effect of Pollution Control and Environmental Kuznets Curve—a New Interpretation of causes of Environmental Kuznets Curve”, 2002,(5):12-14.

³³ Yang Kai, Ye Mao and Xu Qixin, “Study of Environmental Kuznets Curve of Waste Growth in Shanghai”,

Wang Xiqin, and Li Feng, 2005³⁴). Their research concludes that some regions confirm indeed the assumptions and can subsequently serve as indicators. They also confirm the the relationship between economic growth and environmental quality. But much of the research is limited by region, concentrated mainly in the more developed areas in East China, so the results cannot comprehensively or fully describe the overall situation in China. However, the empirical study of Cao Guanghui and Wang Feng (2006)³⁵, adopting national data on the basis of their research has indicated that: China is in a period of environmental deterioration; there is no evidence showing that there is phenomenon of Environmental Kuznets Curve in China, but the possibility cannot be dismissed that China is in the rising period of Environmental Kuznets Curve; Bao Qun, Peng Shuijun, and Lai Mingyong (2006)³⁶, by constructing an equation set including output equation and pollution equation at the same time, apply the simultaneous equation set estimation method to estimate the Environmental Kuznets Curve to a U curve. This method can not only observe the internal feedback mechanism between environmental change, pollution emission, and economic growth, but can also facilitate more comprehensive investigation into the effect of exogenous variables of the economic system on balancing output growth and pollutant emission.³⁷

2.1.3.2 FDI and “Pollution Havens” Hypothesis

To analyze South-North trade relationships and environmental problems of developing countries, Copeland and Taylor (1994) have constructed a general balancing model including multiple commodities and multiple countries—a South-North Model, in which all countries are classified into South (developing countries) and North (developed countries), and products are classified into different levels according to their degree of pollution. The model focuses on the impacts of free trade, tradable emission permits, international income transfer, and international agreements on limiting or reducing pollutant emissions as it pertains to social welfare and ideal pollution levels. The research shows the following: if in trade balance of reference price equalization, the scale of industrial pollution in southern countries (developing countries) will expand, while the scale of clean industry in northern countries (developed countries) expands; the transfer of pollution-intensive industry

Geographical Studies, 2003,(1):21-22.

³⁴ Wang Xiqin and Li Feng, “Relationship between Economic Growth in Tianjin and Environmental Pollution,” *Geographical Studies*, 2005,25(6):834-842.

³⁵ Cao Guanghui, Wang Feng, Zhang Zongyi and Zou Chang, “Study of Relationship Between Economic Growth in China and Environmental Pollution”, *China's Population Resources and Environment*, 2006,(1):26-27.

³⁶ Bao Qun, Peng Shuijun and Lai Mingyong, “Economic Growth and Environmental Pollution,” Paper of the Annual Meeting of the Chinese Society of Economics, 2006:45-51.

³⁷ Yang Ying, Study of FDI-based Pollution Intensive Industry Transfer and Environmental Welfare Effect, [Master thesis of Zhejiang University]. Zhejiang: Zhejiang University, 2005,11:21-23.

from developed countries to developing countries alleviates the environmental pollution of northern countries, but increases the pollution level of southern countries, however, the total amount of pollutant worldwide is not affected. If the reference price cannot be equalized, the supply of pure public goods determined by element price change will lead to the reduction of pollution level in northern countries and an increase of pollution level in southern countries, while the total amount of pollutants in the world will also increase. This phenomenon is called “**Pollution Industry Transfer.**” Such industry “replacement” may be caused when developed countries strengthen their own environmental regulations; while a lack of environmental regulation in developing countries can also attract the transfer of pollution industry. People call this phenomenon “Pollution Havens.” While the “Pollution Havens” hypothesis is supported by very rich theoretical research, yet, the results of empirical analysis are not consistent. But the reality of relative growth of pollution industry in developing countries provides very good evidence for empirical research.

The empirical support provided by Robinson (1988) for the “Pollution Havens” hypothesis shows that the pollutant content growth rate of imported commodities in the United States was higher than that of exported products between 1973 and 1982, which means that the trading activities in the United States in this period tended to import more pollution-intensive commodities. The research of Hettige, Lucas, and Wheeler (1992) and Lee and Roland-Holst (1994) has discovered that developing countries are mostly engaged in production from “dirty industries” and mostly export pollution-intensive and resource-consuming products, while developed countries are mostly engaged in exporting clean products. For example, in Brazil and the Amazon Region, to produce products demanded in the international market, forests suffered from unrestrained felling. In some other export-oriented countries like South Korea, the environment has also been adversely affected.

Mani and Wheeler (1999) have provided new empirical evidence for the “pollution industry transfer” hypothesis. They have discovered in their research that during the period from 1960 to 1995, the output ratio of pollution and pollution-free industries in OECD countries and regions like North America, Europe, and Japan kept falling, while at the same time, the import and export ratio of pollution industries was rising year by year; also the industries considered most polluting (iron and steel, nonferrous metals, paper-making, the chemical industry, and non-metallic mining) are the first five items in the detailed catalogue of hazardous substances of the US EPA. On the other hand, the output ratio of pollution and pollution-free industries in developing regions such as Latin America and Asia (excluding Japan) was rising, while the import and export ratio of pollution industries fell, especially in the period from the

mid-1970s to the mid-1980s. These phenomena fully indicate that stringent environmental standards in rich countries have forced pollution-intensive industries to transfer to developing countries with relatively lenient environmental regulations. As a result, developing countries continue to be seen as “Pollution Havens.”

The World Bank (2000)³⁸ holds that FDI stimulates economic growth, which in turn causes more industrial pollution.

Jaffer (1995)³⁹ concludes that there is no significant relationship between the gap of environmental standards among countries and decisions about where FDI is directed, which shows that there is no inevitable relationship between environmental standards and pollution industry transfer. Xu (1999)⁴⁰ studied the situation from 1965 to 1995 and concluded that there was no evidence showing that developing countries benefitted from competitive advantages in terms of “pollution” industries during this period.

2.1.3.3 Hypothesis of “Race-to-the-Bottom (Environmental Standard)”

The research of Esty and Geradin (1997), Dua and Esty (1997), and others has pointed out as a result of global trade liberalization, all countries will drop their environmental quality standards to attract international capital, maintain or strengthen the international competitiveness of their industries, and that the pressure of competition gives the governments of underdeveloped countries the motive to reduce their environmental protection standard or relax environmental regulation, giving rise to the so-called phenomenon of “race-to-the-bottom (environmental standard)”. Markusen (1995)⁴¹ calls this phenomenon in environmental standard “race-to-the-bottom effect” or the “race-to-the-bottom” hypothesis. Barrett (1994) has also pointed out that when the environmental marginal damage stipulated by environmental policy is very low, ecological dumping will for strategic reasons.

Critics of free trade are concerned that “race-to-the-bottom” will collapse the environmental standard of some countries, as polluters may transfer their production equipment to the “Pollution Havens” of developing countries. Therefore, from a development perspective, the trade income of developing countries is doubtful

³⁸ World Bank. Is Globalization Causing a Race to the Bottom Environmental Standard? PREM Economic Policy Group and Development Economics Group, 2000.

³⁹ Jaffer. Environmental Regulations and International Competitiveness; What Does the Evidence Tell Us?. Journal of Economic Literature. 1999.

⁴⁰ Xu, X. Do Stringent Environmental Regulations Reduce the International Competitiveness of Environmentally Sensitive Good? A Global Perspective, World Dev, 1999:1215-1225.

⁴¹ Markusen, J.R. Competition in Regional Environmental Policies When Plant Location Is Endogenous. Journal of Public Economics, 1995.

(Ropker, 1994; Daly and Goodland, 1994). But scholars such as Eliste and Fredriksson (1998) have investigated the impact of trade liberalization and strategic trade policies of export competing countries on environmental regulation standards. In an empirical analysis of agriculture, they have not discovered adequate evidence supporting the conclusion of “race-to-the-bottom (environmental standard).” The research of Wheeler (2000) has also provided negative empirical evidence for the conclusion of “race-to-the-bottom”.

2.1.3.4 The Impact of Environmental Regulation on FDI

As far as the impact of environmental regulations (or policies) on international competitiveness is concerned, two distinctively different views have been formed in academic circles. The conventional school, based on the classical free trade theory, holds that the implementation of environmental regulation will reduce a country’s competitiveness, as higher environmental standards will increase production costs for domestic manufacturers, thus compromising their competitiveness in the international market; also the environmental income produced by stringent environmental regulation (for example, improvement of environmental quality) may even be offset with the loss of the overseas market. Therefore, adopting higher environmental standards may be a practice where the losses outweigh the gains. Pethig (1976), Siebert (1977), McGuier (1982), Palmer, Oates and Portnery (1995), and Simpson and Bradford (1996) have all conducted strict theoretical analysis on it.

Representatives of the revisionist school, Porter and Linde (1995) and especially Porter(1991⁴², 1995⁴³), hold that the pressure of environmental regulation is just like the pressure of market competition, encouraging innovation in clean production or clean products. Such innovation may partly or fully offset the cost of regulation and improve pollution control technology, so that FDI may produce environmentally positive effects, winning obvious advantages in competition.

2.1.3.5 The Impact of Strategic Environmental Policy on FDI

The differences in environmental standards among different countries is derived from the difference in the level of economic development, environmental resource endowment, environmental preferences and demands, as well as cultural and institutional differences. However, in recent research, some scholars have pointed out that with the gradual elimination of traditional trade measures, environmental policy

⁴² Porter M.E., America’s Green Strategy. Scientific American, 1991

⁴³ Porter M.E., Van Der Linde. Toward a New Conception of the Environment-competitiveness Relationship. Journal of Economics Prospect, 1995.

is gradually becoming part of trade policy, aiming at promoting the export of pollution-intensive products instead of controlling pollution. This is strategic environmental policy, which means the trade development strategy of winning trade interest by reducing one's environmental standard. Rauscher (1994) describes it as "policy failing to internalize the environmental external effect." Due to differences in environmental standards and environmental policies of various countries, the production costs of products differ. The production costs of products in countries implementing lower environmental standards are lower, so the international competitiveness of their exported products is enhanced. Countries deliberately reducing environmental standards to win competitive edge can gain market share in and improve their welfare level.

Strategic environmental policy has a new explanation for the flow of FDI. That is, developed countries, as capital-exporting countries (exporting capital mainly via transnational corporations), mainly invest in host countries in industries for which no strategic trade interest can be obtained if producing in home countries. As the environmental regulation in many developing countries is relatively lenient, they are more likely to be competitive. Therefore, the flow of FDI depends not only on the environmental policies of countries seeking to attract investment, but even more importantly on the strategies for gaining trade space and interests.

2.2 Current Status of Foreign Direct Investment in China

2.2.1 Definition of Foreign Direct Investment

FDI, according to the definition in China's National Yearbook, refers to investment by foreign enterprises and economic organizations or individuals (including overseas Chinese, residents of Hong Kong, Macao, and Taiwan and Chinese enterprises registered overseas) to open solely foreign-funded enterprises, run Chinese-foreign equity joint ventures or cooperative joint ventures, or co-develop resources with any enterprises or economic organizations within the territory of China in the form of spot exchange, real object or technology (including re-investment of income from foreign investment), as well as actions of any enterprise borrowing funds from overseas within the total amount of project investment approved by relevant government authorities.⁴⁴

⁴⁴ Source: *China's National Yearbook 2009*, National Statistical Bureau

2.2.2 Current Status of Foreign Direct Investment and its Main Characteristics

With the acceleration of economic globalization, international trade and foreign investment based on transnational corporations continue to expand. China is one of the most active host countries in receiving FDI. In 2010, China ranked the second in the world and second among developing countries in terms of amount of foreign investment absorbed. Currently, foreign investment in China has the following prominent characteristics:

First, broad sources. Over 170 countries and regions worldwide have investment enterprises in China. In terms of actual accumulated investment, half comes from Hong Kong, Macao, and Taiwan, one quarter comes from developed countries such as Europe, America, and Japan, and about one tenth comes from Southeastern Asian countries and some free ports. In 2010, the actual foreign investment from Hong Kong, Macao, and Taiwan amounted to USD 74.832 billion, accounting for 70.77% of the total amount of absorbed foreign investment nationwide. Twenty-seven countries of the EU newly established 1,688 enterprises in China in 2010, an increase of 6.97% over the previous year; and the actual amount of foreign investment was USD 6.589 billion, an increase of 10.71% over the previous year. The United States established 1,576 new enterprises in China, a decrease of 0.76% from the previous year; but the actual amount of foreign investment was USD 4.052 billion, an increase of 13.31% over the previous year.

In 2010, the top ten countries/regions investing in China (according to the actual amount of foreign investment) were: Hong Kong (USD 67.474 billion); Taiwan (USD 6.701 billion); Singapore (USD 5.657 billion); Japan (USD 4.242 billion); the United States (USD 4.052 billion); South Korea (USD 2.693 billion); the United Kingdom (USD 1.642 billion); France (USD 1.239 billion); Holland (USD 952 million); and Germany (USD 933 million). These top ten countries/regions accounted for 90.1% of the actual foreign investment in China in 2010.

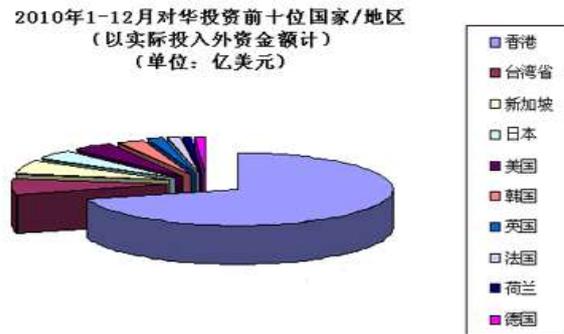


Figure 2.2 Top Ten Countries/Regions Investing in China in 2010

Source: Statistical data of the Ministry of Commerce

Second, the industrial structure is continuously being adjusted. Foreign investment in China is mainly concentrated in secondary industries. According to Table 2.1, FDI flowing into secondary industries in China accounted for 57.58% of total FDI, and the actually utilized foreign investment amounted to RMB 49.8948 billion. Manufacturing is the primary destination of foreign investment, accounting for 93.78% of the total amount of inflow into secondary industries. Foreign investment absorbed by China's manufacturing industry is mainly concentrated in chemical raw material and chemical product manufacturing, agriculture and related foodstuff processing, nonferrous and ferrous metal smelting and calendaring processing, metal product industry, textiles, paper-making and paper product industry, and plastic product industry which are mostly environmentally-sensitive industries featuring high energy consumption and high emissions. Substantial increases in investment will increase consumption of energy and resources. Lack of effective policy guidance and supervision will pose potential threats to the Chinese environment.

Table 2.1 Tendency of Change of Total Industrial Output Value of Some Environmentally-Sensitive Foreign-Invested Industries

Industry	2003	2005	2006	2007	2008
Coal mining, washing, and dressing	7.35	58.73	82.56	146.48	370.94
Petroleum and natural gas exploitation	253.40	491.09	568.08	603.61	812.06
Ferrous metal mining and dressing	2.50	20	31.37	56.86	104.58
Non-ferrous metal mining	5.78	45.1	30.47	61.53	179.5

and dressing					
Non-metal mineral mining and dressing	25.39	57.71	69.82	108.84	134.16
Other mining industries	/	5.45	0.1	0.06	0.07
Agriculture and related processing	1,653.61	3,071.71	3,605.44	4,881.23	6,400.04
Food processing	883.19	1,376.69	1,813.85	2,341.68	2,839.85
Beverage processing	711.58	1,056.07	1,453.61	1,842.27	2,231.17
Tobacco industry	12.36	6.9	8.25	8.62	4.74
Textile industry	1,827.15	3,201.8	3,756.06	4,460.4	4,867.17
Textile clothing, shoes, and hat manufacturing	1,589.51	2,290.07	2,770.18	3,430.45	3,981.89
Leather, fur, feather (down), and other products industry	1,160.14	1,827.08	2,191.91	2,587.06	2,790.01
Wood processing and wood, bamboo, vine, palm, and grass products	263.03	426.84	512.54	666.71	726.25
Furniture manufacturing	358.95	788.09	960.6	1,137.12	1,221.97
Paper-making and paper products	793.17	1,454.58	1,770.58	2,198.95	2,643.06
Printing industry and duplication of recording media	345.16	467.78	543.22	650.41	753.01
Petroleum processing, coking, and nuclear fuel processing	632.09	1,269.96	1,599.71	2,646.39	3,030.59
Chemical raw material and chemical product manufacturing	2,175.20	4,197.18	5,559.85	7,526.09	9,114.43
Pharmaceutical manufacturing	636.00	1,047.9	1,271.02	1,628.12	2,133.45
Chemical fiber manufacturing	290.79	725.61	940.21	1,226.89	1,221.66
Rubber product	482.50	848.92	1,000.59	1,226.46	1,639.17
Plastic product	1,310.29	2,165.85	2,637.73	3,206.69	3,646.91
Non-metallic mineral products	959.28	1,685.09	2,141.18	2,863.82	3,557.39
Ferrous metal smelting and calendaring processing	874.23	2,751.73	3,666.18	4,842.6	6,459.21
Non-ferrous metal smelting and calendaring	471.99	1,207.14	2,095.48	2,873.97	3,329.76

processing					
Metal product	1,345.41	2,395.2	2,975.66	3,987.48	4,649.24
Handcrafts and other manufacturing	543.93	822.28	1,044.12	1,294.73	1,519.47
Production and supply of electricity and thermal power	1,238.80	1,893.86	1,886.74	2,241.92	2,498.52
Production and supply of fuel gas	70.27	174.67	253.31	411.06	627.05
Production and supply of water	16.85	59.72	99.7	127.81	156.27

Source: China Statistical Yearbook (2004–2009)

Since 2005, the proportion of foreign direct investment directed to manufacturing has been decreasing, while the proportion to the service industry has been rising. By 2010, the proportion of foreign investment absorbed by service industry and manufacturing industry nationwide became basically equal (Figure 2.3).

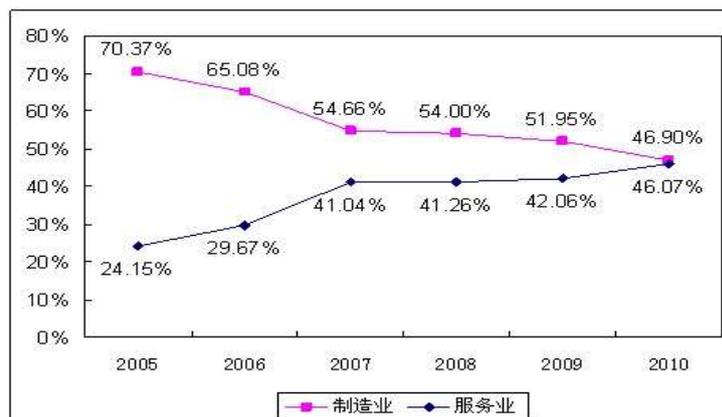


Figure 2.3 Proportion of Amount of Actual Foreign Investment in Manufacturing and the Service Industry Nationwide, 2005–2010

Source: China's National Yearbook and data from the Ministry of Commerce

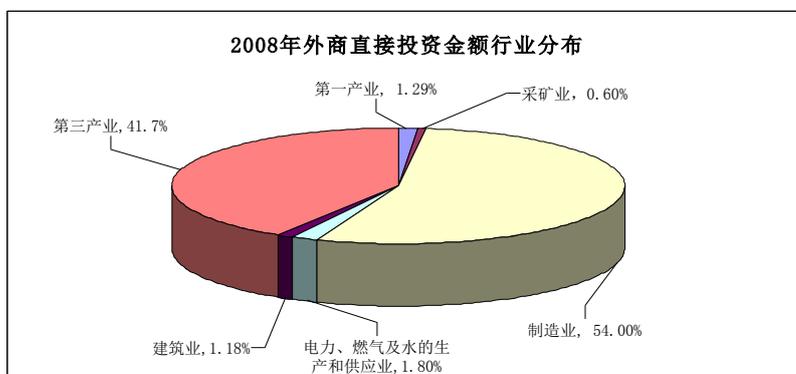


Figure 2.4 Industrial Distribution of Foreign Direct Investment in 2008

2009 Source: China's National Yearbook 2009

Third, diversified methods of investment. Among foreign-invested enterprises under operation, Chinese-foreign joint ventures and solely foreign-funded enterprises account for about 40% each, Chinese-foreign cooperative enterprises account for 17%, and the other investment methods are co-development and shareholding, etc.

Fourth, the geographical distribution of foreign direct investment in China is very unbalanced. As the eastern coastal region has a higher degree of openness, a better investment environment, and an obvious location advantage, the scale and performance of its utilization of foreign investment far outdo those of other regions, especially the Bohai Rim Economic Circle centering Beijing, Tianjin, and Hebei areas (including the Shandong Peninsula, Liaodong Peninsula, Tianjin and Beijing); the Yangtze Delta centering on Shanghai (including Zhejiang, Shanghai and Jiangsu etc.); and the Pearl River Delta Region centering on Guangdong. These regions absorb over 80% of the FDI in China. In recent years, with the continuous improvement of the investment environment in Central China and West China, their relative advantages arise, and their market conditions for guiding FDI transfer start to form. Besides concentrating in the eastern coastal region, FDI has been gradually moving towards Central and West China.

Table 2.2 **Regional Distribution of Foreign Investment in China (2007 and 2008)**

Regional distribution	Number of enterprises		Total amount of investment (USD 100 million)		Registered capital (USD 100 million)	
	2007	2008	2007	2008	2007	2008
Total amount nationwide	286,232	434,937	21,088	23,241	11,554	13,006
Northeast China	19,166	32,380	1,546	1,585	935	998
North Coastal region	48,446	79,609	2,959	3,271	1,641	1,875
East Coastal and Yangtze Drainage Area	89,382	154,801	8,931	9,878	4,933	5,523
South China	88,638	118,844	5,475	5,814	2,745	3,037
Central	6,008	19,981	771	832	406	447

China						
Southwest China	10,892	24,313	832	1,090	476	632
Northwest China	1,472	4,782	113	143	66	83

Source: Arranged according to the data in the national statistical yearbook

2.3 Social and Environmental Impacts of China's Foreign Direct Investment

2.3.1 Environmental Policy Related to Foreign Direct Investment

In the 1990s, China began to use legal means to coordinate the relationship between environmental protection and foreign direct investment, and formed a basic framework composed of various special laws, related laws, and regulations. Environmental problems caused by foreign direct investment are mainly reflected in three levels of law:

The first level is constitutional norms. China's constitution stipulates that the State should protect and improve the living and ecological environment and prevent pollution and other public hazards, and also provides that foreign investors making investments in China must follow Chinese laws and foreign investment and that foreign investors' legal rights are protected by China.

The second level is laws, administrative regulations, and departmental rules. This level of laws is the central level of legislation.

They are mainly classified into two categories: one is mandating environmental protection in investment-related laws, such as the provision of Article 4 of the *Regulations on Implementing the Law of the People's Republic of China on Chinese-Foreign Equity Joint Ventures*. This provisions states that applications to establish joint ventures that will cause environmental pollution shall not be granted approval by the State. The provision of Article 14 of the *Detailed Rules for Implementing the Law of the People's Republic of China on Foreign-Funded Enterprises* says that "a written application for the establishment of a foreign-funded enterprise shall contain:... (10) the degrees of possible environmental pollution and measures for solving this problem,"

The other category is environmental protection laws, which give provisions on possible environmental problems caused by foreign investment activities, such as the provision of Article 30 of the *Environmental Protection Law* that "a ban shall be imposed on the importation of any technology or facility that fails to meet the requirements specified in the regulations of our country concerning environmental protection."

The third level is local laws and regulations. Many local laws and regulations also

address the coordination of environmental protection and local investment. For example, *Regulations of Shanghai Municipality of Environmental Problem*, *Regulation of Sichuan Province on Encouraging Foreign Investment*, *Regulations on the Import of Technology to the Xiamen Special Economic Zone*, etc., in which specific pronouncements are made about environmental protection and investment, and foreign investors investing should comply with the provisions of local laws and regulations.

Table 2.3 **China's Environment-related Investment Laws**

Name of laws and regulations	Departments and dates	Related content
<i>Detailed Rules for Implementing the Law of the People's Republic of China on Chinese-Foreign Cooperative Joint Ventures</i>	Approved by the State Council on August 7, 1995, and promulgated by Decree [1995] No. 6 of the Ministry of Foreign Trade and Economic Cooperation on September 4, 1995	Article 9. Applications on the establishment of joint ventures will not be approved under any one of the following circumstances: ... (3) The proposed joint venture would cause pollution to the environment
<i>Detailed Rules for Implementing the Law of the People's Republic of China on Chinese-Foreign Equity Joint Ventures</i>	Amended and promulgated by Decree [2001] No. 311 of the State Council on July 22, 2001	Article 5. Applicants to establish joint ventures shall not be granted approval if the project involves any of the following conditions: (4) Causing environmental pollution
<i>Detailed Rules for Implementing the Law of the People's Republic of China on Foreign-Funded Enterprises</i>	Amended and promulgated by Decree [2001] No. 301 of the State Council on April 12, 2001	Article 3. A foreign-funded enterprise to be established must benefit the development of China's national economy and be capable of gaining remarkable economic results. The state encourages foreign-funded enterprises to use advanced technology and equipment, engage in the development of new products, realize the upgrading of products and the replacement of old products with new ones, economize energy and raw materials, and it is also encouraged to establish foreign-funded enterprises that are

		<p>export-oriented.</p> <p>Article 5. No application for the establishment of a foreign-funded enterprise shall be approved if the proposed enterprise is under any of the following circumstances:</p> <p>(5) May result in environmental pollution.</p>
<i>Provisions on Guiding the Direction of Foreign Investment</i>	Promulgated by Decree [2002] No. 346 of the State Council on February 11, 2002	These provisions are promulgated in order to guide the direction of foreign investment and make it suitable for China's national economic and social development plans. Foreign investment projects are divided into four categories: encouraged, permitted, restricted, and prohibited.
<i>Catalogue for the Guidance of Foreign Investment Industries (Revised 2007), which will be revised again in 2011</i>	Approved by the State Council Put into effect as of December 1, 2007	Encourage foreign investors to invest in developing circular economy, cleaner production, renewable energy sources, and the protection of the environment. The catalogue does not encourage foreign investors to invest in scarce or non-renewable important mineral resources. For foreign investors, the exploration and exploitation of some important non-renewable mineral resources is prohibited. Foreign-funded projects with high material consumption, high energy consumption, and high pollution are restricted or prohibited.
<i>Catalogue of Priority Industries for Foreign Investment in the Central and Western Regions</i>	Approved by the State Council in 2008, and put into effect from January 1, 2009	Make detailed provisions for competitive industries in western provinces invested by foreign investors. The listed items include: returning farmland to forests or grassland; protecting natural forests and other country's ecological projects; and water-saving irrigation and

		water-saving technology for dry farming, development and application of conservation tillage technology, mining, ecosystem restoration, reconstruction projects, and other fields for promoting environmental protection and construction.
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2.3.2 Development Stages and Environmental Impacts of Foreign Investment

Since China began to open up, foreign-invested enterprises as the main form of using foreign direct investment, have gone from non-existence to a position of great size and strength. The increase of foreign-funded enterprises in China, on the one hand, has made an indelible contribution to China's economic development and has created many jobs; on the other hand, it has also produced negative effects, such as market segmentation and pollution transfer, and foreign investment has different environmental and social impacts at different stages of development. Depending on the period, China's FDI absorption policy and the development of foreign investors, the development of foreign investment can be divided into four stages:

The first stage is **initial stage** (1979–1985). In 1979, the second session of the Fifth National People's Congress passed and promulgated China's first FDI law – *The Law of the People's Republic of China on Chinese-foreign Equity Joint Ventures* marking the legalization of foreign investment. Early in the days of reform and opening up, as many of China's FDI policies were not completely clear, foreign investment in China was basically exploratory. At this stage, due to the backwardness of China's infrastructure, foreign investment was mainly concentrated on China's four special economic zones (Shenzhen, Zhuhai, Shantou, and Xiamen). Nationwide investment from foreign countries had not expanded fully and the total investment was on a small scale, and thus the impacts on the environment were less significant.

The second stage is the **rapid development stage** (1986–1994). Since the late 1980s, foreign investment expanded from the coastal regions to include all regions and all industries. In October 1986, the State Council formulated and promulgated the *Provisions on the Encouragement of Foreign Investment* to give preferential treatment to export-oriented foreign-invested enterprises and foreign-invested advanced technology enterprises. Since then, foreign investment began to flow into China and a large amount of FDI was directed to manufacturing, the chemical industry, and other pollution-intensive sectors, and because the government did not restrict the investment structure, it led to the transfer of pollution-intensive industries to China, which had an impact on China's environment.

The third stage is the **adjustment and improvement stage** (1995–2005). In order to put foreign investment in line with China's industrial policies, FDI policy started to be

adjusted from mid-1995. The State Planning Commission, the State Trade and Economy Commission, and the Ministry of Foreign Trade and Economic Cooperation jointly developed the *Interim Provisions on Guiding Foreign Investment Direction* on June 20, 1995, which classified foreign-invested projects into encouraged, permitted, restricted, and prohibited, and also issued the *Catalogue for the Guidance of Foreign Investment Industries*, and permitted foreign investment projects were not included in the "*Catalogue for the Guidance of Foreign Investment Industries*." Meanwhile, for equal competition between domestic enterprises and foreign enterprises, it also adjusted tax relief policy for foreign investment enterprises. With large-scale entry of foreign investment, its impacts on the environment drew more and more attention. Some large multinational corporations began to pay attention to internal environmental management, and introduced advanced environmentally-friendly technology into China. However, they were only reactive behaviours on the part of the enterprises, whose role as a model for domestic enterprises is limited, and due to the continuous expansion of the scale of investment, foreign investment's impacts on the environment were still mainly negative.

The fourth stage is the **sustainable, coordinated, and stable development stage** (2006–present). In this stage, the foreign investment structure was further optimized, and the proportion of modern services, modern agriculture, and other industries was further promoted. In 2006, China released *The Eleventh Five-Year Plan on Foreign Capital Utilization*, which included stricter provisions for the environmental management of foreign investment, and clearly called for the optimization and upgrading of foreign investment industrial infrastructure; promoted the building of a resource-saving, environmentally-friendly society; actively and steadily promoted the opening-up of service; promoted the building of a more open innovation system; promoted coordinated development of the regional economy; and made a series of requirements, such as improving the quality and efficiency of the utilization of foreign loans. In March 2007, the *Enterprise Income Tax Law of the People's Republic of China* was formally promulgated and two taxes of domestic and foreign enterprise income tax merged, which was a sign of equal competition between domestic and foreign enterprises. As the domestic environmental awareness continued to emerge, the idea of sustainability entered mainstream thinking about development. The upgrading of industrial infrastructure, the advent of the policy theme of economic growth mode transformation, the demonstration effect of foreign investment to domestic enterprises became gradually more clear, much more advanced technologies are introduced into China, and the environmental impacts of foreign investment gradually reflect a positive side.

Table 2.4 **Four Stages of FDI**

Time	Stage of development	Development features	Environmental impacts
1979–1985		– <i>The Law of the People's</i>	Foreign investment in

	Initial Stage	<p><i>Republic of China on Chinese-foreign Equity Joint Ventures</i> marks the legalization of foreign investment.</p> <ul style="list-style-type: none"> - Foreign investments in China are mainly exploratory. - Investment is mainly concentrated on four special economic zones (Shenzhen, Zhuhai, Shantou, and Xiamen), and national foreign investment has not expanded fully. 	China has not expanded fully, the total investment was on a smaller scale, and thus impacts on the environment were smaller.
1986–1995	Rapid Development Stage	<ul style="list-style-type: none"> - Accelerated the legislative work related to foreign investment, and improved foreign investment environment. - Under the multiple super-national treatment stimulation, foreign investment grew rapidly. 	Under the guidance of a series of preferential policies, such as "market for technology," a large number of foreign investments swarmed into manufacturing, chemical and other pollution-intensive industries, and because the investment structure was not limited and foreign investment continued to increase, it led to a large transfer of pollution-intensive industries to China, and caused varying impacts on the environment.
1996-2005	Adjustment and Improvement Stage	<ul style="list-style-type: none"> - The foreign investment industry guiding policies emerged – <i>Interim Provisions on Guiding Foreign Investment Direction</i>; twice amended <i>Catalogue for the Guidance of Foreign</i> 	The environmental impacts of foreign investment attracted more and more attention, and some large multinational corporations began to pay attention to internal

		<p><i>Investment Industries</i> and amended <i>Catalogue of Priority Industries for Foreign Investment in the Central-Western Region</i>.</p> <ul style="list-style-type: none"> - The average scale of foreign investment continued to expand. - The industrial structure of foreign investment was further adjusted, foreign investment in high-tech, infrastructure, and other sectors increased substantially. 	<p>environmental management, but the demonstration effect to domestic enterprises was limited. Due to the continuous expansion of the scale of investment, foreign investment impacts on the environment were still mainly negative.</p>
Since 2006	Sustainable, Coordinated, and Stable Development Stage	<ul style="list-style-type: none"> - In 2007 the <i>Enterprise Income Tax Law of the People's Republic of China</i> was formally promulgated, and two taxes of domestic and foreign enterprise income tax merged, which was a sign of levelling the playing field between domestic and foreign enterprises. - Strengthen the policy guidance of foreign investment industries and the investment direction of the region. - Guide various forms of domestic and foreign technical cooperation and joint innovation. - Improve foreign investment projects to make energy and water consumption, occupation of land, and other access standards, focus on the sustainability of foreign investment. 	<p>With sustainability becoming part of the mainstream of development, and China's strict restrictions on the entry of low-level, high-consumption and high-pollution foreign investment projects, the environmental impacts of foreign investment gradually reflect a positive side.</p>

2.3.3 Analysis on the Comprehensive Effect of Foreign Direct Investment

Social and environmental effects brought about by foreign investment can be categorized into the following types: halo effect, scale effect, structure effect, technology effect, and regulation effect. Each effect is basically a double-edged sword, i.e., it is helpful to China's environment on one hand but causes pollution on the other. Only when an accurate judgment on the above effects is made can the future foreign investment be channeled toward a correct direction and a win-win situation of economy and environment be realized.

Table 2.5 Effects of International Investment

Definition of effect	Positive effects	Negative effects
<p><u>Halo effect</u></p> <p>Foreign-invested enterprises that adopt more environmentally-friendly behaviours and use better environmental technologies than the host country.</p>	<ol style="list-style-type: none"> 1. Promotes the economic restructuring of the host country. 2. Enhances the public's environmental awareness. 	<p>Risks concealing the double standard.</p>
<p><u>Regulation effect</u></p> <p>"Investment-attracting" behaviour of the host government seeking FDI with strong environmental and CSR values.</p>	<p>Well-funded foreign enterprises can enhance the regional economy when environmental regulations pose challenges.</p>	<p>Increases pollution and emissions in regions with loose environmental regulations.</p>
<p><u>Scale effect</u></p> <p>Impact on the environment when FDI expands the scope of business activities in the host country.</p>	<ol style="list-style-type: none"> 1. Foreign-funded enterprises that value sustainable development bring advanced environment and development concepts, consistent with a society's desire to strengthen environmental protection. 2. Introducing transnational corporations with excellent abilities and perspectives on management and sustainable development helps host countries accelerate their own transitions. 	<p>In the event of rapid growth or significant decline, many medium and small foreign-funded enterprises will have trouble keeping up with the obligations in environmental regulations.</p>

<p><u>Structure effect</u></p> <p>Changes taking place in different departments of the host country caused by FDI, thereby changing the economic structure.</p>	<p>Depending on existing levels of pollution in the host country, foreign investment can inspire upgrades to a host country's industrial structure.</p>	<p>1. It could become increasingly difficult to control pollution due to an imbalance of investment in different industries and regions. 2. Foreign investment in China is mainly composed of small and medium enterprises, and the positive scale effect is lessened.</p>
<p><u>Technology effect</u></p> <p>The phenomenon that foreign investment increases the rate of technology upgrading, dissemination, and transfer.</p>	<p>1. Transnational corporations with advanced technologies promote the deployment of environmental protection technologies. 2. The entry of transnational corporations with advanced technologies helps improve technology at the host country's own enterprises.</p>	

2.3.3.1 Analysis on the Halo Effect of Foreign Direct Investment

The halo effect refers to the global unified environmental management model that foreign-invested enterprises adopt. Specifically, foreign-invested enterprises adopt more friendly environmental behaviours and transmit better environmental technologies to the host country.

(1) Promoting China's Sustainable Development and Economic Transformation

In view of the reasons behind the halo effect, firstly, the global unified standards signify that the same procedure can be replicated in all subsidiaries so as to ensure that technology innovation in high-standard regions can be promptly applied in all regions. Global unification also conforms to the strategies of the transnational corporations to be globally competitive. Second, from the perspective of development, low standards do not necessarily mean low costs. Besides, some clean technologies offer higher production efficiency which lowers operating costs for the company. Generally speaking, foreign-invested enterprises adopt a unified environmental management model by proceeding from their economic interest, which in turn, contributes the sustainable development of the host country. The government may promote the environmental behaviours of the same kind of enterprises by publicizing their advanced management concepts and practices. Furthermore, the spread of advanced environmental protection technologies will provide technological support

for China's economic transformation.

Specifically, the role of FDI in promoting China's sustainable development and economic transformation is mainly reflected in the following thoughts:

i) The technology "spillover effect" brought about by FDI will be the driving force for Chinese enterprises to be more engaged in the research and development of advanced technology and environmentally-friendly technology. Some transnational corporations with a high awareness of corporate environmental responsibility also serve as a model for local enterprises.

ii) FDI is beneficial to the accumulation of China's human resources which will provide infinite momentum for sustainable development. Human resources have become the most important resources in present-day society and also the most competitive resources. Of the foreign-invested enterprises, quite a number of them are focused on human resource management and capacity building. And the majority of transnational corporations will build a talent-training mechanism for training local employees in the host county. The more advanced technology the company is engaged in, the more funds will be required for training people. Local workers who are familiar with international practice and who are specialized in technologies can become the leaders of China's economic sustainable development.

iii) Attracting high-quality and high-tech foreign-funded enterprises will promote industrial restructuring and the green transformation of China's economy. The invisible technology transfer of multinational enterprises and the forced technology innovation of local companies will together boost China's industrial structure and promote the sustainable development in China.

(2) Promoting Corporate Social Responsibility and Environmental Awareness

Through the halo effect, foreign-invested enterprises can create good social reputation and avoid pressure from special interest groups. In addition, because of the need to enhance the additional value of the product, the company will appropriately publicize its good environmental performance, which will, to some extent, improve the public's environmental awareness. The public will have knowledge of this corporate environmental target. More importantly, through comparison with other national or small and medium-sized enterprises of the same kind, the relevant enterprises will be faced with double pressure: one relating to corporate reputation; the other is of the corporate performance. If there exists no significant difference in the quality or the price for the same kind of product, the public is bound to choose the products from companies that pay more attention to environmental protection. This would effectively promote good environmental behaviour in the company and, indeed, throughout an industry.

In the context of economic globalization, corporate social responsibility (CSR) gradually becomes the focus of all stakeholders. An enterprise that seeks to be socially responsible should play a role in safeguarding the rights and interests of employees and customers, protecting the environment, saving energy and reducing emissions, ensuring product quality, maintaining partnerships within the supply chain, advancing technologies, etc. Foreign-invested enterprises, particularly the large transnational corporations from developed countries in Europe and the United States, see CSR as a corporate culture to publicize, which sets an example for Chinese companies. In 2008, the Ministry of Commerce issued *Guidelines of Foreign-invested Enterprises Fulfilling Social Responsibilities (draft)* which set up the bottom line for the transnational corporations to fulfill CSR in China and also signifies that the Chinese government attaches great importance to foreign-funded enterprises fulfilling their CSR. At present, an increasing number of local Chinese enterprises have begun to integrate CSR into their management strategies and policies.

With the promotion of CSR, the public has become increasingly aware of environmental issues. An increasing number of enterprises have participated in public environmental education to publicize their environmental-friendly image give them a competitive edge.

(3) Risk of Concealing a Double Standard

Due to the halo effect of foreign-invested enterprises, the public generally views favourably the products, CSR efforts, and environment behaviour of foreign enterprises. The fact is, though, that the government and the public know little about the environmental management model and the final implementation of the environmental standards adopted by the foreign-invested enterprises. As long as the pollutant emission standards are in line with the China's national laws and regulations, the company can keep operating.

2.3.3.2 Analysis on the Management Effect of Foreign Direct Investment

Management effect refers to the "investment-attracting" behaviour of the host government, particularly the foreign investment impact caused by the environmental management policy.

Environmental regulation refers to the aggregation of various environmental protection policies and measures, such as environmental standards, pollution emission regulations, and expense input of treatment, that a country and region formulates and implements with the objective of protecting the environment. Environmental regulation mainly influences the choice of location of foreign investment in polluting industries. As other conditions remain unchanged, it is more economical to run a business in a country with loose environmental regulations or poor law enforcement capacity than in a country with strict regulations. Specifically, in a country with strict

regulation, the operator is forced to input a large amount of extra resources into non-productive activities, such as environmental auditing, waste treatment, and dealing with environmental disputes. Therefore, the production efficiency may be negatively influenced. While in a country with loose environmental regulations, the company may use obsolete production facilities, outdated technologies, and products that have been forbidden in the country with strict regulation, thus the costs incurred by the company are further reduced and the life cycle of the products is extended, and the profit of the company is thereby increased. As far as China is concerned, due to the large gaps in economic development among regions, some regions carry out stricter environment standards, which leads to different environment effects.

For those regions with relatively high pressure of environmental regulation, the cost of foreign investment in polluting industries is expected to be increased; hence its proportion is to be brought down, the regional economic structure level will be enhanced, and the regulation effect will have a positive effect on the environment. While in regions where the environment is loosely regulated, foreign investment in polluting industries will increasingly move in, hence regional pollution emissions will increase. In terms of the overall regional distribution of foreign investment, in 2008, the increasing rate of total investment amount in central and southwestern regions was higher than that of eastern coastal regions (Table 2).

2.3.3.3 Analysis on the Scale Effect of Foreign Direct Investment

The scale effect refers to the impact on environment when FDI expands the scope of business activities in the host country.

(1) Intensification of the Inherent Conflict between Investment and Environmental Protection due to the Increase of Foreign Direct Investment

The scale effect leads to the increase of economic aggregate, which calls for more resource inputs and thus emits more by-product contamination. In this way, it aggravates environmental pollution. Economic development versus environmental protection is the inherent conflict in the traditional social developmental pattern. At the very beginning of the opening up of China's market economy, the introduction of foreign investment, as a major measure to stimulate economic growth, has long been adopted by the government. An abundant and low-cost labour force in China, along with the government's long-term export-oriented policy to foreign-invested enterprises, leads to the increase of foreign-invested enterprises' total production, which has made a significant contribution to the development of foreign trade and export growth of China (Table 3). However, with the expansion of investment scale, environmental problems gradually become obstacles limiting the development of China. How to coordinate the attraction of foreign investment alongside the achievement of environmental protection is a thorny problem for the Chinese government.

(2) Conducive to Government and Society's Strengthening of Environmental Protection

The expansion of the economic scale brought about by foreign investment promotes the economic growth in the host country and the increase of per capita income. Meanwhile, environmental protection gradually becomes the major priority of the public. Thus, government and the society are increasingly willing to invest in the environment and the environmental situation is, therefore, improving. According to the Environmental Kuznets Curve (EKC), when environmental development has reached a certain level, the rate of environmental pollution will decrease along with economic growth. Thus, environmental conditions will improve gradually. The scale effect caused by foreign direct investment will shorten the time China has to complete the transition.

Table 2.6 Major Economic Indicator of Foreign-invested enterprises (Unit: RMB 100 Million)

	National Gross Industrial Output	Industrial Output of Foreign-invested Enterprises	Occupied Proportion (%)	Total National Industry and Commerce Tax	Foreign Tax	Occupied Proportion
1999	63,775.24	17,696.00	27.75	10,311.89	1,648.86	15.99
2000	73,964.94	23,145.59	22.51	12,665.00	2,217.00	17.50
2001	94,751.78	26,514.66	28.05	15,165.00	2,883.00	19.01
2002	101,198.73	33,771.06	33.37	17,004.00	3,487.00	20.52
2003	128,306.14	46,019.55	35.87	20,461.60	4,268.00	20.86
2004	187,220.66	58,847.08	31.43	25,732.00	5,355.00	20.81
2005	249,625.00	78,399.40	31.41	30,867.03	6,391.34	20.71
2006	315,630.14	99,420.83	31.50	37,637.04	7,976.94	21.19
2007	404,489.06	125,036.94	30.91	49,451.80	9,972.60	20.17

Source: *China Commerce Yearbook 2008*, Ministry of Commerce of the People's Republic of China

Notes: Marked in the yearbook, foreign tax paid by foreign-funded enterprises count for over 98% of the total foreign tax.

2.3.3.4 Analysis on the Structure Effect of Foreign Direct Investment

The structure effect refers to the change taking place in different sectors of the host country caused by FDI, as a result of which, the economic structure will be changed.

(1) Increasing the Difficulty of Pollution Control due to Unbalanced Distribution of Foreign Investment in Different Industries and Regions

Currently, foreign investment in China is mainly characterized by its imbalanced distribution in different industries and areas. Specifically, from either investment scope or investment amount, the proportion of foreign investment in China flowing into secondary industries is much higher than in primary and tertiary industries. The manufacturing industry alone absorbs 50% of the total capital flow (see Table 3). However, in the manufacturing industry—those like paper-making, iron and steel, metal, cement and chemical engineering—belong to high energy consumption, high pollution, and labour-intensive industries, which not only have a negative impact on industrial restructuring in China, but also threaten China’s overall environmental condition.

Since China’s accession to the WTO, the Chinese government has consciously guided the direction of foreign investment from secondary to tertiary industries, and reduced the proportion of the total investment in secondary industries. However, due to the unceasing expansion of foreign investment's scale, the total sum of foreign investment in China’s secondary industries actually demonstrates a steadily increasing trend. In 2008, a report from the Institute of Population and Labour Economics, Chinese Academy of Social Sciences, pointed out that, the “top 10 manufacturing industries in terms of intensity of carbon emission” are⁴⁵: petroleum processing, coking and nuclear fuel processing, non-metallic mineral product, chemical raw material and chemical product manufacturing, ferrous metal smelting and calendaring processing, papermaking and paper product, chemical fiber manufacturing, non-ferrous metal smelting and calendaring processing, art and craft products and other manufacturing , textiles, and food processing industry. One can tell from the statistics of Table 1 that from 2003 to 2008, gross industrial output of foreign businesses in these ten industries demonstrates a remarkably ascending trend with an average growth rate as high as 3.3 times. In the ferrous and non-ferrous metals smelting and calendaring industries, within five years, the gross industrial output of foreign-invested enterprises has increased by over five times.

Table 2.7 Tendency of Change of Total Industrial Output Value of Some Environmentally-Sensitive Foreign-invested Industries

Industry	2003	2005	2006	2007	2008
Coal Mining, Washing, and Dressing	7.35	58.73	82.56	146.48	370.94
Petroleum and Natural Gas Exploitation	253.40	491.09	568.08	603.61	812.06
Ferrous Metal Mining and	2.50	20	31.37	56.86	104.58

⁴⁵ Herein carbon emissions per GDP unit is preferred as the criterion to differentiate between a clean manufacturing industry and a pollution-intensive industry.

Dressing					
Non-ferrous Metal Mining and Dressing	5.78	45.1	30.47	61.53	179.5
Non-metal Mineral Mining and Dressing	25.39	57.71	69.82	108.84	134.16
Other Mining		5.45	0.1	0.06	0.07
Agriculture and Sideline Foodstuff Processing	1,653.61	3,071.71	3,605.44	4,881.23	6,400.04
Food Processing	883.19	1,376.69	1,813.85	2,341.68	2,839.85
Beverage Processing	711.58	1,056.07	1,453.61	1,842.27	2,231.17
Tobacco	12.36	6.9	8.25	8.62	4.74
Textiles	1,827.15	3,201.8	3,756.06	4,460.4	4,867.17
Textile Clothing, Shoes, and Hat Manufacturing	1,589.51	2,290.07	2,770.18	3,430.45	3,981.89
Leather, Furs, Feather (Down), and Other Products	1,160.14	1,827.08	2,191.91	2,587.06	2,790.01
Wood Processing And Wood, Bamboo, Vine, Palm, and Grass Products	263.03	426.84	512.54	666.71	726.25
Furniture Manufacturing	358.95	788.09	960.6	1,137.12	1,221.97
Paper-making and Paper Products	793.17	1,454.58	1,770.58	2,198.95	2,643.06
Printing and Duplication of Recording Media	345.16	467.78	543.22	650.41	753.01
Petroleum Processing, Coking, and Nuclear Fuel Processing	632.09	1,269.96	1,599.71	2,646.39	3,030.59
Chemical Raw Material and Chemical Product Manufacturing	2,175.20	4,197.18	5,559.85	7,526.09	9,114.43
Pharmaceutical Manufacturing	636.00	1,047.9	1,271.02	1,628.12	2,133.45
Chemical Fiber Manufacturing	290.79	725.61	940.21	1,226.89	1,221.66
Rubber Product	482.50	848.92	1,000.59	1,226.46	1,639.17
Plastic Product	1,310.29	2,165.85	2,637.73	3,206.69	3,646.91
Non-metallic Mineral Products	959.28	1,685.09	2,141.18	2,863.82	3,557.39
Ferrous Metal Smelting and Calendering Processing	874.23	2,751.73	3,666.18	4,842.60	6,459.21
Non-ferrous Metal	471.99	1,207.14	2,095.48	2,873.97	3,329.76

Smelting and Calendaring Processing					
Metal Product	1,345.41	2,395.2	2,975.66	3,987.48	4,649.24
Handcrafts and Other Manufacturing	543.93	822.28	1,044.12	1,294.73	1,519.47
Production and Supply of Electricity and Thermal Power	1,238.80	1,893.86	1,886.74	2,241.92	2,498.52
Production and Supply of Fuel Gas	70.27	174.67	253.31	411.06	627.05
Production and Supply of Water	16.85	59.72	99.7	127.81	156.27

Source: *China Statistical Yearbook (2004–2009)*

Table 2.8 **Distribution of Foreign Direct Investment Industries**

Industry	Contracted Project	Actually Utilized Amount
	(Unit)	(USD 10,000)
Farming, Forestry, Animal Husbandry, and Fishery	917	119,102
Mining	149	57,283
Manufacturing	11,568	4,989,483
Electricity, Gas, and Water Production and Supply	320	169,602
Construction	262	109,256
Transports, Storage, and Postal Services	523	285,131
Information Transmission, Computer Services, and Software	1,286	277,479
Wholesale and Retail	5,854	443,297
Lodging and Catering Services	633	93,851
Finance	25	57,255
Real Estate	452	1,858,995
Lease and Business Services	3,138	505,884
Scientific Research, Technical Service, and Geologic Exploration	1,839	150,555
Water Conservancy, Environment and Public Facilities Management	138	34,027
Resident Services and Other	205	56,992
Education	24	3,641
Health Care, Social Insurance and Social Welfare	10	1,887
Culture, Sports, and Entertainment	170	25,818
Public Management and Social	1	

Organizations		
International Organizations		6

Source: *China Statistical Yearbook (2009)*

Due to the higher degree of openness in the eastern coastal areas of China, the traditional advantages of labour force and market are attracting most of the enterprises investing in China, which further intensifies the imbalance of regional economic development. Besides, the gradual expansion of investment scale has placed tremendous pressure on the resource environment of these regions. In recent years, with the improvement of soft investment environment in the central-western region, foreign investment reveals the trend to transfer from the east to the central west region. But it is notable that while the central-west region, particularly the remote west mountainous areas, are blessed with abundant natural resources in energy, mineral products, land, and other features, their ecological environment is vulnerable. Therefore, correct and reasonable policy guidance for foreign investment is of significant importance.

(2) Positive Scale Effect Difficult to Appear due to the Main Body of Investment formed by Small and Medium-Sized Enterprises

According to the differentiation criteria for foreign-invested enterprises by the Ministry of Commerce, projects with contracted foreign investment of over USD 10 million are considered large-scale enterprises or large-scale investment projects. By the end of 2003, the number of foreign-invested large-scale enterprises was 14,562, counting for 3.31% of the accumulative total number of items. Contracted foreign investment amounted to USD 474.987 billion, accounting for 50.36% of the accumulative total sum. Medium-sized and small projects with amounts invested below USD 10 million enjoy as high as 96.69% of the amount in foreign investment utilization project, accounting for 49.64% of total contracted capital of China. Seen from an average investment amount of a single foreign-invested project, contracted foreign investment amounted to USD 20.027 million, and the amount of foreign investment in actual use is USD 1.0778 million. Apparently, in China, the scale of foreign-invested enterprises is generally small, that is, it is mainly composed of medium-sized and small enterprise projects.

Although many transnational corporations have introduced advanced technology into China, many foreign-invested enterprises with relatively less capital still adopt the backward or obsolete technologies of their own countries, which places significant stress on China's environment. Even the technology adopted by some foreign-invested enterprises is above the average domestic level, it is not at the internationally advanced level, which means that its resource efficiency and environmental performance fall behind the advanced technology in the developed countries. Since production facilities formed by investment in the fields of energy, industry, infrastructure, and other fields is characterized by high capital intensity, high emission

intensity, long working life, etc., the lock-in effect of technological input makes many enterprises unable to use more advanced technology at once, which delays technical upgrading and innovation of Chinese industry.

(3) Improvement of the Overall Pollution Industry Structure of China due to Foreign Investment

The structure effect of foreign direct investment depends on pollution degree of a new department compared with the original department, that is, it depends on the comparison of relative pollution degree between the expanding department and the contracting one. If structural adjustment leads to pollution-intensive specialized productive departments, it will cause negative impact on the environment and vice versa. Distribution structure of foreign-invested industry and that of national industry can be compared by the establishment of the index (Production value of foreign-invested pollution-intensive enterprises⁴⁶ / Production value of foreign-invested cleanness-intensive enterprises) / (Production value of national invested pollution-intensive enterprises / Production value of national invested cleanness-intensive enterprises).

Research shows that compared with pollution-intensive industry, foreign-invested cleanness-intensive enterprises enjoy higher productivity and more obvious comparative advantage. At the same time, the distribution structure of foreign-funded pollution-intensive enterprise is better than that of China. Therefore, foreign investment can improve the industrial structure of overall pollution in China.⁴⁷

2.3.3.5 Analysis on the Technology Effect of Foreign Direct Investment

The technology effect refers to the phenomenon that foreign investment increases the rate of technology upgrading, pervasion and transfer.

(1) Conducive to the Spread of Environmental Protection Technology and Promoting the Pervasion of Environmental Technology

FDI enterprises, especially those multinational corporations committing to the global strategy, tend to utilize identical technology in every country, which comprises an important part of their competitive strategy. The technology they use is not only merely based on the current management system, but also grounded on the

⁴⁶ According to the definition and features of pollution-intensive industry, the provisions of other various national regulations and the actual influence on environment by some industrial departments and in the consideration of the practical situation in China, pollution-intensive industries include: coal mining and processing industry; petroleum exploitation, processing and coking petroleum chemical industry; ferrous metals mining and dressing and smelting industry; nonferrous metals mining and dressing and smelting industry; some non metal mineral mining and dressing industry and some non metal mineral products; vegetable oil processing and sugar baking in food processing industry; fermented products, preserved food products and condiment products manufacturing in food processing industry; alcohol and potable spirit production in beverage manufacturing; printing and dyeing textile industry; shoemaking (cloth shoes excluded) industry; leather, furs, down and other manufacturing; papermaking and paper products industry; thermal power industry; chemical raw materials and chemical products industry; pharmaceutical manufacturing; chemical fiber manufacturing; rubber products; some plastic products; some metallic products; some engineering products manufacturing; some electrical machinery and equipment; some products of electronic and telecommunication equipment manufacturing, etc.

3. Jin Yi., 2008, Environmental Protection Research on China's Utilization of Foreign Direct Investment, Master's thesis.

development of management system. Hence, they pay much attention to the transformation of current technology and the introduction of new environmental technology to reduce the pollution to the environment. For example, upon the establishment of Beijing Panda P&G Cleaning Products Co., Ltd, this company has conducted a series of technology transformation in reducing dust pollution, increasing the degree of process automation and upgrading products to be environment friendly products. It also spent nearly USD 2 million importing foreign advanced equipment to establish a modern sewage plant so as to reduce the company's pollution to the environment.⁴⁸

(2) Promotion of the Popularization of Environment-Friendly Products

The entry of the large amount of foreign investment can promote China's economic development to a certain degree. From the perspective of economics, environment quality is a kind of normal goods, the demand of which increases with the increase of income. When the income increases, inhabitants of a certain country will have the demand for better environmental quality and purchase more environment friendly products, so as to raise the competitiveness of environment friendly technology.

Hence it further promotes the development of China's environmental industry. Attracted by the large potential environmental market in China, foreign investors have invested in establishing some environmental enterprises. Not only do they provide sources of fund and advanced technological equipment for the protection and management of environment in China, but they also quicken the structural adjustment and optimization of environmental industry and products. At the same time, they meet the huge demand of environmental market and effectively reduce the environmental pollution. The comparatively high environmental consciousness and advanced environmental management method of foreign-invested enterprises have a positive learning demonstration effect for their Chinese partners to improve the environmental consciousness and environmental management level. In this way they enhance the competitiveness of Chinese enterprises.

(3) Promotion of the Progress of Technology in Chinese Enterprises due to Advanced Technology of Foreign Enterprises

Foreign-invested enterprises introduce new products and new technology. They are the model of domestic enterprises, as well as the major source of the pervasion of new technology and new products. Especially in the development of clean technology industry, the leading role of foreign-invested enterprises is very obvious. Chinese enterprises are constantly improving their learning and innovation ability so as to greatly upgrade environmental technology and raise management level of domestic enterprises. The other way round, with the promotion of Chinese enterprises, industrial investment factors of foreign enterprises are showing the transition from

4. Yan Fulei, 2008, Research on the Relationship between FDI and China's Environmental Protection, Mater's thesis

labour-intensive and capital-intensive industry to technology-intensive and cleanness-intensive industry. The level of technology is increasing and it can match various investment patterns.

2.4 International Comparative Study

2.4.1 Comparison of FDI in Brazil, India and China

Against the international backdrop of economic globalization, China, Brazil and India have gradually realized that participation in the course of globalization is a sufficient and necessary condition for developing their economies. They have actively grasped opportunities and launched a series of FDI attracting policies meeting their national conditions. As a result, the total amount of the FDI they have absorbed is rising, and they have become countries most attractive for FDI in the world. However, as developing countries, in the course of FDI absorption, unsound economic system and market structure lead to many structural and institutional risks in economic operation. Therefore, how to absorb FDI and what kinds of FDI to be absorbed are of great significance for further promoting economic growth.

2.4.1.1 Comparison of Policies for FDI Absorption

Among various factors attracting FDI, besides uncertain regional factors such as the resource endowment, stability of political and economic policies and economic development level of the host country, the host country's policy for attracting foreign investment plays a very important role. We may say that the government's policy orientation for attracting foreign investors directly decides foreign investors' contributing to greet investment. China, Brazil and India have their specific features in terms of foreign investment policies.

Like China, Brazil is also a large country with a rich resource endowment. However, the proportion of investment in resource industries is far lower than that in China, which is closely related to its industry policy orientation. To maximally utilize the opportunities resulting from globalization, the Brazilian government started to actively expand the proportion of service industry and infrastructure in national economy as early as the mid 1990s, guiding FDI to shift to sectors such as service industry, energy, communication, finance and transportation. At present, Brazil's investment policy is the freest among the three countries. According to the evaluation report of an international financial company on over 20 emerging markets in the world, Brazil is rated as "a market that can be freely accessed", which also creates good investment environment for the development of the tertiary industry.

India's FDI policy attaches most importance to efficiency among the three countries. Though India's national conditions are similar to those of China, and its national development strategy is also very much like that of China. However, compared with India, China features higher government intervention, and government has more advantage over India in terms of economic environment and infrastructure construction, which cause a large amount of manufacturing industry to flow into China. At the same time, the service industry, which is also labour-intensive industry, develops vigorously in India. Besides, India's highly efficient financial market, advanced IT technology and better English command of Indian people provide a hotbed for growth of the service industry.

China's effort and scale in attracting FDI and FDI's contribution to national economy are all the largest. From the 1980s to the present, the Chinese government has promulgated over 500 laws and regulations concerning foreign-related economy, and established a great amount of infrastructure, creating excellent environment for foreign investor's investment and setting up factories in China. As a result, China's FDI utilization far outperforms the other two countries. Among the three countries, the Chinese government has the best preferential treatment for foreign investment, and therefore has the largest scale of foreign investment absorption. Compared with Brazil, the development course of FDI in China is shorter, and the attention to sustainability in FDI attracting orientation also came later. Consequently, foreign investment in China focuses on pollution intensive industries such as manufacturing and mining, with larger impact on the environment.

From the above analysis, it can be seen that Brazil's FDI introduction was several decades than China, and therefore Brazil paid attention to sustainable development earlier. Under the guidance of government investment industry directions, FDI structural transformation has been basically completed, and foreign investment in Brazil is mainly concentrated in low pollution industries such as service, energy, communication, finance and transportation. India's national conditions are similar to those of China, and its national development strategy is also very much like that of China. However, compared with India, China features higher government intervention, and government has more advantage over India in terms of economic environment and infrastructure construction, which cause a large amount of manufacturing industry with higher requirements on rigid investment environment to flow into China. Meanwhile, the service industry, which is also a labour-intensive industry, sees prosperous development in India. Different policy orientations of the three countries have led to distribution of FDI in different industries and also made FDI cause different extents of impact on the environment of the three countries.

2.4.1.2 Comparison of Developmental Courses of FDI Attraction

In early period of FDI attraction, China had weaker economic development. China, for a time, created excellent economic growth momentum and stable political environment and successfully attracted a large amount of FDI in the “manufacturing outsourcing” of developed countries by relying on its low-price labour cost, preferential FDI absorption policy, thus successfully squeezing into the “internationalization chain” and becoming a link. Manufacturing in Chinese GDP accounts for about 30%; thus China known as the “World’s Factory” is criticized for “exchanging environment for economy”, and China’s shift to a green economy also becomes an issue that foreign enterprises to invest in China must consider.

Different from the course of economic development in China, India did not carry out structural shift and upgrading according to the trajectory of developing from primary, secondary to tertiary industry in terms of the evolution course of its industrial structure, but according to the industrial structural pattern of primary, tertiary and secondary industries. According to statistical data, industry only accounts for 22.25 of GDP in India, while service industry accounts for 51.2%. In the IT service area, in particular, India is becoming the “background office” for more and more European and American enterprises. Compared with manufacturing industry, service industry itself is a technology and knowledge intensive industry, and the main competitiveness of service enterprises is reflected in soft technology and intangible assets. Therefore, whether in terms of structural effort or technical effect, the environmental impact caused by FDI on India is far less than that on China.

Brazil has undergone the course of transforming from mining, manufacturing to finance and electricity industries in the course of FDI utilization. Before the 1990s, Brazil’s foreign investment was mainly concentrated in the mining sector and manufacturing sector. Since the 1990s, besides the manufacturing sector, financial service sector and information and communication sector have been more and more favored by foreign investors. The proportion of FDI in various sectors of Brazil is respectively: service sector 73.2%, industry 23.8% and agriculture, husbandry and mining 3%. The causes for such change are: new technology revolution exerts major impact on the industrial structure of developed countries so that the role of Brazil as a raw material supply base is gradually diminishing, and developed countries’ investment interest in Brazil’s mining sector is gradually dropping; the Brazil government, to accelerate industrialization and attract foreign investment and advanced technology, formulates some policies favorable for foreign investment; emerging industries (for example, information and high-tech industry) keep

developing and disseminating worldwide, and the financial service and IT sector of Brazil are opened to the outside, which have increased developed countries' investment effort in these sectors of Brazil. At present, foreign investment in Brazil mainly focuses on industries with huge potentiality for development such as telecommunication, finance, electricity and Internet. As such industries require less consumption of natural resources and have less pollution, they exert less pressure on the environment than manufacturing. The increase of investment in high-tech industries will produce positive influence on the environment.

From the above analysis, we can see that Brazil attached great importance to technology introduction and technical transfer from the very beginning of FDI introduction. The primary, tertiary and secondary industry structure development pattern in India, to some extent, determines that its tertiary industry is most attractive for FDI. However, in the beginning of FDI introduction in China, as the economic base was weak and more emphasis was given to the growth of market scale, foreign investment in China mainly focuses on primary product manufacturing with high sensitivity to the environment.

2.4.2 Comparison of Foreign Investment in China and the United States

China and the United States are respectively the developing country and the developed country absorbing the most FDI in the world. As the largest developed country in the world, the United States not only conducts a large amount of foreign investment but also actively use foreign investment. It is not only the largest capital exporting country in the world but also the most attractive and largest investment market in the world, with significant performance in attracting foreign investment. China, as the developing country absorbing the most FDI in the world, has huge gap from the United States in terms of foreign capital stock, industrial pattern or FDI attracting policy. Different market environment and policy orientation have led to different impact of FDI on the environment.

2.4.2.1 Comparison of Location Advantages

The big gap between China and the United States in terms of economic development level has caused the two countries to have different location advantages in attracting foreign investment. For the United States, its economic and technological development level is high and the competitiveness of its domestic enterprises is very strong. Therefore, it tends to adopt a liberal and open policy for foreign investment, and treat equally enterprises involving or created by foreign investment and domestic enterprises according to law, practicing no-difference treatment. Its liberal investment

environment, convenient corporate operation mechanism, limited and predictable policy system and appropriate taxation burden are causes why the United States attracts foreign investment. In addition, the United States has excellent infrastructure and stable policy and laws, which are very attractive for global investors.

As an emerging developing country, China's main advantages are reflected in: first, China has rapid economic growth speed, and especially in the general economic slowdown worldwide, the stable growth of Chinese economy is especially eye-catching; second, China has a huge market, as China is the country with the largest population in the world, featuring the largest potentiality for market development; third, China has rich labour resources, with low labour cost and improving labour quality.

The difference in location advantages has caused difference in foreign investment's emphasis in these two countries. As domestic enterprises have higher degree of modernization and powerful competitiveness in the United States, the motive of FDI by most foreign investors in North America is to occupy market, acquire technology and information and avoid trade friction, and as a result there is more investment in industries such as service, automobile and high technology. In China, however, the basic motive for the entry of much foreign investment is to seek low cost production or acquire rich natural resources, and as a result, China becomes an important product part production and processing base for many countries, and manufacturing and natural resource mining account for a larger proportion in FDI.

2.4.2.2 Policy Comparison

In the United States, as the market mechanism has been well developed and domestic enterprises have very strong competitiveness, the government authorities pay more attention to the market nature of investment and its policy on foreign investment aims at providing foreign investors with a fair, transparent and liberal investment environment and excellent infrastructure, to attract foreign investment with efficient and high-quality government service and liberal investment environment. It generally tends to adopt a liberal and open policy for foreign investment, and treat equally enterprises involving or created by foreign investment and domestic enterprises according to law. Foreign capital can freely enter the investment areas like domestic capital in the United States. There is no special restriction on investment industry areas, investment ratio, term or transfer. There is some restriction only on investment in some special fields involving national safety (national defense and transportation etc.) or the investment of some specific countries (generally referring to

enemy countries). But on the whole, such restriction does not constitute barrier or problem generally facing foreign investors.

Though the US government has created a relatively liberal environment for the entry of foreign investment, yet it does not mean that it follows foreign investors completely or that foreign investors can invest in any project anywhere, but it establishes excellent infrastructure by preferential policy, efficient service and urban planning and investing in a huge amount of money, so as to attract the projects and enterprises it needs to settle in “development areas” and strive to promote “cluster economy”. There are “development areas” generally in cities of the United States, as platform for development of foreign investors. On this basis, the US government attaches great importance to the micro management of foreign-funded enterprises, and its foreign investment policy is basically implemented with a mature law and regulation system. In this way, there are laws to go by and laws must be observed, freeing foreign investors from worries.

Compared with the United States, FDI started later in China. Foreign investment was not formally included into the track of development of national economy until the inception of reform and opening-up in 1979. In the early period of foreign investment inflow, as there was a huge gap between the overall conditions of economic development in China and those of advanced countries in the world, China issued a series of super-national preferential policies aiming at attracting foreign investment, in an attempt to make up for the deficiency in investment environment caused by backward infrastructure. In the early period of foreign investment inflow, the government’s effective intervention and other systems played an important role in attracting FDI. However, the government’s excessive intervention has led to a series of adverse effect, for example, the leaning of central policy caused vicious competition for FDI in various places, and some places attached importance to the amount of FDI absorbed but neglected quality, which often caused labour-intensive, natural resource intensive and pollution intensive industries to be transferred to China, thus resulting in the consumption of a large amount of resources and tremendous destruction of ecological environment, substantially weakening the sustainability of the foreign investment introduction strategy.

Since 1995, though China’s foreign investment policies have been adjusted, more attention has been given to the sustainability of the environment in FDI attracting policy and foreign invested industries and FDI flow direction have been specified by the method of combining encouragement and limitation, yet, China’s foreign investment policies still lay more emphasis on introduction, lack late project

management, regulation on foreign-invested enterprises is weak, and infrastructure equipment is not sound enough, which still lead problems such as low quality of FDI introduced.

On the whole, the investment policies of the United States place more emphasis on establishing a long-term stable investment environment. The government aims at providing foreign investors with a fair, transparent and liberal investment environment and excellent infrastructure by creating a liberal environment, limited and predictable policy system and efficient and high-quality government service. Investors must observe various legal provisions in the United States, including its environmental standards and environment-related legal provisions. The high degree of market orientation also forces enterprises to attach importance to the sustainability of investment; otherwise they would be eliminated by the market. Whereas China's investment attracting policies mainly aimed at attracting extensive short-term benefits against the backdrop of local governments' blind pursuit of GDP, and some of them were even launched at the cost of national assets and environmental destruction. The relative disconnection between investment laws and environment, lack of late project management and weak regulation over foreign-funded enterprises are important causes for unreasonable FDI structure and serious environmental destruction in China.

2.5 Case Study

Case 1: Comparison of Transnational Corporations' Environmental Information Disclosure and Corporate Social Responsibility in China and in Other Regions

(1) Comparison of Shell's Performance of Environmental Responsibilities in China and Overseas

Environmental Information Disclosure⁴⁹

The sustainable development report is an important channel for Shell's active disclosure of its environmental information, and how Shell's environmental standard is implemented is directly reflected in the reports publicized on the websites of its branch companies. However, a careful comparison of the 2008 sustainable development reports of Shell China and Shell's companies in other countries and regions can discover that the contents of report of Shell China are simpler, without global vision or description of technological innovation and application from the perspective of global energy sustainable exploitation. Data support is lacking for

⁴⁹ This part is based on the disclosures in 2008 Annual Reports.

environmental performance and therefore there is more simple confirmation of its performance. The reports of Shell US and Shell headquarters in Holland use many words and diagrams to describe its technological improvement and social involvement in various aspects for sustainable development. In comparison, the sustainable development reports of the US and Holland companies cover a more extensive environmental field, including Shell's achievements in atmosphere, water and energy utilization and Shell operation's impact on the environment, and production safety, among others, highlighting Shell's assumption of social responsibilities by promoting development and application of new technologies in order to improve energy utilization ratio, energy conservation and pollution reduction. However, even the contents are relatively comprehensive, yet the amount of specific emissions, such as the amount of hazardous chemical substances, is not reflected in the report and has to be retrieved in the government's information system. See Table 5 for details of comparison.

Table 2.9 Comparison of Contents of 2008 Sustainable Development Reports of Shell China and Other Shell Companies

Contents included in the report	The United States	Holland	China
Analysis of energy situation	Y	Y	-
Climate change	Y	Y	-
Company's voluntarily set objective	Y	Y	-
Sustainable development and business strategy	Y	Y	Y
Clean products (road, lubricant, and chemical products)	Y	Y	-
Petroleum difficult to exploit	Y	Y	-
Transportation of sustainable development	Y	Y	-
Electricity generation with clean fuel	Y	Y	Y
Application of major technologies	Y	Y	-
Reduction of greenhouse gases	Y	Y	-
Reduction of freshwater use	Y	Y	-
Biodiversity	Y	Y	-
Oil spill prevention	Y	Y	-
Environmental performance	Y	Y	Y
Social investment	Y	Y	Y
Safety standard	Y	Y	Y

Environmental Pollution Incidents and Disclosure

According to disclosure of media and public investigation, Shell China has not fully implemented its idea of sustainable development in its course of operation, and has not timely disclosed incidents of pollutant discharges exceeding stipulated standards.

Shell China was subject to an incident of sanitary wastewater exceeding stipulated standard in Shanghai China in 2008-2009, and failed to disclose the incident within the stipulated time. Under the pressure of non-governmental organizations, Shell China publicized an announcement on its website to describe the results of investigation and treatment of the incident. Shell Road Engineering (Shanghai) Co., Ltd. is a company in which Shell holds 75% shares. On April 28, 2008, Shanghai Minhang Environmental Protection Bureau, in its regular check of the company, discovered that the detected COD data in the sanitary sewage of the plant area were higher than the emission value stipulated by the State. The announcement finally pointed out that in Shell's business operation, "environmental management shall be further strengthened, and relevant environmental management laws and regulations shall be strictly followed, regular self inspection shall be carried out to timely discover, solve and report any problem."

Besides, Shaanxi Yulin media disclosed that in August 2009 Shell Changbei Natural Gas Treatment Plant did not use its special sewage treatment plant but employed people to take sewage outside the plant to dump to a desert beside a highway, and was caught by environmental protection law enforcement personnel on the site.

In the United States, Shell has also been subject to penalty for violation of environmental law. In October 2009, Shell Oil Co. Station reached an agreement with the California government in the United States for its violation of California's law on underground fuel storage and hazardous wastes that Shell would pay civil compensation and pay compensation for investigation cost to the California government and organizations of various levels, amounting to over USD 19 million. Besides compensation, Shell agreed to take immediate steps to strengthen warning monitoring and employee training and upgrade the oil station's ability of hazardous waste management and emergency response.⁵⁰

Before this incident, in March 2005, an inspector discovered that the operators of a Shell station located at 30245 Agoura Road in Agoura Hills failed to properly conduct and maintain secondary containment testing and monitoring for its gasoline tanks. The

⁵⁰ Source of information: Pacific Auto Net: <http://drivers.pcauto.com.cn/yongpin/rhy/news/0911/1013268.html>.

state's inspector also found liquid and hazardous substances in the containment sump and Shell's own inspector found liquid in the sump on previous visits to the station.⁵¹

The reports of Shell China, US and Holland on pollution problems in the course of Shell operation are as follows (Table 2.10).

Table 2.10 Occurrence of Shell Pollution Incidents and Disclosure⁵²

	The United States	Holland	China
Sewerage exceeding stipulated standard	-	-	Y
Dumping sewage	-	-	Y
Information disclosure	-	-	Y
Hazardous substances	Y	-	-

Table 2.11 Comparison of Results of Incident Treatment

	Time	Incident	Results of treatment
China	April 2008	Detected COD data in the sanitary sewage of the plant area were higher than the emission value stipulated by the State	Release announcement and strengthen management
	August 2009	Dumping sewage to desert	-
The United States	October 2009	Oil station violated relevant California law	Paid civil compensation and compensation for investigation cost amounting to over USD 19 million. Besides compensation, and agreed to take steps to strengthen warning monitoring and employee training and upgrade ability of hazardous waste management and emergency response.

(2) Comparison of Performance of Environmental Responsibilities in BASF's Chinese Enterprise and Its Other Enterprises

⁵¹<http://www.sandiego6.com/news/local/story/Shell-Fined-by-State-for-Gas-Station-Flaws/iFDsFg8NjkuDfE4onppNBg.csp>.

⁵² http://en.wikipedia.org/wiki/Royal_Dutch_Shell_environmental_issues.

Disclosure of Environmental Information

BASF North America has disclosed the greenhouse gas data and the quantity of nitrogen, organic substances and heavy metals discharged to water from 2002 to 2007.⁵³

BASF America has provided detailed data of analysis of ecological efficiency⁵⁴ and conducted analytical description in terms of energy consumption, gas emission, hazardous substances, resource use and land utilization.⁵⁵

BASF America (Belvidere) Company has publicized the details of its annual reports from 2001 to 2007. One of the important contents in the annual report is the company's performance of its environmental responsibility and publicity and information disclosure. The contents disclosed include data of environmental protection objective, measure, extent of implementation and hazardous waste, nontoxic waste and water resource use. The website also describes the monitoring of ISO14001 Standard and the time when the certificate was obtained.

The 2008 Corporate Report disclosed by BASF German Headquarters introduces BASF's measures in coping with climate change and waste management, the data of the company's greenhouse gas emission, carbon footprint, energy use, water use and wastewater discharge. The headquarters website also introduces BASF's strategic considerations and direction of endeavor addressing climate change, energy utilization, and bio-diversity protection.

The website disclosed *Annual Report on BASF Greater China*, which describes the information about the company's emission of water, atmosphere and solid waste. As to information about resource utilization and hazardous substances, the Greater China website specifically explains that in compliance with Chinese laws, "Several production bases have got positive feedback for providing data to the government authorities. Environmental data become part of the government's environmental monitoring database once reported to the government authorities". However, **as the environmental information provided to the government not only includes emission data, but also some business and process related facts and data, which**

⁵³ <http://www2.basf.us/corporate/pdfs/fact-sheets/EHS-Fact-Sheet.pdf>.

⁵⁴ BASF's ecological efficiency analysis is a quantification tool, measuring the relationship between economic income and the environment, so as to reduce resource consumption and improve energy utilization rate.

⁵⁵ See the Ecological Efficiency Data Table for details:
http://www2.basf.us/corporate/pdfs/Eco-efficiency_060705.pdf.

are all business secrets. Therefore, such information has not been disclosed.⁵⁶

The comparison of environmental information disclosure at the websites of BASF German Headquarters, North America (including America Belvidere) and Greater China is as follows:

Table 2.12 Disclosure of Main Environmental Information of BASF Enterprises Worldwide

	The United States	Germany (Headquarters)	China
Analysis of ecological efficiency	Y ⁵⁷	Y	-
Data of hazardous wastes	Y	Y	-
Data of nontoxic wastes	Y	Y	-
Amount of water used	Y	Y	-
Water body emission	Y	Y	Y
Atmosphere emission	Y	Y	Y
Solid wastes	Y	Y	Y
Amount of land used	Y	Y	-
Annual report	2001–07 (America)	2008–09 (Global)	2008 (Greater China)
ISO 14001 certification	Y	Y	-

Case 2: Attempting to Promote New Environmental Management Measures—Walmart’s Green Supply Chain

As the largest retailer in the world, Walmart procured products from over 30,000 factories in China amounting to about USD 32 billion. 70% of the goods sold at Walmart are made in China.⁵⁸ Currently, Walmart has become the seventh largest trade partner of China. Walmart’s business operation activities are closely connected

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http://www.greater-china.basf.com/apw/AP/GChina/zh_CN/function/conversions:/publish/GChina/upload/new/customer_letter_Aug_13_web_version_e.pdf.

⁵⁷ See the data table of ecological efficiency for details:

http://www2.basf.us/corporate/pdfs/Eco-efficiency_060705.pdf

⁵⁸ Andrew Huston. Environmental Supply Chain Hot Spots. April 2010.

with the industrial chains of its Chinese suppliers. Its procurement action in China not only affects the production actions of upstream Chinese factories but also is closely related to the environmental impact of these Chinese factories.

Walmart has always been ahead of the retail industry in China in terms of green supply chain development. In 2009, Walmart announced to infuse the concept of sustainable development into operation and supply chain management, which meant that the largest retailer in the world would meet customers' future demand substantially, and produce and sell goods by a highly efficient method meeting ethic standard and responsible to the environment. In fact, as a large retailer operating on a transnational basis, Walmart has always been dedicated in promoting a series of sustainable development activities, paying attention to the important effect of environmental protection on its global competitive edge. In recent years, Walmart has taken energy conservation and carbon emission reduction as one of the important goals for its sustainable development. It not only actively implements energy conservation and emission reduction in the course of its own operating activities but also vigorously promotes energy conservation and emission reduction in its supply chain. According to estimation, the carbon footprint produced by Walmart's own operating activities only accounts for 8% of the total carbon footprint, while 92% of the carbon footprint is produced by the supply chain and customers' use of products.⁵⁹ Walmart takes the energy conservation and emission reduction and environmental protection of its supply chain as an important opportunity for its sustainable development, and helps its suppliers promote energy conservation, emission reduction and environmental protection through procurement constraint and incentive and on-the-spot review.

In 2008, at the "Global Sustainability Summit" held in Beijing, Walmart declared to several hundred top Chinese suppliers that it would use its own market power to upgrade the standard of its huge supply chain and announced a series objectives addressing the Walmart supply chain, including environmental law compliance, reduction of water and energy consumption, reduction of packaging and commitment to developing more sustainable products etc.⁶⁰ Mike Duke, President and CEO of Walmart, promised at the summit that Walmart would strengthen cooperation with Chinese suppliers, help suppliers improve energy efficiency and reduce consumption of natural resources, and proposed to cooperate with 200 leading Chinese suppliers and help them improve energy efficiency by 20% by 2012. Afterwards, the Walmart

⁵⁹ Yao Junfeng. Walmart's Path to Sustainable Development. September 21, 2010.

⁶⁰ Jonathan Burchill. Walmart Is Planning to Construct "Green Supply Chain". *The Financial Times*, UK. <http://www.ftchinese.com/story.php?storyid=001022646>

Global Procurement Office initiated the “Walmart Energy Efficiency Upgrading Project” in 2009, proposing to help Chinese suppliers improve energy use efficiency, reduce energy cost and improve enterprise competitiveness and sustainable development ability.”⁶¹

According to data, since 2009, over 300 suppliers from different industries such as toys, furniture, shoes, garments and electronics have participated in the project. Compared with 2007, 135 factories participating in the project have achieved energy efficiency upgrading of above 10%, and the total energy saved has reached 80 million KW, equivalent to reducing the carbon dioxide emission of 70 thousand tons, and equivalent to reducing the carbon emission of about 12 thousand cars driving one year regularly.⁶²

2.6 Opportunities and Challenges Facing Foreign Investment

2.6.1 Opportunities Facing Foreign Investment in China

1. Since the outbreak of the financial crisis, the effective coping measures of the Chinese government has maintained a stable investment environment, providing a relatively safe harbor. Effective coping with the financial crisis has made China remain one of the most attractive countries for FDI. In a predictable period in the future, the stable and tremendous market of China will still maintain the attraction for FD. Most transnational corporations are firmly convinced that the Chinese market and investment prospect are promising. According to the survey of the United Nations Conference on Trade and Development on several hundred transnational corporations, in terms of regional flow of international capital, China and other emerging economies will still be places that various corporations vie for.

2. With the further implementation of China’s policies and measures for encouraging the use of foreign investment, the positive effect will come out gradually. In 2010, the State Council launched “Several Opinions on Further Managing Matters Regarding Utilization of Foreign Investment”, and various departments of the Central Government and local governments at various levels successively launched policies and measures on implementing “Several Opinions”, which have played an active role in stabilizing and enhancing investors’ confidence. With the further implementation of supporting policies and measures for “Several Opinions”, the positive effect will come out gradually.

⁶¹ How Retailers “Play with” Green Supply China, *International Business Daily*

⁶² Spearheading Sustainable Development and Co-Constructing Green Supply Chain, *Impression Walmart*, Vol. 4, 2010

3. The potentiality of central and western regions of China for absorbing foreign investment will be further increased. The soft and hard environments for investment in central and western regions keep improving, the consumption market is increasingly expanding, industrial supports are gradually perfecting, and development of industrial concentration areas are accelerating; in view of the rising element costs in the eastern region, obvious comprehensive cost advantages can be found in central and western regions. At the same time, a large amount of low-end labourers are returning from the east to the central and western regions, and the development of economy and society in the central and western regions is also attracting more high-quality human resources, which upgrade the element endowment of the central and western regions. All these will vigorously promote the central and western regions to undertake industrial transfer of manufacturing and develop producer service industry.

4. Strategic adjustment of economic structure provides new hotspots for foreign investment. After the start of the period of the “Twelfth Five-Year Plan”, accelerating the strategic adjustment of economic structure will become the main direction for China’s shift of economic development pattern. The reconstruction and upgrading of manufacturing industry, vigorous development of service industry and cultivation of strategic emerging industries, among others, will provide new growth points for China’s absorption of foreign investment. Currently, various major economies in the world are redoubling their effort to promote a new round of technological revolution and industrial adjustment. In the course of cultivating some emerging industries, China has participated or is forming the ability to participate in world competition and higher level of international labour division. Compared with developed countries, China features still low comprehensive cost and expanding market space, and contains excellent opportunities for attracting overseas investors in emerging high-end manufacturing industry and producer service industry. In 2010, the State Council promulgated the “Decision on Accelerating the Cultivation and Development of Strategic Emerging Industries”. The plans for development of seven major strategic emerging industries will be gradually launched in 2011. In the industrial policy orientation of the future period, foreign investment will be guided to high-end manufacturing industry, high-tech industry, modern service industry, new energy and energy conservation and environmental protection industry. All these will provide new space of development for foreign investment in China.

2.6.2 Challenges Confronting Foreign Direct Investment

While China remains to be the most attract host country for FDI, foreign investment is

also confronted with a series of challenges here.

1. Chinese economy is confronted with various challenges compounded by external environmental domestic economic restructuring. With China's further integration into world economy, global economic risks will exert larger influence on China. In 2011, China will continue to be confronted with problems such as unceasing trade disputes, upward pressure on the Renminbi, imported inflation and inflow of hot money. From the perspective of domestic situation, the effect of heavy investment coping with the financial crisis is gradually diminishing, the cultivation of consumption ability still needs a period of time, liquidity risk is worth considering, and the inner drive for economic growth is to be activated; at the same time, economic restructuring is still going on with hardship, long-term problems and short-term problems are interweaved, institutional conflicts and structural problems are piled up, macro control becomes more difficult and unpredictable phenomena increase.

2. Operating costs in China are rising. Inflation pressure, sustained RMB appreciation tendency, and rising labour cost as well as other factors have been raising foreign investor's operating cost in China. Since 2010, many provinces and cities have raised their minimum wage standard, and have once been subject to the "tide of wage hike". In eastern regions where foreign-invested enterprises are concentrated, labour cost rise will be a long-term tendency. Giving comprehensive consideration to these factors, foreign-invested enterprise with low added value may possibly invest in central and western regions with lower cost and enjoying regional preferential policies, or transfer to neighboring countries and regions with cost advantage and preferential policy.

3. With industrial structural adjustment in China, the international investment competition confronting China may be further intensified. On one hand, China is still a large country of labour-intensive manufacturing, low added value processing and manufacturing industries will be still one of the main areas of foreign investment within a short and medium term, while some neighboring countries and other emerging economies with similar element endowment and industrial structure with China will become China's rivals for investment absorption in labour-intensive processing and manufacturing fields. On the other hand, major developing economies have successively put forward in their strategies for economic development that they should reinvigorate manufacturing industry, and vigorously develop new energy, energy conservation and environmental protection, high-end manufacturing, strategic emerging industry. Therefore China is confronted with intensive international competition in terms of attracting foreign investment in these

high value-added industries.

4. With the further improvement and maturing of China's market mechanism, various "super national treatments" that foreign-funded enterprises enjoy will end or have already ended, which raise higher requirements on foreign-funded enterprises. At the beginning of opening-up, due to lack of both technology and fund, China adopted taxation preferential policies for foreign-funded enterprises; as a result, China became a hot destination for foreign investors, foreign-funded enterprises pursuing profit won tremendous profit in China, and foreign investment also became an important aid for the economic development in China. However, under the intense competition of preferential policies of various places, some foreign-funded projects attracted were actually transferring environmental and resource pressures to China. Behind the foreign investment heat is hidden the trouble of constant extensive growth of economy. Besides, unfair market competition has also seriously damaged fair market environment, and it is imperative to eliminate "super national treatment". In March 2007, the *Corporate Income Tax Law of the People's Republic of China* was formally promulgated, and the income tax of domestic enterprises and foreign-funded enterprises is combined, which became a symbol for equal competition of domestic enterprises and foreign-funded enterprises, signifying that China's economic restructuring path is irreversible and also that China is shifting from the pursuit of quantity to the pursuit of quality in terms of foreign investment absorption. With China's established policy of welcoming foreign investment and attracting foreign investment, the development direction of foreign investment in China will surely change.

2.7 Main Conclusion and Policy Suggestions

2.7.1 Main Conclusion

1. Over three decades since the start of foreign investment absorption, the inflow of foreign capital has made positive contribution to China's environment and development, particularly to environmental management and environmental technology.

2. Absorbing industries with high risk of pollution has also confronted China's environmental development with more green challenges. Compared with countries with similar economic development conditions such as India and Brazil, we discover that absorbing different types of foreign investment leads to different effect of green development. China, which has absorbed more traditional manufacturing industry,

while becoming the “world factory”, is also confronted with more serious environmental challenges.

3. China has become an important destination of absorbing transnational corporations. Some advanced ideas of transnational corporations have further improved the environmental protection awareness of Chinese society and public and promoted the society’s extensive concern with and involvement in environmental issues; and introduced corporate social/environmental responsibilities into China. However, as there is still a gap between Chinese domestic standard and high standard of developed countries, transnational corporations still fail to be truly consistent or treat equally without discrimination in China, as compared with their international environmental responsibility (mainly according to the comparison of transnational corporations’ corporate social responsibility reports in different regions).

4. The uneven distribution of foreign investment in industries and regions has increased the difficulty of pollution governance. The environmental advantage of foreign investment in sensitive industries is weakened. Take the chemical industry for example. In the recent five years, the pollution of foreign investment has been increasing, and continuous increase of foreign investment in chemical industry, to some extent, does not meet China’s environment and development policy orientation of “energy conservation, emission reduction and green development”.

5. Foreign investment will continue to be an important driving force of Chinese economy, but we should not blindly overestimate the influence of foreign investment on Chinese enterprises. In fact, FDI cannot truly foster domestic enterprises, and the reinvigoration of national industries in China must rely on longer-term our own efforts. Foreign investment should provide important support for preventing the constant inflow of backward technology and optimizing economic growth structure.

6. Voluntary environmental management measure, as a brand new environmental management method, is still at the starting period in China. Foreign investment’s rich experience and “spillover effect” can be used to effectively promote the development and progress of voluntary environmental management measures in China.

2.7.2 Policy Suggestions

1. Supplement and improve details relating to foreign investment’s environmental behaviors in the *Detailed Rules for Implementing the Law of the People’s Republic of China on Chinese-Foreign Cooperative Joint Ventures*, the

Regulations on Implementing the Law of the People's Republic of China on Chinese-Foreign Equity Joint Ventures and the Detailed Rules for Implementing the Law of the People's Republic of China on Foreign-Funded Enterprises, and gradually improve the environmental law system relevant to foreign investment

Currently, in Chinese laws on foreign investment, no dedicated environmental protection law on foreign investment has been established, and the constraints of foreign investor's environmental behaviors in China are scattered in investment laws. Documents such as the *Regulations on Guiding the Direction of Foreign Investment* and the *Catalogue for the Guidance of Foreign Investment Industries* only provide directional guidance to foreign investment, without involving specific environmental behaviors. Unsound legal system has left greater degree of freedom to environmental behaviors of foreign investment. The difference of environmental standards between China and the home countries of foreign investment have also resulted into the inability to promote foreign-funded enterprises' advanced technologies and ideas. Therefore, China should, with reference to the environmental legislation experience of developed countries, gradually establish measures for administrating foreign investment's environmental behaviors meeting international norms and national conditions of China as soon as possible, supplement and improve details relevant to foreign investment's environmental behaviors on the basis of the *Detailed Rules for Implementing the Law of the People's Republic of China on Chinese-Foreign Cooperative Joint Ventures*, the *Regulations on Implementing the Law of the People's Republic of China on Chinese-Foreign Equity Joint Ventures* and the *Detailed Rules for Implementing the Law of the People's Republic of China on Foreign-Funded Enterprises*, and promulgate supporting detailed rules for implementation, to give legal guidance for environmental behaviors of foreign-invested enterprises in China.

2. Launch the “Twelfth Five-Year Plan” for Utilizing Foreign Investment as soon as possible, incorporates environmental behaviors of foreign investment into the plan and promote China's green shift

The “Twelfth Five-Year Plan” has clearly proposed the strategic direction and requirements for green development: in face of the intensifying resource and environment constraints, China must enhance crisis awareness, establish the green and low carbon development concept, focusing on energy conservation and emission reduction, improve the incentive and constraint mechanism, accelerate the construction of energy conserving and environmentally friendly production methods and consumption modes, strengthen the ability of sustainable development and improve the level of ecological civilization. As an important force for promoting

economic growth in China, foreign investment has made outstanding contribution to promoting economic growth in China. However, as mostly the primary industrial chain is involved and management demonstration is better than technological dissemination, if “further restructuring” is not realized in the course of attracting FDI, such kind of investment absorption itself cannot be sustained. It may be said that at present stage, China’s shift to green economy is more important than growth, and also more crucial to China’s future development.

Therefore, the government should formulate the “Twelfth Five-Year Plan” for Utilizing Foreign Investment as soon as possible, incorporate the sustainable development of foreign investment into the plan as an important content, and determine the guiding thoughts, strategic goals, key tasks and corresponding policies and measures through planning. In the meanwhile, the government should further open up the field of high technology, encourage foreign investment to transfer to high-tech industries, and strictly restrict “high energy consumption, high pollution and resource exporting” and low level and excessive production capacity expansion projects. Only when the objective of promoting economic restructuring by foreign investment is determined and investment quality is stressed that China will remain invincible in the battle of economic structural adjustment.

3. Guide the direction of foreign investment flow, optimize industrial structure and channel foreign investment to fields such as modern agriculture, high technology, advanced manufacturing, energy conservation and environmental protection, new energy, and modern service industries

Currently, steady and rapid development is maintained for Chinese economy, and the shift of development pattern and economic structural adjustment are entering a critical period. In October 2010, the State Council launched the Decision on Accelerating the Fostering and Development of Strategic Emerging Industries, clearly determining that package policies would be launched in terms of finance and taxation to accelerate the fostering and development of strategic emerging industries, on the basis of major technological breakthroughs and major development demands, promote in-depth integration of emerging technologies and emerging industries, and on the basis of continuing to strengthen and expand the high-tech industry, foster and develop strategic emerging industries into leading and mainstay industries.

In the course of introducing foreign investment, China should highlight the major objective of accelerating the shift of economic development pattern, promote foreign investment development to shift from stressing scale and speed to stressing quality

and efficiency, and guide foreign investment to invest more in fields such as modern agriculture, high technology, advanced manufacturing, energy conservation and environmental protection, new energy and modern service industry. At the same time, the country should encourage foreign investment to participate in the restructuring of traditional industries, encourage and support foreign investment to restructure traditional industries such as automobile and machinery manufacturing with high technology and applicable advanced technology, and establish competitive market structure in the link of investment introduction, so as to promote foreign investment to accelerate the transfer of core technology and actively promote product upgrading. Furthermore, it should guide foreign investment policy to combine with the objective of coordinated development of regional economy, and make full use of regional development strategies such as Great Development of Western Region to encourage foreign investment in central and western regions and guide clean, low carbon and green foreign investment to central and western regions.

4. Gradually eliminate the “super national treatment” of foreign-funded enterprises, and create a fair market competition environment to complete the shift of foreign investment policy from quantity to quality

While launching encouraging policies, China should restrict the shift of foreign investment to general manufacturing and heavy chemical industry. “Super national treatment” for labour intensive industries such as textiles and garment, and household electrical appliance such as colour TV, washing machine, cell phone and telephone and general telecommunication equipment industries. While creating a fair market competition environment, it should launch supporting measures to strictly restrict foreign investment in industries whose domestic production capacity is already excessive. For heavy chemical industry rapidly shifting to China by foreign investment, it should pay attention to resource conservation and environmental protection of such industries, raise the access threshold for foreign investment to enter such industries as appropriate, and restrict the inflow of funds to such industries.

5. Formulate the Policy Guidelines for Encouraging Foreign Direct Investment in Green Technologies, and use policies such as taxation and soft loans to promote the introduction of truly advanced green technologies

The international financial crisis has made the issue of China’s shift of economic development pattern more prominent. In the course of promoting adjustment of industrial structure, the country must realize that vigorous development of green technologies is the only way out for resolving the resource and environmental

constraints in economic and social development of China. Therefore, in the course of investment introduction, it should, combining with documents such as the *Catalogue for the Guidance of Foreign Investment Industries*, formulate the *Policy Guideline for Encouraging Foreign Direct Investment in Green Technologies*, and by methods of tax reduction and loan provision, encourage local governments and enterprises to introduce international green technologies such as new energy technology, energy conservation and environmental protection technology and circular economy technology, to promote the upgrading of green technologies in China.

6. Introduce innovative and voluntary environmental management measures

(1) Further improve and strengthen the system and mechanism of corporate environmental responsibility and introduce “international fair” corporate environmental information disclosure

As a developing country, China’s environmental standard and environmental responsibility system still have some gap from those of developed countries. Foreign-funded enterprises, especially influential transnational corporations, have richer experience in assumption of corporate environmental responsibility. Compulsive introduction of environmental information disclosure system which is the same with that of their home countries in the course of foreign investment in China will not only play a powerful role of demonstration for Chinese enterprises but also exert positive influence on the awakening of environmental awareness of Chinese enterprises and conscious establishment of system and mechanism for corporate environmental responsibility.

(2) Promote green supply chain and promote international green investment

In the course of investment introduction, China should give full play to enterprises’ initiative to promote development of green supply chain, and through opening up of important links of industrial chain, avoid inadequate structural adjustment motive resulting from simple reliance on technological innovation, and by promoting the green shift of the complete industrial chain of the whole strategic emerging industries, achieve the purpose of attracting international green investment and promoting the green shift of the whole society.

Chapter 3 Environmental and Social Impacts of Chinese ODI on Host Countries

The Chinese government started to promote ODI and cooperation in 1990s. With the rapid growth of China's outward direct investment (ODI), the country's enterprises have drawn more attention on the world stage. At present China holds USD 3.2 trillion in reserves and reaches USD 4,000 in per capita GDP, which means that China has entered the large-scale outward investment stage according to international investment theory. At the same time, considerable environmental and social impacts of Chinese enterprises' investment on host countries have aroused more and more international attention. With the increased awareness of environmental protection in host countries, governance of natural resources and increased attention to corporate social responsibility by the international community, China's ODI needs to concern itself with environmental issues and the potential social benefits to host countries. With the increased awareness of environmental protection by host countries, continuous proper utilization of natural resources by international community and the growing concern about corporate social responsibility, Chinese ODI is faced with larger and larger social and environmental pressure and needs to be more concerned with environmental protection and social development needs of host countries. The pressure is and also will be the largest challenge of sustainable development faced by Chinese ODI, which demands urgent and in-depth discussion and research on measures and policies.

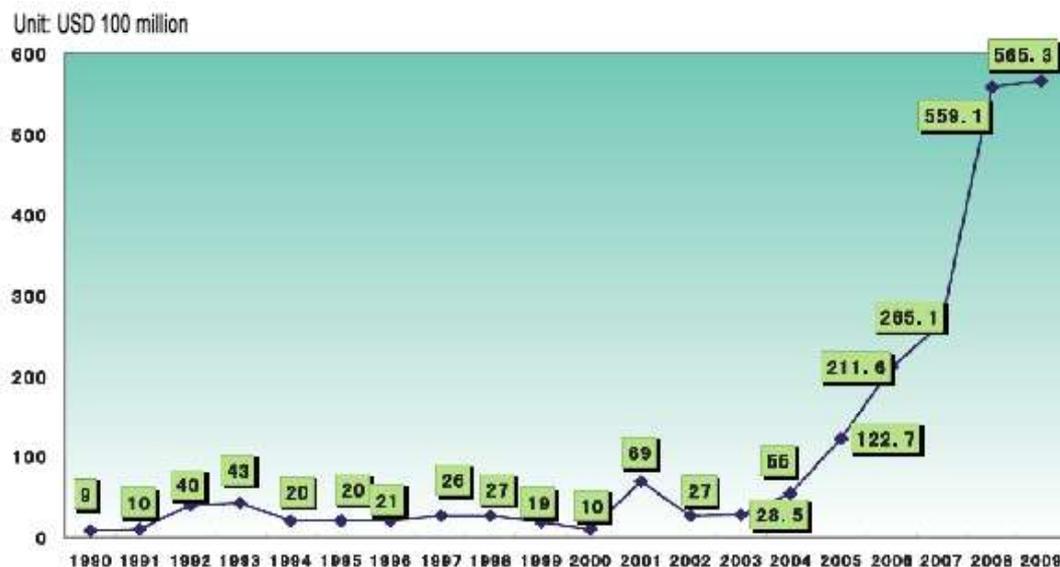
This chapter analyzes and discusses how to treat China's image, including perceptions of its ODI by media and other parties; whether Chinese overseas enterprises only comply with lower environmental standards in host countries; whether a large number of medium-sized and small Chinese overseas enterprises pollute the local environment of the host countries; and how well Chinese overseas enterprises have performed vis-à-vis minimum wage standards, medical care, welfare measures, and local employment.

3.1 The Current State of China's ODI and Future Trends

3.1.1 Current State of China's ODI

China experiences many diversified changes in the global economy and fast ODI development. Table 1 shows the increase of Chinese ODI since 1990. Its growth pattern in the new century is remarkable, especially since the "Go-Global" policy proposed by Chinese government, which promotes the increase of ODI. China's volume of ODI increased from USD 33 to 230 billion during 2003–2009, approximately a seven-fold increase. By the end of 2009, 12,000 domestic Chinese investors had created 13,000 directly-invested enterprises in 177 countries around the world, totaling USD 245.75 billion in investments. These were broken down into USD 76.92 billion in equity investment (31.3% of the total), USD 81.62 billion in reinvested earnings (33.2% of the total), and USD 87.21 billion in other types of

investment (35.5% of the total). The total assets of Chinese enterprises operating overseas exceeded USD 1 trillion by the end of 2009 (Figure 3.1).



Note: Figures of China's ODI from 1990 to 2001 are from UNCTAD's World Investment Report; figures from 2002 to 2009 are from MOFCOM.

Figure 3.1 **Rapid Growth of China's ODI**

Source: UNCTAD and MOFCOM

Despite the recent rapid growth of China's ODI and the fact that it ranked fifth in the world (first among developing countries) in 2009, the flow and volume of ODI of China respectively accounted for merely 5.1% and 1.3%⁶³ of the 2009 world's total.

3.1.2 China's ODI Structure

Contrary to many assumptions about China's ODI being concentrated on energy and mining, the sectoral distribution of China's ODI is actually reasonably balanced (Figure 3.2). Leasing and commercial services, and the finance sector each represent a higher percentage of Chinese ODI than mining, which accounts for a mere 16.5%. The manufacturing sector ranks even lower at 5.5%. This is in clear contrast with the characteristics of China's domestic economic structure.

⁶³ UNCTAD World Investment Report 2010

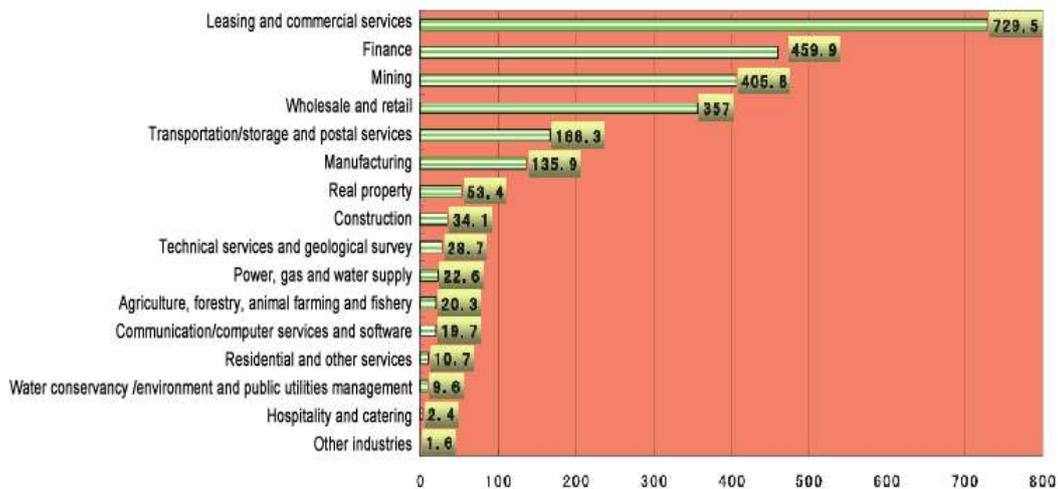


Figure 3.2 **Industrial Distribution of ODI Volume of China by the end of 2009**
 Source: 2009 Statistical Bulletin of China's Outward Foreign Direct Investment, MOFCOM

Heavily concentrated in Asia, followed by Latin America and Africa, the geographic distribution of Chinese ODI is highly uneven. By the end of 2009, the investment volume in Asia registered at USD 185.5 billion, accounting for 75.5% of the total volume and mainly concentrated in Hong Kong, Macao, Japan, South Korea, and Southeast Asian countries; the investment volume in Latin America was USD 30.6 billion, accounting for 12.5% of the total and mainly concentrated in the British Virgin Islands, the Cayman Islands, Brazil, and Peru; the investment volume in Africa was USD 9.33 billion, accounting for 3.8% of the total and mainly concentrated in South Africa, Nigeria, and Zambia (Figure 3.3).

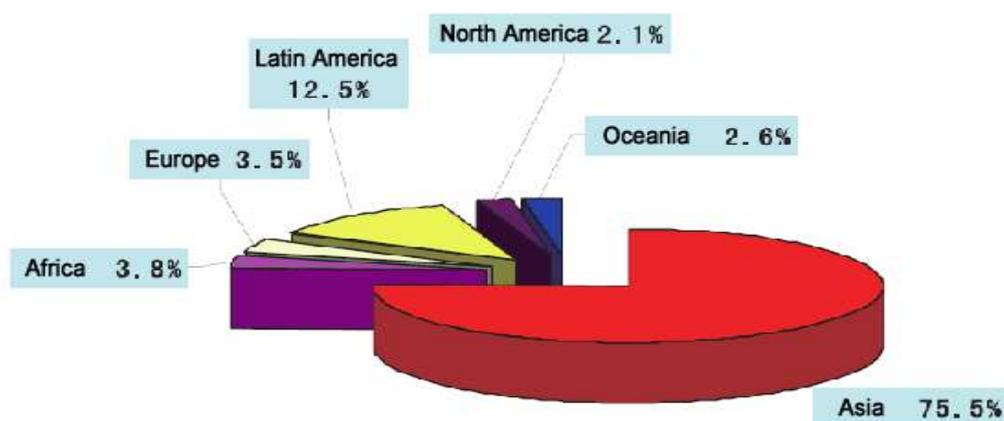


Figure 3.3 **Regional Distribution of China's ODI**
 Source: 2009 Statistical Bulletin of China's Outward Foreign Direct Investment, MOFCOM

From an ownership perspective, state-owned enterprises (SOEs) account for the

largest proportion at 69.2% of China's total ODI, followed by limited liability companies and shareholding limited companies, accounting for 22.0% and 5.5% respectively; while privately-owned enterprises account for a mere 1.0% (Figure 3.4).

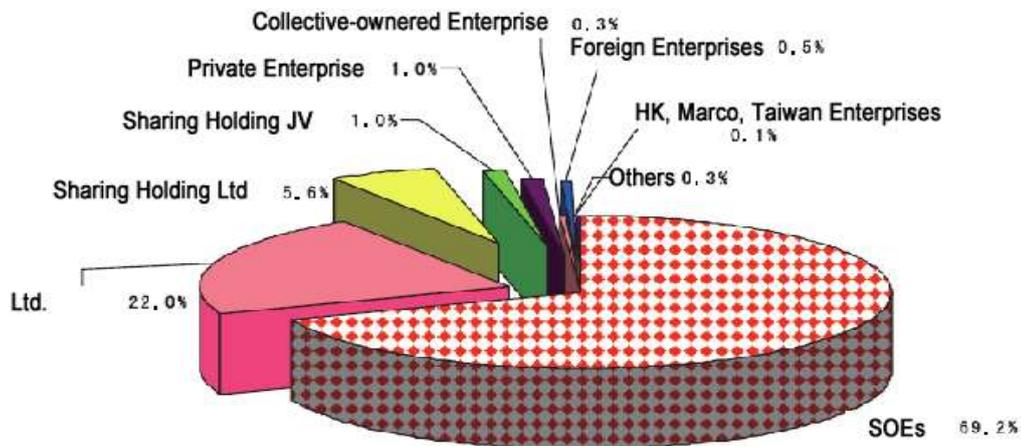


Figure 3.4 **Non-financial Volume of China's ODI at the end of 2009, by Registration Type of Domestic Investors**

Source: 2009 Statistical Bulletin of China's Outward Foreign Direct Investment, MOFCOM

3.1.3 Future Trends in Chinese ODI

Noticeably, China's sudden increase of ODI on free ports is the essential reason for the turning point of ODI. By comparing the overall Chinese ODI statistics and taking out the investment statistics of three ports (Hong Kong, British Virgin Islands, Cayman Islands), we can find that the major Chinese ODI results from the establishment of headquarters by inland enterprises or round trip investment on international free ports. If taking out investment on free ports, we can find that Chinese ODI increase rate is noticeably lower than overall increase rate and the former can better reflect changes of Chinese outbound investment.

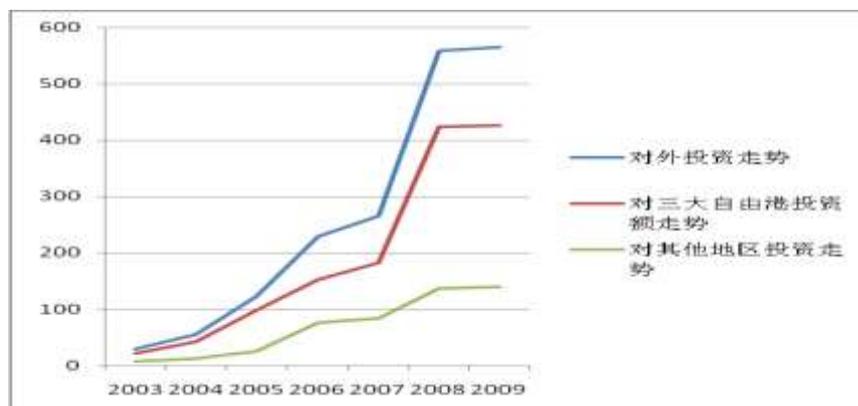


Figure 3.5 **Development trend of Chinese ODI and investment on three free ports**

China's "Going Global" strategy is the requirement of changing economic development pattern and accelerating industrial adjustment, the strategic method to alleviate foreign reserves pressure and improve international balance of payment and also the objective requirement of Chinese enterprises' international operation and participation in international competition.

According to the report by the UN IN 2010, China is counted as the second most potential investor (UNCTAD, 2010a). The global financial crisis does not hurt the confidence of ODI development. In 2009, ODI of non-financial sectors increases with the speed of 6.5% to USD 43.3 billion (Wang Chao, assistant of Chinese financial minister, speech on the 14th Chinese international trade and investment conference). In 2010, the estimated ODI by Ministry of Commerce amounted to 60 billion (no official source but the following-mentioned USD 60 billion is from Economic Research Guide 2008.26.41-46). Most of the ODI is from manufacturing, wholesaling, retailing and trade sectors of Asia, Africa and Latin America. Chinese ODI structure is gradually diversified and the amount of investment on services and technology-intensive industries are bound to increase. Mining and resources industry will continue to be the investment focus of Chinese enterprises.

According to the projection 2 of Institute for International Economic Research, National Development and Reform Commission on econometric model, by the year of 2015, the ODI of non-financial sectors will amount to USD 100 billion, the accumulated non-financial ODI will amount to over USD 400 billion; the ODI on developed economies in European and American countries increases by 50% over the same period of 2010, that on developing countries by 100%; ODI on manufacturing accounted for over 20% and private enterprises for over 50%.

China's ODI is gradually becoming more diversified as the number of technology-intensive projects continues to increase. China's ODI facilitates the export of merchandise related to its domestic production, while trade related to ODI plays a significant role in the growth of foreign trade. According to a UN survey in 2010, China ranks second in the world in global investment potential (UNCTAD, 2010a).⁶⁴ China's confidence in ODI was not dampened by the global economic crisis. In 2009, its non-financial ODI reached USD 43.3 billion with significant annual growth. The Ministry of Commerce predicts that China's ODI for 2010 will have totaled USD 60 billion. Most of the ODI flows to Asia, Latin America, and Africa and is focused on design and manufacturing, sales, and the retail and trade sectors. Mining and resource-related sectors are becoming the new focus of investment by Chinese enterprises.

⁶⁴ Yin-Wong Cheung, XingWang Qian, Shu Yu, China's Outward Direct Investment in Africa

As growth in ODI increases, so do complaints of environmental and social impacts.

3.2 Social and Environmental Impacts of China's ODI

3.2.1 Social Impacts and Challenges of China's ODI

3.2.1.1 Essential issues demanding concerns

The assessment of environmental and social impact of Chinese ODI is a complicated and arduous task. It can be an independent research topic focusing on social and environmental impact on particular country or region. For example, Chinese Ministry of environmental protection conducted the research in 2007 on social and environmental impact of Chinese ODI on ASEAN shows that different fields of investment have great differences of natural and social impacts. From the industrial distribution table below one can find that the social and natural impacts of forestry and mining investment are relatively high; while social impact of hydroelectricity investment is high, its natural impact medium; the natural impact of infrastructure construction is relatively high, social impact relatively low.

Table 3.1 Social and natural impacts of Chinese ODI on ASEAN

Industry	Credit	
	Natural impact	Social impact
Mining	7	8
Fossil fuels	6	5
Real estate	3	1
Hydro power	5	9
Infrastructure	6	3
Transportation	4	6
Forestry	9	9
Metal and non-metal	7	4
Fossil	7	3
Food	4	2
Biology and medicine	7	3
Paper-making	8	3

The topic is so large that it is difficult to cover it from a quantitative study stand point and data on it is scarce that it is almost impossible to make a reliable global assessment of it. So our research tries to analyze these important issues in this field by combining theoretical analysis, case analysis and field research.

China is increasing its investment on leasing and renting, commercial services, financial services, mining, manufacturing and infrastructure. International organizations are ready to admit the positive benefits brought by Chinese ODI to Africa (International Monetary Fund, 2010; UNECA, 2010; UNCTAD, 2010b). Although Chinese investment projects contribute to local economic development, the media is always raising concerns about Chinese ODI's social and environmental impacts on host countries and the international community. The major western medias generally offer a negative assessment on this and this study intends to analyze the objectivity of such views.

Environmental standard is an important criterion to assess Chinese ODI's environmental impact. China Import and Export Bank provides financing and investment for overseas projects. In terms of environmental standards, it will choose the higher standard between those of China and host countries. Yet many researches and studies show that Chinese enterprises usually have lower environmental standard. The study attempts to analyze and illustrate this issue.

Another discussion is that China's large state-owned enterprises usually adopt more stringent environmental protection measures, while small and medium enterprises are ineffective in the implementation of measures related to environmental protection or are even frequently responsible for polluting the local environment, particularly when environmental regulations are relatively weak. Some small and medium enterprises are accused of transferring high-polluting industries to the above mentioned countries in order to avoid domestic regulations. This study will test whether such facts are really true.

Some scholars believe that, Chinese investors' preference to employ Chinese workers in high value-added occupations, often leads to stimulating higher local unemployment rates. Concerns have also been raised about the negative effects of Chinese investment on the local government regulation, environmental, and political reform. The social impact analysis of Chinese ODI will evaluate the behavior of Chinese enterprises and their effect in terms of the minimum wage, medical benefits, employment rates, etc.

China's ODI in Africa is considered as strongly beneficial to local economies (International Monetary Fund, 2010; UNECA, 2010; UNCTAD, 2010b). In the past, the African continent had long been ignored by international investors. Chinese investment in Africa provides valuable alternative financial resources, improved infrastructure, increased local productivity, increased exports from African countries

and improvement of people's living standards. China's African ODI contributes to economic development and diversification in the manufacturing, mining, construction and other areas of trade. It also creates a great number of jobs. Africa will become an importa and typical case study for this area.

The study questionnaire showed that although 94% of respondents believed that Chinese enterprises investing overseas promote local economic development, but 40% of the people thought that Chinese enterprises caused problems, mainly ecological and environmental deterioration and pollution, followed by reducing local employment and slow development of local enterprise.

3.2.2 Social influence and major challenges concerning China's foreign investment

China's ODI has created a large number of job opportunities for host countries, but there is still room for improvement in the employment structure it provides.

In Cambodia and Vietnam, investment by the Chinese in manufacturing is concentrated in labour-intensive manufacturing. In Cambodia, the 27 Chinese manufacturers surveyed have a total of 26,439 employees, 98% of whom are Cambodian. In Vietnam, the 33 Chinese enterprises surveyed have provided a total of 10,020 jobs, 95% of which are held by Vietnamese⁶⁵. The labour structure within an enterprise may vary according to the level of technical intensity. In Cambodia, local employees account for less than 30% of the intermediate and senior positions as most of the senior executives are Chinese. This situation can be attributed to Chinese investors' belief that local candidates are lacking in skills and experience. Therefore, the clothing industry and Asian enterprises have come to a consensus that Chinese nationals should constitute a large proportion of supervisors. However, communication difficulties and cultural differences between these Chinese nationals and local Cambodian workers sometimes lead to labour unrest and strikes, and Chinese supervisors cannot easily solve these problems. The case in Vietnam is the opposite, as 63% of supervisory positions are held by Vietnamese. The major difference between Chinese enterprises operating in Cambodia and Vietnam is the gap of education level between these two countries. In Vietnam, Chinese enterprises would rather employ Vietnamese than expensive overseas Chinese as executives as it costs less for to train their Vietnamese employees for these executive positions.

Governments of many countries require Chinese enterprises to provide a certain

⁶⁵ EU-China Civil Society Forum, *The Impact of Chinese Outward Investment*, Published on 2 March, 2011, Viewed on 13 Oct, 2011:
http://www.eu-china.net/.../11-03-02_Impact%20of%20chinese%20outward%20investment.pdf

proportion of employment opportunities for local workers. For example, the host country of the national stadium project in Costa Rica demanded that the project be completed within one year and that no Chinese workers should be involved. (In the end, only Chinese workers were employed and the stadium was finished in two years).⁶⁶

Many countries hoped that Chinese investment could create employment opportunities for the country, but the quality of labour and labour productivity differ from country to country, which often leads to failed expectations. Many countries ask the Chinese investment enterprises to provide a certain percentage of local staff employment but such demands are oftgen difficult to fulfill. Chinese investment in India mainly focused on road construction, infrastructure and power plant construction. However, in order to increase employment rates for local residents, the Indian government decided to restrict labour inflows, especially from China. New immigration policies required that every Chinese employee with a work visa to return to China after completing the work project. Chinese investors who are doing business in mining and forestry in the Russian were required to hire local engineers and drivers. But these people often cannot guarantee to work on time, because of frequent drinking. Chinese investors had to employ Chinese workers to finish the work while they had already employed Russian workers.

In terms of wage and social security, the host country and the international media often complain about low wages of Chinese enterprises and inadequate social protections. This research group found in Africa that the wages of Chinese invested enterprises were quite variable depending on the industry and the region. In the mining industry, the wage provided by Chinese invested enterprises was in some cases higher than the host country's minimum wage, such as was seen in Zambia. The TF found that the mining workers were firly satisfied about their wages in a private conversation. At the same time, Chinese investors provided better health care systems for the miners, in which the whole family of one worker could obtain medical assistance. However, in the case of the textile industry in South Africa, both Chinese investment enterprises and other countries' investment enterprises provided wages that were lower than the minimum wage in South Africa. This shows that the wage levels of workers are closely related to industry profitability and industry wage levels, and the wages of different country's enterprises in the same industry can also be different, but this difference is relatively limited, not substantially different.

The cultural challenges faced by Chinese enterprises pose a major barrier to their development. Chinese enterprises investing overseas are faced with an unknown environment featuring totally different commercial practices, not to mention managerial, financial, and cultural rules that differ from those on China's in green field investment as well as mergers and acquisitions (M&A). For example, studies of M&A of Chinese enterprises in Germany show that the most important factors in

⁶⁶ Older Entry, *Costa Rica Insight*, viewed on October 13, 2011, <http://costaricainsights.wordpress.com/page/2/>

managing overseas acquisitions are staff integration and narrowing the cultural gap between Chinese investors and the corporate protocols in Germany⁶⁷. In order to improve purchasing volume, SOEs need try to cater to their culture and know the society, environment and legal supervision in the host country.

In Zambia, many of the local complaints from community and labour representatives centered around misunderstandings and social disputes occurring between Chinese and local people due to a lack of dialogue and cultural exchange. These seemingly superficial crises often led to deep resentment, xenophobia and hysterical media accounts that were based it would appear on misperception and a lack of communication. In order to improve the performance of an acquisition, Chinese enterprises must make a special effort to better integrate with their host community in order to prevent and resolve cultural differences; and create links with the local society, its stakeholders, its government and NGO representatives, as well as the country's environment, labour, and regulatory officials.

The performance of ODI may vary greatly depending on circumstances, and even well-planned direct investment projects may be confronted with unexpected difficulties due to differences in culture and management practices. For example, TCL found itself in a very difficult situation after its acquisition of Alcatel in France due to unexpected problems in managing local staff; Shougang Group was challenged by strikes and conflicts between investors and labour in South America; Shanghai Automobile Industrial Corporation (SAIC) also had similar experiences after its acquisition of Ssangyong Automobile in South Korea in 2004 and failed in its negotiation with the labour union on wages.

Likewise, during the TF field trip to Indonesia, the team visited the Pertamina-Petrochina joint oil desulfurization unit in Bojonegoro, East Java. While the company had serious accidents in the past, management was proud to show that it had reduced its accident rate to zero since the arrival of the Chinese partner. Nevertheless, they had suffered a lot of complaints from the field as Chinese drilling rig equipment had no safety notices in either English or Bahasa Indonesia (Indonesia's official language). A small detail considering the size of the investment, but it led to false allegations that the equipment was not safe and performed below par. The local media amplified these issues creating the false image that Chinese drilling rigs were of low quality and Petrochina's drilling teams were not concerned with worker safety.

China's ODI enterprises suffer from a lack of expertise, experience and preparation. Poor confidence and inadequate experience in cross-border investment in a strictly regulated environment with complicated market administration have proven the lack of necessary expertise of Chinese enterprises. Examples include the joint-venture of SAIC and Ssangyong Automobile in South Korea and the recycled

⁶⁷ Kay, Li Kuen Andrew, *International Exhibition Organizers in China and Their Performance*, The Hong Kong Polytechnic University, Published in June 2007, <http://www.cpexhibition.com/introd/Kay%20DBA.pdf>

steel plate project operated by Baosteel in Brazil. However, although increasing globalization has exposed the limited expertise of Chinese enterprises in large-scale Western-style acquisitions, many destinations of Chinese ODI—especially Africa and Asia—still feature weak organizational structures, flawed intellectual property rights protection, government intervention, and different corporate management systems. Western multinationals are comfortable operating in stable markets with transparent regulations, while their Chinese counterparts are better equipped to operate in more complicated and unclear regulatory frameworks. This could be considered one of the unique advantages that have helped China develop innovative and country specific relationships with African countries. Its business expansion in that continent has become a strong example of its “Going Global” strategy.

China is still suffering from the negative effects of its ambiguous definition of property rights, a lack of a clearly defined regulatory mechanism for the private sector, flawed corporate governance, and inadequate experience in international business. Private enterprises in China are relatively weak in seizing ODI opportunities. Their senior management need to be trained to enhance corporate governance in line with international practices. In countries with mature institutional systems, the costs of contracts and other legal supports are relatively low, making them effective in building relationships, yet Chinese enterprises need more time to be adopting them.

Their global presence will inspire changes in Chinese enterprises, especially those who have entered developed countries and compete in high-end product markets. How should Chinese enterprises establish their own identity on a global scale, designing suitable business models adapted to the realities of different countries while enhancing corporate governance both at home and abroad? How should Chinese enterprises improve the quality of their products and services as well as corporate governance while competing for market share and developing an institutional system in China? What modern governance system is suitable for the trajectory of development in China? These questions will exert profound influence on the development of Chinese enterprises in the foreseeable future.

3.2.3 Environmental Impacts and Major Challenges of China’s ODI

Environmental Impact on Forest and Biodiversity

Research into the environmental impacts of China’s ODI considers the exploitation of natural resources and the degradation of biodiversity. For example, China’s investments in Southeast Asia and Africa are concentrated in environmentally-sensitive sectors (e.g., petroleum and gas extraction, mining, hydropower, and forestry) and infrastructure projects (e.g., highways, railways, electric-power and transmission lines). The Kunming-Bangkok Highway, an important corridor for trade and investment and a facilitator of interaction between China and Southeast Asian countries, is significant for economic prosperity and

development. However, environmentalists believe the highway has damaged local biodiversity. A Chinese enterprise built a rubber plantation in the “Golden Triangle,” to help Burma and Laos replace the cultivation of cash crops and illegal logging in an opium-based economy, as the governments try to eradicate drug abuse and poverty. However, similar allegations of local biodiversity damage have also been leveled against the Chinese. There is clearly a need to study how to better assess those projects.

China is the second largest importer of timber in the world. Chinese logging companies have expanded around Southeast Asia, West Africa, and in the Amazon region. Approximately one third of such imports is intended for processing and re-export to G8 countries. Exports from Africa to China have been rising quickly, and it is estimated that 70% of these exports are from Gabon and Equatorial Guinea. Russia has also become an increasingly important source of timber to China. Illegal logging and certification are of great concern to the international community⁶⁸.

During the TF visit to the East Kalimantan region of Indonesia, the team assessed the impacts of China’s growing trade in coal and palm oil; China is Indonesia’s second buyer of palm oil. Increasing demand for the oil, coal and the lucrative nature of the international market, combined with weak public governance at the domestic level promote illegal logging, deforestation, and the rapid conversion of forest land into coal mining and palm oil plantations in Indonesia. This type of coal and palm-oil operation has caused massive ecological damage and adverse social-economic impacts to the region and to local communities. Yet, China is more interested in importing the raw natural resources for domestic processing, while leaving the responsibility of the upstream impacts of this business, such as illegal logging and degraded forests, entirely in the hands of the host country

Challenges in Environmental Standards Compliance

A pre-project evaluation of environmental impact; the implementation of environmental measures during a project; and environmental assessment after completion are required for all projects funded or financed by the China Export-Import Bank⁶⁹. China’s environmental standards are compared with those of the host country, and the higher standards are adopted.

Research conducted by the CCICED team in Zambia found that the energy consumption of copper production per MT in Luanshaya Copper Mines—in which China Nonferrous Metal Mining (Group) Co. is investing—is 186 MTce with the application of the most advanced technology and equipment from Australia. At the

⁶⁸ Prof. Sun Siheng, State Forestry Administration, *A Guide on Sustainable Management and Utilization of Oversea Forest by Chinese Enterprises*, Published on 8 September, 2010

⁶⁹ China Intelligent Online, *China Environmental Protection Industry Overview*, Published on 2008, Viewed on 13 Oct, 2011, <http://www.slideshare.net/chinaintel/china-environmental-protection-industry-report-2008>

same time, the energy consumption of copper production per MTce is 260 MT of standard coal equivalent at China-Yunnan Copper Co., Ltd. and Jiangxi Copper Co., Ltd. This case shows that environmental standards adopted by the enterprise in Africa appear superior to the standards applied in China.

Many well-known Chinese enterprises, managing environmental concerns, have taken the initiative to adopt ISO14000 environmental standards and the ISO26000 guiding principles of social responsibility. However, problems in compliance with environmental standards may exist with some medium-sized and smaller enterprises (SMEs) due to their limited environmental awareness, economic strength or other reasons. While some developing countries in Asia, Africa, and Latin America are developing stronger environmental awareness, with environmental standards that are increasingly aligned with the international mainstream, the environmental behavior of Chinese SMEs still often lags behind such mainstream levels. Whether the companies are large, medium, or small-sized, they are representing Chinese interests and respect for the environment should be part of their way of doing business. This should be the case regardless of whether or not the Chinese government provides foreign aid, capacity development, or other assistance to the developing host country.

3.3 Related Roles Played by Major Stakeholders in Reducing the Social and Environmental Impacts of ODI

3.3.1 China's ODI Enterprises

When it comes to the adoption of modern social and environmental approaches to their ODI activities, Chinese enterprises still appear to be 15–20 years behind their western counterparts. This is perhaps due to the more active role of influential NGOs in the west. At present, Chinese some enterprises are making a considerable effort to invest in environmental enhancement and projects to advance social well-being, yet there is a major gap in capacity and roles between state-owned and private enterprises. Generally speaking, the social and environmental performance of large state-owned enterprises is somewhat better. Considering that over 70% of Chinese ODI comes from large state-owned enterprises and only 1% from medium- and small-sized enterprises, it is easy to conclude that the overall environmental and social impact of Chinese ODI is largely in the hands of the government.

In recent years, China has actively promoted policies that stress the adoption of social and environmental commitments by FDI and ODI enterprises. For example, in 2007, China's import and export bank (EXIMBANK) promulgated the "Guiding opinions on the environment and social evaluations of EXIMBANK loan projects." That same year, the China Banking Regulatory Commission printed and distributed "Opinions on consolidating the corporate social responsibilities of the banking industry and financial institutions," requiring that large-scale banks abide by the 10 basic principles

of CSR advanced by the UN Global Compact. The Commission also asked these banks to prepare CSR reports to articulate their activities. In 2007, the Ministry of Environmental Protection, together with the People's Bank of China and the China Banking Regulatory Commission issued documents that established China's Green Credit Policy. The International Finance Corporation (IFC) Performance Standards and the Equator Principles were identified as international guidance documents that Chinese banks can refer to in their implementation of the Green Credit Policy.

In addition, in order to encourage the enterprises to engage in CSR activities, in December 2007, the state-owned Assets Supervision and Administration Commission of the State Council distributed the "Guiding opinions on the exercising of corporate social responsibilities by state-owned enterprises," and proposed that as Chinese enterprises "go global," they should help host countries modernize and implement their environmental regulations. The international trend towards more environmental considerations in international agreements is quite clear and China should be fully engaged in contributing to its development.

3.3.2 Central and Local Governments of Host Countries: Sharing Responsibility for Regulation and Enforcement

Chinese enterprises generally abide by the laws and regulations of the host countries in which they invest, hence it is the central and local governments of the host countries that should play the major role in regulation. A Canadian governmental official, while analyzing the positive and negative impacts of China's investment in the mining sector of Canada, said that China-based overseas investors are beginning to learn to abide by local laws and regulations with no apparent difference from other industrialized countries⁷⁰. In the bidding efforts for investment in Rio Tinto in February 2009, the president of Chinalco endorsed the sustainable development pledge of Rio Tinto⁷¹. In Indonesia, the local Regent of Bojonegoro, East Java, told the TF team visiting Petrochina's oil exploration operations that they were taking voluntary actions in relocating schools and communities as well as financing mobile libraries for the local populations (together with EXXON-Mobil) in order to spare them from the pollution and dangers of living in close proximity to oil desulfurization plants and crude oil production wells. These actions were very much appreciated and widely recognized by the local communities.

On the other hand, there are reports of Chinese enterprises, especially small private enterprises, turning a blind eye to environmental requirements or bribing local

⁷⁰ Prof. Sun Siheng, State Forestry Administration, *A Guide on Sustainable Management and Utilization of Oversea Forest by Chinese Enterprises*, Published on September 8, 2010

⁷¹ UNCTAD, *World Investment Report 2009*, Published in 2009, United Nation Publication, ISBN 978-92-1-112775-1, http://www.unctad.org/en/docs/wir2009_en.pdf

officials. An increasing number of NGOs and civil society organizations criticize Chinese enterprises for failing to comply with local laws and regulations. The solution requires, in part, the application of a transparent and accountable system to the public in the host country and improvement in the administrative capacity of host governments to enforce their laws and regulations.

3.3.3 Central and Local Governments of China: Sharing Responsibility for the Environment

As China positions itself to become a major global player, central and local governments are beginning to require Chinese enterprises to improve their environmental performance and enhance their social contribution in an effort to safeguard China's image and promote sustainable global investment and business. Progress in policy-making, legislation, and standardization in China is an important driving force for Chinese enterprises to meet environmental and social goals. In particular, the Chinese government requires enterprises to conduct clean production auditing on a regular basis, which effectively improves their environmental performance. And Chinese enterprises, state-owned and private, are actively engaged in improving their governance and ameliorating their environmental and social impacts at the urging of government. A positive example is that China's Forestry Administration issued A Guide on Sustainable Overseas Forests Management and Utilization by Chinese Enterprises to provide guidance on investment and operations of China's ODI in host countries in consideration of sustainable development, environmental protection, and CSR.

3.3.4 Non-Governmental Organizations

Non-governmental organizations may monitor ODI and ensure that these investments will not exert negative impact on local environment and society. Of all Chinese ODI activities, two major areas are of particular concern: natural resources, such as coal, wood, petroleum, natural gas, etc.; and construction projects, such as building highways, hydro-dams, water supply reservoirs, electric-power and distribution systems, public housing, etc. Both types of investment have important social and environmental impacts. Therefore, enterprises must exert the utmost diligence in avoiding such impacts, compensate for any damage by restoring and rehabilitating damaged sites, and offer additional compensatory facilities such as new schools and hospitals that can somewhat mitigate impacts. These proactive steps in a "going global" project are likely to be acknowledged by the beneficiaries of such investments and lead to a more positive perception of China by the residents of the host country. Local stakeholder organizations and international NGOs may play a role monitoring such actions and controlling malevolent or corrupt and defamatory media campaigns against Chinese interests.

3.3.5 Media

The strong and committed environmental governance efforts of some Chinese enterprises involved in ODI projects have produced quite visible positive results as

Chinese enterprises assume greater CSR initiatives. For example, the China International Marine Containers (Group) Ltd. has adopted the UN Global Compact Environment Statement; China National Petroleum, Sinopec, and CNOOC have adopted a series of rigorous environmental protection standards; and the Industrial Bank of China has become the first Chinese bank to adopt the Equator Principles. Yet international media tend to focus mostly on criticizing the environmental performance of China's outward investments, which raises suspicions about the country's strategy of "going global." Furthermore, there is little coverage about Chinese ODI in the Chinese media, and even less coverage about the environmental and social impacts of such investments. An improved Chinese media focus on the efforts made by Chinese enterprises to minimize their negative environmental impacts will help create a more accurate image of Chinese ODI and help reduce the negative perceptions transmitted by the international media.

3.4 Examples of the Positive Contributions of Chinese ODI

3.4.1 China's ODI in the Natural Resource Sector

The investment by Chinese state-owned enterprises in the natural resource mining and petroleum sectors of some South American countries has had significant impacts on local societies, economies, and their environment. At first, those impacts tended to be negative, but as the firms adjusted their CSR strategies and policies, positive impacts began to gradually manifest themselves. Andes Petroleum Ecuador Ltd., a joint venture of CNPC and SINOPEC, for instance, is a symbol of China's cooperation with the central government of Ecuador. The company plays an active role in the alleviation of tensions between the local government and its residents. Shougang Hierro Peru S.A.A. has also reversed its early negative impact on the social development of the Peruvian community where it operates by deciding to adopt a proactive approach to addressing local social issues it used to ignore.⁷² In Indonesia, on the other hand, the TF team witnessed considerable environmental degradation related to surface coal mining activities in East Kalimantan intended to supply Chinese trade. Over 24% of imported coal in China in 2009 was from Indonesia, and Kalimantan accounts for a majority of coal production in Indonesia. In 2005, East Kalimantan's share was 51.7% and South Kalimantan was 41.2%. Significant production increases in recent years have occurred to supply the export market at more than 75% of national coal production. Most of that goes to China, which is blamed for the resulting environment damage to Indonesia.

3.4.2 China's ODI in the New Energy Sector

China's ODI enjoys great opportunity in the new energy sector. In Africa and developing countries elsewhere, Chinese low-carbon technologies and products are particularly competitive with advantages ranging from low costs, limited infrastructure requirements, low emissions, and high economic returns. Compared

⁷² Julie Jiang & Jonathan Sinton, *Oversea Investments by Chinese Oil Company*, International Energy Agency, Published in February, 2011, <http://www.iea.org>

with advanced technologies and products in western countries, Chinese companies are better equipped to facilitate green development and the required economic shift in developing countries. Installing a Chinese low-carbon solar water heater is one-third the cost of installing an average water heater. Likewise the extensive palm oil plantations being stimulated by China's appetite for vegetable oils could also provide a unique resource for renewable energy through biodiesel applications. The TF team visited a small, privately-owned Chinese steam boiler and electric turbine producer on the outskirts of Jakarta (ZUG POWER GROUP, PT. ZUG Industry Indonesia). The firm was anxious to receive some form of incentive to produce small off-grid power plants that would use their equipment and supply renewable energy to isolated communities. The new energy resource sector will become an increasingly important target for Chinese ODI.

3.4.3 China's ODI in the Infrastructure Sector

The cost for Chinese enterprises to invest in the infrastructure sector is up to 50% less than it is for their European and American competitors. At present, Chinese investors are interested in water storage projects, especially hydro-dam construction projects in Southeast Asia and the Middle East, including the Stung Cheay Areng Dam on Cheay Areng River in Cambodia, the Shweili Dam Project in Myanmar, the Aswan Dam Project in Egypt, and others. Although dams and water reservoirs will generate agricultural benefits, they also create an impact on the local environment and society. It should be noted that the investor and property owner of dam projects are usually the host country governments rather than Chinese enterprises, which are mainly involved in construction and finance. For those mid- and small-scale hydropower projects with a capacity below 60 MW, Chinese investors are the key players as developed countries have decided not to explore this market. As a result, Chinese project builders are often the target of media and NGO criticism when in fact the responsibility for the project is mostly in the hands of the host countries, and only very rarely in those of the Chinese investors and contractors.

3.4.4 China's ODI in the Forestry and Agriculture Sector

Old growth forest exploration causes loss of native forest-related biodiversity and promotes the disappearance of local culture. A Chinese enterprise built agro-forestry projects in the "Golden Triangle," an area on the boundary between Thailand, Burma, and Laos, to help replace the opium-based economy with cash crops and commercial timber. This ODI project is killing two birds with one stone, as it aims to control the drug flow into China while cracking down on drug abuse in the host country. There are approximately 40 Chinese enterprises (including eight major rubber companies) operating in Northern Laos under the guidance of anti-drug policies.

A positive management model in forestry will also promote the healthy development of the forest ecological system. For instance, a Chinese enterprise in British Columbia, Canada, has harvested mature and post-mature forests in compliance with the law

regarding reforestation, thereby meeting governmental standards⁷³. Managers of Chinese enterprises have gradually grasped the complex nature of the forest ecological system, and the activities of Chinese enterprises have also triggered extensive interest among local residents in the forestry sector. Take another Chinese enterprise in Russia for example. After purchasing the Far East Forest company in Russia, it managed the firm's logging activities through sustainable harvesting methods which reduced the amount of waste wood logged annually; and recycled low-value wood for sawdust and chips for pulp/paper making, thereby enhancing the efficiency rate of the resources. Similarly, two Chinese enterprises have located their headquarters respectively in Indonesia and Brazil and built overseas factories to process wood into pulp. Lands for cultivation of the timber supplies are secondary, low-return, and infertile forestlands where the wood coverage is below 20 m³ per acre. These enterprises conscientiously fulfill their pledge to protect biodiversity in high conservation value forests as in all typical forest ecosystems.

3.4.5 Field Trip Research in Indonesia, South Africa, and Zambia

In order to get first-hand information, the Task Force carried out field trips to Indonesia, South Africa, and Zambia (see Annex 1 and 2 of this report for a detailed and illustrated account of the separate field trips). In general, China's ODI seemed to be greatly appreciated by local governments. It is also welcomed as China's ODI is also seen as an opportunity to help achieve local sustainable development targets. Both the scope of trade and investment as well as its rapid pace of development has accelerated greatly in recent years, placing new challenges before China's ambitions. If Chinese enterprises want to improve the performance of acquisition, China needs to bridge the cultural difference and be familiar with social, environmental, legal and regulatory system of host countries.¹³

In Indonesia, China's ODI enterprises have demonstrated some very good practices, which have led to the construction of new schools, new housing developments, hospitals, and road infrastructure. However, when compared with other ODI, China's investments are generally less well accepted than western investments. They often rank lower than even Indian and Japanese investments. One of the reasons seemed to be that Chinese investors rarely invest downstream into the markets when they are exploring for minerals or oil & gaz, for instance. They will extract the resources and ship them away. As an example, Indian investors, instead, are more inclined to invest downstream building local fertilizer plants or LNG bottled gas distribution networks. Indian investors integrate more into the economy and society. SMEs' improper practices are generally responsible for damaging the reputation of China's ODI, although certainly problems are not restricted to SMEs. The lack of communication by some Chinese ODI enterprises, large and small, and their tendency to live in an isolated way inside the host communities are further reasons why some have difficulty in gaining acceptance and admiration. The case of Indonesia was somewhat different

⁷³ Prof. Sun Siheng, State Forestry Administration, *A Guide on Sustainable Management and Utilization of Oversea Forest by Chinese Enterprises*, Published on September 8, 2010

as the team observed many instances where Indonesians, Indonesian-Chinese and Chinese overseas entrepreneurs share common cultural roots, cuisine, and living habits, which did, in fact, facilitate dialogue.

In South Africa and Zambia, the image of China's ODI also aroused some concerns. The Task Force team visiting South Africa read about media stories denouncing the behavior of "bad Chinese" investors. Indeed, it was later discovered that they were Asians, but not Chinese. China is far away from Africa and so the lack of cultural communication led to many misperceptions and caused needless stress. Most of China's ODI enterprises are state-owned enterprises running under a top-down management system. While they do not develop sufficient connections with other local powerful organizations, such as the labour unions, other stakeholder groups, or NGOs, they pay greater attention to maintaining good and strong relations with local government representatives. The lack of communication with these local community and social organizations is one of the great hurdles faced by China's ODI enterprises. China's ODI enterprises should be better equipped to overcome such hurdles before going global. In one of the South African site visits of the TF delegation, the highly-efficiency fully integrated PET recycling operation established by Chinese investors (Sen Li Da) made important contributions to solidifying China's positive image with the local population as it helped create jobs and clean up the environment. The environmental protection industry is expected to become a promising area for Chinese ODI.

3.5 Policy intention

Chinese foreign investment will not only help to meet the goals of the Twelfth Five-Year Plan, but it can also help boost green development and transformation in host countries. In fact it will be consistent with the development goals of the host country, the Millennium Development Goals and other relevant international sustainable development goals.

3.5.1 China should combine its "Going Global" strategy with the promotion of social development in the host country while strengthening at the same time its environmental protection.

In the implementation of the "Going Global" strategy, the expansion of foreign aid, building of infrastructure, hospitals and schools all promote social development, which has successfully formed a positive development model which in Asia, Africa and Latin America has achieved a high degree of success. With China's growing economic strength, the country will continue to promote the implementation of its Going-Global strategy, which will require that it also gradually expand the scale of its foreign aid. This is especially important for some developing countries where it will be able to provide much needed social assistance and preferential loans, making China's overseas investment not just a for profit business activity, but also a contributor to promoting the host country's environmental protection and social

progress. Construction of special economic zones can also be used in a similar manner. By applying the SAR methodology, China can build factories, help resettle workers, reprocess SAR environmental pollutants, all of which is not only beneficial to the urbanization process and social progress of host country, but helps build as well a good working environment, conducive to reducing costs and risks of Chinese enterprise's ODI.

3.5.2 China should formulate more relevant policies and regulations that help enterprises promote green oversea investment.

China is in urgent need of setting up regulations and guidelines for green foreign investment, aid, loans, and establishing and adding policy guidelines and regulations for the "Going Global" enterprises so that China's maintains a high degree of consistency in its "green development" strategies. In particular, the central government needs to establish regulations on environmental protection issues for overseas investors, build up a more transparent, user friendly operating national standard, as well as clear implementation procedures, methods of supervision and public appeal systems. China should develop "measurable, reportable and manageable" statistics and evaluation system while gradually establishing tighter standards in cooperation with developed countries. The government needs to develop environmental guidelines for foreign-invested enterprises, taking the environmental impact assessment, protection agreements, compensation for ecological damage, corporate social responsibility and other factors into the investment decision-making and management processes. Such action should contribute to improve the "soft power" of our country on the international stage,

New "corporate social responsibility guidelines" (CSR) should be established so that China's own standards and internationally recognized corporate social responsibility elements remain consistent. The guideline should emphasize the developing areas with environmental, social and sustainable development not supervised by China, or those whose regulatory levels are lower than the internationally recognized standards. The guideline should encourage Chinese ODI to undertake environmental and social responsibility, align environmental and social issues in the country with those of the country. Voluntary regulations making, active implementation of environmental and social responsibility should be encouraged in the banking and financial services areas, research and development, tax and fiscal policy, etc. Domestic departments should punish Chinese enterprises which do not comply with corporate social responsibility regulations and damage the image and reputation of overseas companies. For example, in issuing permits and inspection qualifications to overseas investment enterprises, the competent authorities should consider suspending or revoking the license status of foreign investors, who do not apply and observe corporate social responsibility rules.

Through the improvement of policies and regulations, the behavior of Chinese foreign investors could be standardized, enabling Chinese enterprises to maintain corporate

social responsibility standards in the process of "going out". Enterprises should invest and carry out production within the local laws, regulations and policies. Enterprises should obey the local ecological environment protection laws and regulations, especially in the exploration of resources, enterprises should take effective measures to prevent impact on the local ecological environment; enterprises who implement the "Going Global" strategy should negotiate with the government on the percentage of local staff, and they should shoulder responsibilities while they contribute to the development of the country.

3.5.3 Increasing transparency, strengthening PR, communication and cultural exchange to improve international image

Overall, China's ODI has been welcomed warmly, but often because of lack of communication and promotional investment behavior, it draws negative perceptions. In particular the Western mainstream media's assessment of China's overseas investment is rather negative. China's overseas investment policies and related processes need to work on increasing transparency of their actions and efforts should be made to facilitate their understanding and appreciation by the international community. During the overseas inspection, the group witnessed a number of overseas Chinese companies taking positive action, but there is little public awareness of these actions by the host country. For example, the China Nonferrous Metals Group copper smelting business case in the Zambian Copper Belt region, near Kitwe, is a state of the art modern industrial operation, established and managed with exemplary social and environmental considerations, yet little is publicly known about it.

Openness and transparency will promote Chinese foreign investment enterprises to develop good relationship with local stakeholders, businesses, community groups and citizen representatives, and to help safeguard the interests of Chinese investors. If they are properly run, these activities will not only ensure that foreign investment from China is widely trusted in the host country, but also help China's overseas investments get relative fair evaluations. Chinese overseas investment enterprises should integrate themselves into the host society, be consistent with local stakeholders' interests, and improve the quality of products and services provided to the host country with special emphasis on environmental protection and sustainable development. These actions require fully-prepared investment managers, better implementation policies and better communication and exchange of ideas.

Chinese overseas investment enterprises should be fully prepared for the "going global" policies, and play active roles in green development in the host country. China should encourage foreign investment to go in the direction of great development potential and green investment with huge potential. It should systematically improve communication, eliminate prejudice and discrimination. China could clearly play an important role in the green transformation of the host country, especially in the case of green transformation in developing countries. China should set up more channels to

obtain information and feedbacks on Chinese foreign trade and overseas investment. It is necessary for the Chinese government to coordinate various departments, and work with commercial, economic offices of their Embassies, together with educational institutions, business associations and NGOs. The government should collect overseas information, good and bad, and announce the results in a timely fashion. China should learn from successful cases of other nations and absorb the experience of other multinational enterprises in sustainable development.

China should jointly establish a new dialogue platform with host countries that will help solve specific operational hurdles. The TF representatives who visited the three foreign countries have put forward this demand quite strongly. The platform should be independent and permanent. Its purpose is to facilitate exchange of information by strengthening exchanges between China and host countries and enhance mutual understanding of issues that are commonly addressed by both, goals of China's overseas investment behavior and its impact. This platform can be built in or out of the traditional and formal international mechanisms (such as "China-Africa Cooperation Forum" and "ASEAN plus China's multilateral cooperation platform") and promote the barrier-free exchange between countries, help promote understanding of people from all walks of life, enhance commercial exchanges and strengthen communication ties in areas of the environment, education, social and cultural aspects. People in the host country should have more opportunity to participate in such dialogue

3.5.4 Establishing China's overseas investment promotion organization and evaluating system, helping government to better supervise overseas operating activities of SOE of large scale and SME

China should learn from the successful experience of developed countries and establish overseas investment promotion agencies. China should promote the implementation of the "Going Global" strategy, at the same time assess its impact on local environmental, social, economic and poverty impact, and develop international training, seminars, information and data communication, public participation and assistance programs. It can, for instance, consider using corporate social responsibility (CSR) performances to rate its overseas investment corporations. The establishment of such a framework can benefit from the experience of the Ministry of Commerce, the NDRC, SASAC, the Ministry of Environmental Protection, Bureau of Forestry and the CBRC, to learn from their experience facing environmental and social standards by overseas investment enterprises. The host country and China could

consider joint performance evaluation and rating of foreign-invested enterprises in accordance with corporate social responsibility.

This information must be publicly available in the country and the host country. China should provide more policy incentives to enterprises, which take more social responsibility, such as tax breaks, preferential financing or customs clearance and so on. The information should be shared in assessment by Ministry of Environmental Protection, Customs, Industry and Commerce Bureau, Taxation, the CBRC, embassies and consulates in China and the host countries' reliable civil society groups. China should try to carry out regulation and supervision from the "going global" state-owned enterprises. Dialogue platform will also be able to encourage other national governments to regulate and supervise investment enterprises. The Chinese government should encourage Chinese investment in SMEs in the host country to obtain legal status, and ensure they have a reasonable ability to operate in foreign countries. Chinese government should require SMEs to register their business activities in the local Chinese consulate or embassy upon arrival in the host country. Their behaviors abroad must meet national requirements and should be easier to supervise.

3.5.5 Promoting oversea investment enterprises to better exercise corporate social responsibility

China needs to work together with the international community and businesses and guide foreign investment to promote the green transformation on the basis of non-discrimination. Chinese overseas investment should try to bear a relatively higher standard of corporate social responsibility. If the host country of China's overseas investment is a developing country, the ODI enterprise should at least abide by relevant Chinese laws and regulations when the standard provided by local environmental law is lower than international advanced levels. Domestic companies with oversea business should take appropriate measures to protect the environment, and shoulder more corporate social responsibility, in order to improve the quality of overseas investment. Based on China's overseas investment goals and green development, China should not only maintain its current growth patterns, but it must also guarantee that its overseas enterprises assume and observe social responsibility and environmental sustainability standards, which will benefit the people and the economy of the host country. China's state-owned enterprises can play an active role in this process.

Active use of market instruments to improve the compan's management environmental awareness and capacity.

As the main actors of China's foreign investment, enterprises should strengthen their management's awareness of environmental issues, improve management capacity, focus on environmental behavior and the establishment of some demonstration projects. Chinese enterprises should invest in the establishment of prevention system to avoid adverse social and environmental impact, and not just depend on post-fact remedial action. For this purpose, such entities as the Export-Import Bank, Development Bank, China Investment Co. Ltd. and other Chinese policy financial institutions should be strengthened in terms of CSR and environmental awareness. They should provide specific development assistance, to help develop credit, micro-financing, and general hand-holding support through the development of strategic plans which must be spread throughout their branch and agency networks. Chinese and the international NGOs active in in China's foreign investment and environmental protection, can play an active role in this green and CSR transformation. The government of China should encourage these organisations to participate in the going global process.

The training of overseas investors must be intensified in order to continue to improve their control of the investment risk as well as the social and environmental impacts of their actions.

To encourage enterprises to conduct overseas operations and to better fulfill corporate social responsibility, governments and relevant organizations should provide training for foreign-invested enterprises. Chinese enterprises should be prepared to increase their awareness of the environmental issues at stake, improve their capacity to preserve their own image, avoid risks, and shoulder corporate and social responsibility. More importantly they should be encouraged to make the necessary communication and exchange of information, in order to identify and promote best practices of Chinese enterprises overseas investment. Through these information-sharing activities and capacity building processes, one can expand the reach of the going global and green shift to a greater number of firms that just those planning to go overseas.

3.5.6. Establish a “sustainable development fund”

Permanent long term financial solutions must be created to help mitigate the negative impact of the development and utilization of natural resources, especially when these activities lead to the depletion of resources being explored. There are many of such funds in operation at present, some of which provide the affected local population with alternative development programs, while others set up savings accounts for future generations to use once the resources are gone. Such funds can be established by the host country, local communities and investors together. The Fund

will typically accumulate capital from royalties and should have a third party management trust structure acting as an independent professional body to take responsibility for the growth and preservation of the capital, which belongs to the people of the host country. Some of the profits from the operations must be reserved for site restoration, but that should not be confused with Sustainable Fund purposes, which are to offer alternative sources of living for the population once the resources are exhausted. There are a number of successful cases in existence, which can serve as reference models. They are, among others, the Norwegian Investment Fund for developing countries (Norfund) or the Alaska Permanent Fund (APFC). In many cases, these funds can help improve the image of the investors, because they adopt transparent management methods, are profitable and comply with the wishes of the community. The Fund's income and dividends are usually used to promote industrial diversification and poverty reduction, provide housing and education, and improve health care, environmental protection, green transformation and human and social development in resources-developed areas of host countries. Chinese enterprises committed to green investment and sustainable development, should voluntarily propose to establish and operate "Sustainable Development Funds" that will help promote the sustainability of Chinese green ODI.

3.6 Conclusion

China's investment process should not be based just on profits. It should also aim to improve local employment rates, promote local sustainable development, and protect the local environment while still respecting the host country's cultural traditions and social norms. Besides improving the quality of products and services exported, China should pay more attention to job creation, enhancement of local benefits and protection of the local environment, community, and wildlife. Some major Chinese enterprises are very much aware of the environmental and social impacts on investment destinations while some medium- and small-sized enterprises still fail to address such issues due to lack of attention, limited resources, and poor capacity.

Thus based on case studies and on the literature available on China's ODI, one concludes that good and bad environmental and social performances co-exist in China's ODI. The reduction of negative environmental and social impacts of China's trade and investment must rely on joint efforts by China and its ODI host countries. It is therefore important to enhance the sense of social responsibility of overseas enterprises through education and training, and to design with the appropriate authorities legitimate guiding principles for overseas environmental protection and social responsibility so that sustainable development would be ensured in the communities where Chinese ODI is absorbed.

Chapter 4 China's Participation in the Formulation of Relevant International Rules for Environmental Protection

4.1 Development of Relevant International Rules

The coordination of relations between investment, trade and the environment requires not only the regulation of domestic policies but also guidance and mandate for international coordination. Domestic policies and international rules are mutually coordinative and complementary. Currently there exist multitudes of multilateral or bilateral international rules in investment, trade and environmental fields, which play the role of guidance and coordination of mutual relations.

International investment rules, represented by bilateral investment agreements as well as international trade rules, represented by WTO and Free Trade Agreements (FTA), are the major international rules for standardization and coordination of investment, trade and environmental relations. Other international environmental rules mechanisms are those such as the Montreal Protocol on Substances that Deplete the Ozone Layer and the Kyoto Protocol on Climate Change. They exert much influence on the scale and direction of investment or trade, which are beneficial or harmful to the environment through limits on environmental capacity.

At present, relevant international rules are in a crucial period of development. In terms of investment rules, the number of bilateral and regional investment agreements is growing rapidly, while the multilateral investment rules are not yet in shape. In terms of trade rules, the Development Round that the WTO initiated in 2001, identifies the environmental issue as a core issue on the agenda. Yet no breakthrough has been made in the negotiations. In terms of environmental rules, no agreement targeting at long-term limitation on carbon emission has been achieved, while the first commitment period of Kyoto Protocol is approaching its end. Therefore, from these perspectives, the active participation of China is required for the development of related international rules for a considerable period in the future. The sustainable development of China as well as the world at large is closely related to the direction of development of these international rules.

China has signed more than 50 international environmental conventions, covering areas such as ozone protection, chemicals and hazardous waste, climate change, biodiversity protection and nuclear and radiation safety. China has eliminated about 100,000 tons of output and 110,000 tons of consumption volume for consumption of ozone substances, sharing 50% of that with all the developing countries. China

published the *China Action Plan for Biodiversity Protection* and established an area of natural conservation zones being about 15% of its total land area; it also took the lead in formulating the national implementation program for the Stockholm Convention and completely eliminated nine types of pesticide POPs such as DDT; China also took the lead, among the developing countries, in formulating the National Plan for Response to Climate Change, making unremitting efforts to adequately respond to climate change.

China is a major power in international trade and investment as well as an important participant in the international rules making in relevant fields. As a major developing country with rising global influence, China is no longer merely a rule-taker but gradually becoming a rule-maker. In participating in the formulation of relevant international rules, China must, on one hand, take the initiative in safeguarding its own interests in economic development and environmental conservation, while on the other hand contribute to improvement in global governance. The coordination of interests between these two aspects has become a major challenge for China at present. This is the core issue to be addressed in this chapter.

In recent years, China has been confronted with numerous investment and trade disputes, which especially involve fields related to environmental protection. For example, high anti-dumping taxes imposed by EU on China's export of energy-saving light bulbs, anti-subsidy investigation launched by the United States on the subsidy for new energy development, lawsuits filed by EU and the United States on export limits of charcoal export from China, etc. These disputes reflect the environmental impact of China's increasing focus on investment and trade as well as the need for development of international rules in relevant fields to facilitate sustainable development of China and the world at large.

This chapter aims at arriving at certain policy proposals based on the previous studies through an overview of interests and responsibilities, opportunities and challenges of China in relevant rule-making so as to help the Chinese government to balance the relationship between investment and environment more successfully, which may enable China to play a more active and creative role in relevant international rule-making processes.

China also faces a growing number of trade disputes, with a substantial number related to environmental protection. For example, the export of Chinese energy-saving rights generated high anti-dumping duties levied by the EU⁷⁴, and subsidies directed

⁷⁴ Xinhua News: The Case of Chinese Exported Energy-saving Bulbs Reflects Conflicts of anti-dumping policy

towards alternative energy development were subject to the anti-subsidy investigations of the US⁷⁵. Likewise, China's heavy restrictions on the exports of coke resources were opposed through EU and US lawsuits⁷⁶, despite the self-sacrificing nature of these restrictions.

This Chapter consists of three parts respectively involving international investment rules, international trade rules and international environmental rules. In addressing investment, trade and environmental issues, rules of two categories are involved, namely: international investment rules and international trade rules. International environmental rules also exert indirect impacts on the scale and direction of investment- or trade-related needs beneficial or harmful to the environment by limiting the environmental capacity, yet international co ordinations are eventually realized through international investment or trade rules.

The first two parts mainly focus on the discussions on issues related to environmental protection in respect of investment and trade rules, including domestic rules, bilateral international rules and multilateral international rules. Part 3 is specifically dedicated to issues of trade and investment rules related to climate change, as such trade and investment rules involving climate change, with their profound implications, are hotspot issues for discussion at present, of which China is at the core of discussions on many issues. Such a typical case analysis helps to demonstrate China's significant position in related rule-making.

4.2 Environmental Provisions in International Investment Agreements

To be specific, the first part aims at studying how China participates in international investment rule-making and improves environmental governance while safeguarding its interests of development, focusing on the intergovernmental investment rule-making. Being the world's second largest destination and fifth largest source (not including Hong Kong, SDR) of capital flow, China is now playing an increasingly significant role in the international capital markets with increasing prominent influence on the global progress of sustainable development and growing attention to its own responsibility in international investment and environmental governance.

Questions to be discussed in this part mainly cover the following four aspects:

inside of EU.31 Aug 2007.

⁷⁵ New York Times: "US to Investigate China's Clean Energy Subsidies", 15 Oct 2010. <http://www.nytimes.com/>.

⁷⁶ Financial Times: "US lodges WTO case against China", June 23 2009. <http://www.ft.com/>

- What are the international practices in balancing investment liberalization and environmental protection? What are the trends of development?
- What are the major forms adopted by developed countries for integrating environmental protection into investment agreements in the international scope?
- What efforts have China made for promoting environmental protection in formulating international investment agreements?
- What role should China play in formulating international investment agreements in order to safeguard its own interests of development while promoting sustainable development?

This part is structured as follows: it begins with a review of the status quo of global investment governance, followed by discussions on issues in international investment rules related to environmental protection. Secondly we attempt at discussing major models of balancing investment liberalization and environmental protection in international investment agreements, especially those of North America and Europe. Thirdly we review the contents of major bilateral agreements and free trade agreements of China with discussions on the space of adding provisions on environmental protection. And the last part summarizes and reviews regulations and policies promulgated by the Chinese government in mandating and standardizing investment behaviors of foreign investors, providing guidance for overseas investment and promoting sustainable development.

4.2.1 An Overview of Global Investment Governance

Despite the rapid growth of transnational investment in the era of globalization, global governance related to investment shows a rather decentralized pattern. At present, global foreign direct investment (FDI) flow has exceeded USD 1.2 trillion in 2010 and is expected to reach between USD 1.3 and 1.5 trillion by 2011 (UNCTAD, 2010). However, no uniform multilateral legal framework is yet in existence in international investment field. Although negotiations on multiple agreement of investment (MAI) were initiated by the Organization of Economic Cooperation and Development (OECD), the negotiations ended up in failure in 1998. Currently, international rules governing transnational investment are mainly bilateral or regional international investment treaties.

International investment treaties are usually known as international investment agreements (IIAs) which mainly include three forms: bilateral investment treaties, regional investment treaties and investment provisions in preferential trade agreements. Despite their emergence half a century ago, international investment agreements have witnessed a rapid increase in number mainly in the past two decades, especially in the 1990s (Figure 4.1).

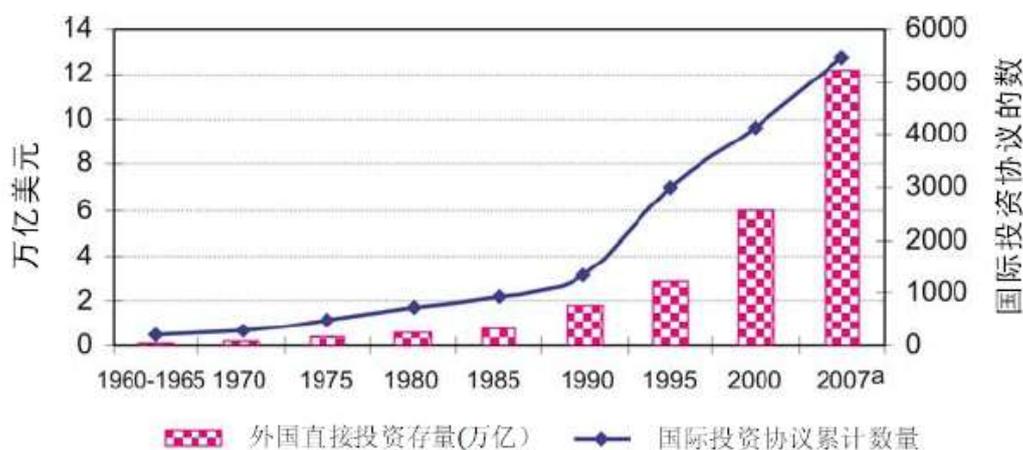


Figure 4.1 Development of Foreign Direct Investment and International Investment Agreements, 1960–2007

Source: UNCTAD, 2008, p.18

According to the statistics in World Investment Report 2010 published by the United Nations Conference on Trade and Development (UNCTAD), by the end of 2009, there are 2,750 bilateral investment agreements, 2,894 double tax treaties (DTTs) and 295 other international investment treaties, including regional investment treaties and investment provisions in preferential trade agreements (Figure 4.2).

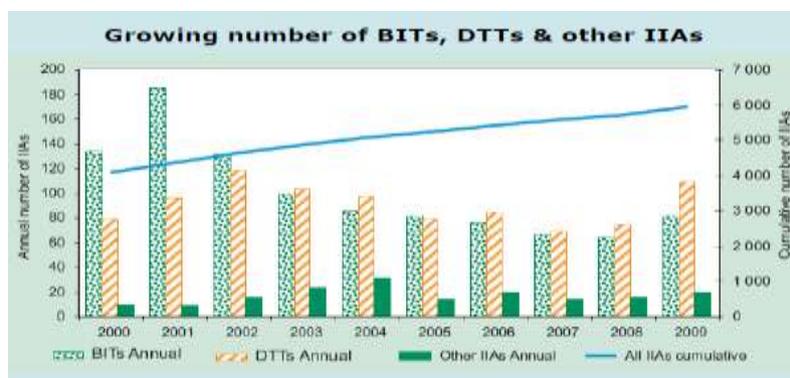


Figure 4.2 Numbers of Bilateral Investment Treaties, Double Tax Treaties and Other International Investment Agreements 2000-2009

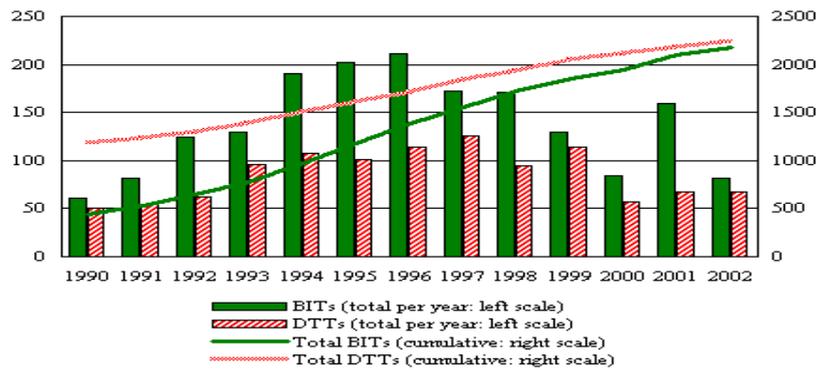


Figure 4.3 Trends in Bilateral Investment Treaties and Double Tax Treaties 1990-2002

Source: UNCTAD, BIT/DTT database; Quantitative Data on Bilateral Investment Treaties and Double Tax Treaties, 2002.

It is noted that China is one of the most active participants in international governance in respect of international investment. It has signed 230 international investment treaties (ranking the 8th in the world), 125 of which are bilateral investment treaties, second only to Germany (with 135).

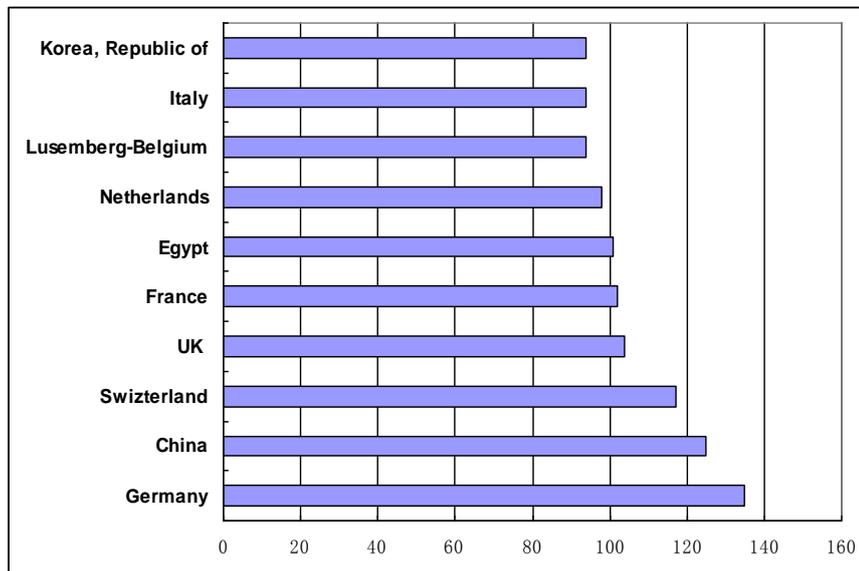


Figure 4.4 Number of Bilateral Investment Treaties Signed by 10 Major Economies by 2010

Source: UNCTAD (2010). World Investment Report 2010: Investing in a low-carbon economy. New York and Geneva: United Nations. July, 2010.

Up to now, China has signed international investment treaties with most of the world's major economies, with the exception of only a small number of developed countries such as the United States and Canada.

4.2.2 Environmental Provisions in International Investment Rules

The relationship between transnational investment and environment has always attracted much attention from the very beginning. Especially in the past decade or so, the integration of environmental provisions has become an important trend in international investment treaties.

In 1976, OECD released *Declaration on International Investment and Multinational Enterprises* as an annex of *OECD Guidelines for Multinational Enterprises*. In 1982, *Nairobi Declaration* requires all multinational enterprises to take environmental protection into consideration while using industrial means and technologies of production and disseminating these technologies to other countries. *Agenda 21* passed on 1992 Rio Earth Summit requires all multinational enterprises to perform their corporate social responsibility (CSR) and promote cleaner and more efficient means of production, including waste reuse, recycling and minimizing. Three principles in *Global Compact* released by the United Nations in 1999 involve environmental responsibilities of multinational enterprises.

As these international treaties lack in executive and binding power, numerous international investment treaties have emerged in recent years to alleviate the conflicts between investment liberalization and environmental protection. In this sense, the integration of environmental issues into international investment treaties is a new trend.

First, Article 3 of *Trade-Related Investment Measures* (TRIMs) stipulates that all exceptions under GATT 1994 shall apply, as appropriate, to the provisions of this Agreement. This is very important as it indicates that exceptions under GATT 1994 also possess binding power for environmental issues emerging in international investment.

Besides, a more crucial legal practice is based on *North America Free Trade Agreement* (NAFTA) adopted in 1993. From then on, the three member states of NAFTA have become active facilitators of integrating environmental terms into bilateral investment treaties. Terms related to corporate social responsibility (CSR) in IIAs started to emerge in the *Introduction* and *Investment* chapters of NAFTA in the

mid-1990s. This model of NAFTA is adopted later by other countries.

Third, in 1995, the Organization of Economic Cooperation and Development (OECD) initiated negotiations on Multilateral Agreement on Investment, directly adopting *OECD Guidelines for Multinational Enterprises* as its annex. According to the latest updated version of *OECD Guidelines for Multinational Enterprises*, a specific chapter on *Environment* is included, requiring multinational enterprise to establish and maintain a system of environmental management appropriate to the enterprise (Article 1), provide information on the potential environment impacts of the activities of the enterprise (Article 2), prepare an appropriate environmental impact assessment (Article 3), take effective measures to prevent or minimize environmental damage (Article 4), maintain contingency plans for accidents and emergencies and maintain mechanisms for immediate reporting to the competent authorities (Article 5), continually seek to improve corporate environmental performance (Article 6), provide adequate education and training to workers in environmental health (Article 7) and contribute to the development of environmentally meaningful and economically efficient public policy (Article 8).

Similar language is adopted in recent agreements or integrated into BIT models of other developed countries (such as Japan, Belgium, Finland, Holland and Sweden). Recently, similar texts on the environment are included in investment treaties between Japan and the Republic of Korea (2002) and Vietnam (2003) but not in the nine treaties (between 1988 and 1998) signed at an earlier date (OECD, 2008).

Obviously, the practice of integrating language of environmental protection into bilateral investment treaties (BITs) is initiated by certain developed countries such as the United States. Such practice aims at preventing countries from attracting international capital flow at the cost of environmental interests, which is especially likely to happen in developing countries.

Generally speaking, models of integrating environmental provisions in FTA and bilateral investment treaties mainly include: preface clauses, specific environmental clauses, environmental exception and exemption clauses, dispute resolution clauses, clauses on relations between effect of investment treaties and environmental treaties, etc.

In concrete terms, North American countries and West European countries have formed their respective models in respect of discussions on environmental protection issues in bilateral investment treaties.

North American Model

As the world's first free trade agreement signed between developed and developing countries, the North American Free Trade Agreement (NAFTA) is also the first intergovernmental agreement with environmental clauses integrated. The three member states of NAFTA have thus become active initiators of integrating environmental clauses in bilateral investment treaties.

As a supplement of NAFTA, North American Agreement on Environmental Cooperation (NAAEC) has stipulated clear environmental obligations for the signing parties, including exception clauses related to environmental issues, such as in Article 1106 on requirements for enforcement where Parties are explicated prohibited from lowering environmental standards to attract foreign investment.

Since 1994, environmental clauses are included in the models of bilateral investment treaties signed between Canada and the United States. Mexico has systematically adopted similar clauses in treaties signed with Latin American and North American countries (although European countries are not included).

On the other hand, the North American model of bilateral investment treaties has taken environmental issues into consideration at an early date. In recent years, both Canada and the United States have developed bilateral investment treaty texts with clarification of the relations between environment and investment and environmental rights and obligations of relevant signing parties.

For instance, bilateral investment treaties of Canada have specific stipulations in environmental obligations:

- Article 7, *Requirements for Enforcement* stipulates that “environmental exception” must be permitted.
- Article 11, *Health, Safety and Environmental Measures* stipulates that signing parties are prohibited from lowering environmental standards to attract investment.
- Article 10, *Special General Exception Clauses* stipulates that signing parties may adopt environmental policy measures provided that such measures do not constitute arbitrary, unjustifiable or disguised discrimination of trade and investment, which is similar with Article XX, General Agreement on Tariffs

and Trade, 1994, with implications that in order to satisfy certain environmental objectives, contracting parties may deviate from obligation requirements in investment treaties including national treatment principle, most favored nation treatment principle, enforcement requirements, collection regulations, etc.

Based on the study of bilateral investment treaties signed by the United States and Canada, it is noted that environmental clauses are integrated in most bilateral investment treaties signed with developing countries since 1994. As is shown in Table 1, requirements of environmental protection are included in the texts in 9 of the 50 BITs signed by the United States and in 9 of the 28 BITs signed by Canada since 1994.

Table 4.1 Bilateral Investment Agreements of the United States and Canada Including Environmental Clauses

NAFTA Member States	BITs Partners (And Years)
The United States	Azerbaijan(2000); Bahrain(1999); Croatia(1996); Salvador(1999); Nicaragua(1995); Rwanda(2008); Trinidad and Tobago(1994); Uruguay(2005); Uzbekistan(1994).
Canada	Croatia (1997); Czech Republic(2009); Barbados(1996); Latvia(2009) ; Peru (2006); Trinidad and Tobago (1995); Romania(2009); Slovakia(2010); Salvador(1999)。
Mexico	Cuba (2001); Switzerland (1995)。

Source: UNCTAD Database and Task Force team statistics

Generally speaking, North American countries are active in integrating environmental

clauses in international investment agreements, with general emphasis on environmental exception clauses and prohibition of lowering environmental standards to attract foreign investment. These clauses are comparatively well-constructed in contents.

The EU Model

Most developed countries in Europe, such as Britain, France and Germany, have not included environmental clauses in their bilateral investment treaties. However, Finland, Luxemburg and Belgium attach much importance to environmental issues in their bilateral investment treaties (see Table 4.2).

Table 4.2 Environmental Clauses in Bilateral Investment Treaties of European Countries

Economy	BITs Partners (And Years)
Finland	Armenia (2004); Uruguay (2005); Nicaragua (2003); Kyrgyzstan (2003); Tanzania (2001); Republic of Bosnia and Montenegro (2000)。
Sweden	The Russian Federation (1995)
Benelux Economic Union	Republic of Korea (2006); China (Memorandum of Understanding); Congo (2005); UAE (2004)。

Moreover, partnership agreements signed between EU and countries in Africa, Caribbean and Atlantic regions have also reflected the will to directly imposing environmental protection requirements on multinational enterprises. For instance, it is stipulated in Article 8.12 that:

- Before launching into business, investors must conduct environmental impact assessment based on the principle of prevention and disclose the results to local community and potential victims;
- Investors must institute environmental management mechanism with corresponding accreditation and must not evade environmental obligations imposed by the host country.

In summary, there currently exists an obvious trend of integrating environmental protection in investment agreements. More attention is needed for the practice of NAFTA and the motion of OECD countries to facilitate *Multilateral Agreement on Investment* (MAI), which includes general exception clauses for environmental reasons and the practice of prohibiting countries from lowering environmental standards to attract foreign investment, etc. A major criticism of *Multilateral Agreement on Investment* (MAI) is grounded in the insufficient consideration of the environment, while numerous environmental clauses are criticized for transferring unjustifiable burden to Southern countries. In the future, with the pressure from OECD countries, negotiations on MAT will be re-opened with the inevitable integration of environmental demands.

Besides, there exist numerous international standards and guides coordinating the relations between investment and environment on a voluntary basis, such as the *Global Compact* initiated by the United Nations, *UNEP Financial Initiative*, *UN Principles for Responsible Investment*, Environmental Impact Assessment of the World Bank, *the Equator Principles* of the International Finance Corporation (IFC), etc., all of which contribute to guiding international investment towards environmental protection. Discussions in detail would be omitted here due to the limit of space.

4.2.3 Environmentally-Relevant International Investment Rules: China's Participation

Integration of environmental clauses in bilateral investment policies is a practice actively promoted by certain developed countries, including the United States in recent years, which may become a significant trend of future development of international investment rules. As an important multinational investor and an international investment rule-maker, China starts to be aware of possible negative impact of international investment on the environment.

The TF has conducted a comparatively complete survey and analysis of major international investment treaties that China has entered into. It seems that no clause of coordinating international investment and environment is included. However, environmental protection is explicitly included in some bilateral trade treaties, such as free trade agreements between China and New Zealand, Chile and Pakistan.

Some explanations can be provided for this result. First, according to the aforementioned survey, up to now, only a very small number of developed countries are actively engaged in the facilitation of integrating environmental clauses into bilateral investment treaties. The fact that China is a developing country, should be taken into consideration. Besides, and more importantly, most bilateral investment treaties signed by China date back to the 1980s and 1990s (see Figure 4.5), while the integration of environmental clauses into investment treaties did not take place until recently.

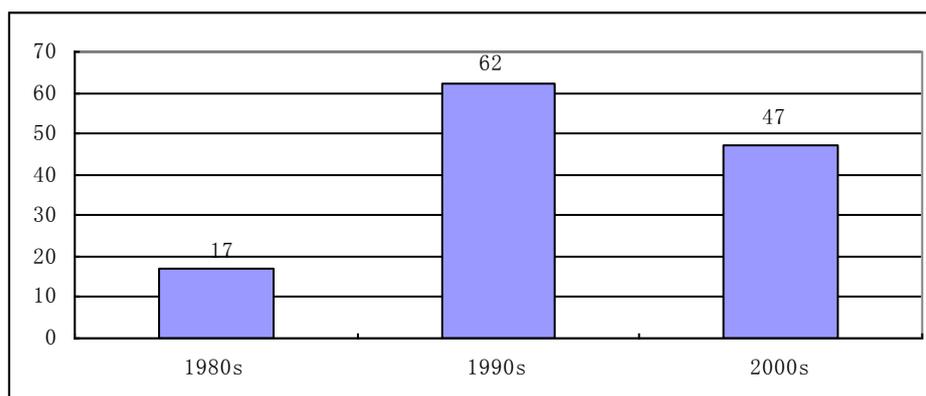


Figure 4.5 Quantitative Distribution of BITs Signed by China in the Past 30 Years

Source: UNCTAD (2010)

Third, although it is highly important for China to adapt itself to this trend and give full consideration to environmental issues involved, it must be noted, on the other hand, that the practice of integrating environmental clauses in bilateral investment treaties is mainly initiated by developed countries and therefore accommodates their interests. Hence integrating environmental clauses in international investment treaties may put the right to development of developing countries at risk.

It should be noted, however, that China has been active in promulgating relevant policies in recent years, emphasizing the social responsibility of enterprises engaged in overseas investment and attaching considerable importance to minimizing the

environmental impact of international investment.

First, the Chinese government strengthened the access control of investment that generates severe environmental hazards since the Eleventh Five-Year Plan. Currently the administration of foreign investment in different industries is mainly based on the principles of *Catalogue for the Guidance of Foreign Investment Industries (2007)*. The State Council and the Ministry of Commerce updated and strengthened guidance of foreign investment in the environmental perspective, and foreign investment projects in the Catalogue is divided into three categories, namely: prohibited, restricted and encouraged based on different environmental impact of foreign investment.

Besides, the Chinese government has designed guiding suggestions to urge enterprises with overseas investment to pay attention to local environmental protection. For example, in October 2006, the State Council promulgated regulations, urging Chinese enterprises to “pay attention to environmental and resource protection” and “maintain local society and residents’ livelihood” overseas. In 2007 and 2009, the State Forestry Administration and the Ministry of Commerce successively issued *Guide on Sustainable Overseas Silviculture by Chinese Enterprises* and *A Guide on Sustainable Management and Utilization of Overseas Forest by Chinese Enterprises*, which are the first industrial guides on overseas silviculture by Chinese enterprises. The promulgation of these regulations and guides are conducive to the facilitation and standardization of overseas investment and business activities of Chinese enterprises and honor China’s pledge as a responsible power (see Table 3 for reference).

Table 4.3 Environmental Policies or Guides Formulated by the Chinese Government for Overseas Investment

Time	Released by	Incident	Contents
2004	The Export-Import Bank of China	Internal environmental guide passed	Guide green credit
2005	Ministry of	<i>Detailed Rules for the Examination and</i>	Include environmental

	Commerce	<i>Approval of Investments to Run Enterprises Abroad</i>	clauses as a reflection of concern over environmental issues of the host country
2006.10	State Council	Regulations	Urge Chinese investors to “pay attention to environmental and resource protection” and “maintain local society and residents’ livelihood” overseas
2007	State Forestry Administration	<i>Guide on Sustainable Overseas Silviculture by Chinese Enterprises</i>	Standardize sustainable forestry activities of Chinese enterprises overseas
2009	State Forestry Administration and Ministry of Commerce	<i>A Guide on Sustainable Management and Utilization of Overseas Forest by Chinese Enterprises</i>	Standardize sustainable forestry activities of Chinese enterprises overseas

Source: Long Feng, Environmental Protection in China’s Foreign Aid and Investment, August 29, 2008; Ge Chazhong, Xia Youfu *et al.* China’s Policies of Environmental Conservation in Overseas Investment, Beijing: China Environmental Science Press, 2010.

In addition, the State-owned assets Supervision and Administration Commission of the State Council has also promulgated regulations to guide state-owned enterprises to

assume their social responsibility, including environmental protection and resource conservation, thus building a solid foundation for overseas investment endeavors of state-owned enterprises. To encourage enterprises to honor their corporate social responsibility (CSR), the State-owned assets Supervision and Administration Commission of the State Council issued *The Guideline on Fulfilling Social Responsibility by Central Enterprises*, which serves as a guide and standardization of environmental and social conducts of Chinese enterprises in overseas investment, proposing that Chinese enterprises, when “going global”, should communicate the successful experience of China and facilitate the formulation of environmental policies of host countries.

At the end of 2007, only 11 state-owned enterprises released social responsibility reports and sustainable development reports; while by 2010, this number has reached 35. Some enterprises have issued country-specific reports; for example, Sinosteel Corporation published *Sustainability Africa Report* and China National Petroleum Corporation (CNPC) issued *Sustainability Kazakhstan Report*. COSCO was rated A+ by Global Reporting Initiative (GRI) and won Corporate Social Responsibility Award of UN Global Compact. China Guodian Corporation issued the first guiding proposal for the performance of corporate social responsibility in China, hence facilitating the establishment of a comprehensive social responsibility system and guiding the enterprise to carry out its social responsibility in a systematic fashion. China Mobile has also designed and implemented strategic social responsibility management and is the first and only Chinese enterprise ranking among Dow Jones Sustainability Indexes.

Third, Chinese financial regulatory institutions are vigorously promoting green credit and sustainable development, which is expected to exert increasing influence on overseas business. Environmental considerations of financial departments for China’s overseas investment are equally important. Financial departments, especially the Export-Import Bank of China and China Development Bank, have established specific standards on green credits for overseas investment.

Considering the possible role of financial institutions in promoting environmental protection, since 2007, the State Council, the Ministry of Environmental Protection, the People’s Bank of China and China Banking Regulatory Commission have successively issued a series of policies and regulations, requiring the overall enhancement of green credit in the financial sector.

Moreover, in support of the energy conservation and emission reduction objectives set

at the beginning of the Eleventh Five-Year Plan, the financial sector has obviously strengthened the credit support for industries related to energy conservation and emission reduction. In the first half of 2007, the State Environmental Protection Administration (now Ministry of Environmental Protection) jointly issued a document with the People's Bank of China, facilitating corporate environmental protection information sharing service, including corporate environmental information database, for firsthand information and technical support for the implementation of green credit. Based on these efforts, on July 12, 2007, the State Environmental Protection Administration, the People's Bank of China and China Banking Regulatory Commission issued a document, demanding for credit restrictions on enterprises that failed to comply with industrial policies and environmental protection requirements, especially for curbing blind expansion of high-energy-consuming and high-pollution enterprises through green credit. China Banking Regulatory Commission also issued *Guiding Opinions on the Credit Work for Energy Conservation and Emission Reduction*, etc. aiming at urging banking institutions to circumvent from credit risks and facilitate policy implementation for energy conservation and emission reduction.

In addition, in November 2007, China Banking Regulatory Commission issued *Guiding Opinions on Strengthening Social Responsibilities of Banking and Financial Institutions*, requiring large banking institutions to assume their social responsibilities and those with qualified conditions should release social responsibility report on the basis of the 10 Fundamental Principles of UN Global Compact. In January 2008, the State Environmental Protection Administration signed an agreement with International Finance Corporation aiming at launching joint research projects, providing guidance for green credit in line with China's reality and providing technical support for deepening green credit mechanism. On January 12, 2009, China Banking Regulatory Commission issued *Guiding Opinions on the Social Responsibilities of Financial Institutions* to urge the banking industry to assume its social responsibilities and promote harmonious and sustainable economic, social and environmental development.

The Export-Import Bank of China is one of the first banks in China engaged in environmental economic policies and practices, with the issuance of *Guiding Opinions on Environmental and Social Evaluation of Loan Projects of China Export and Import Bank* On August 28, 2007. However, compared to international financial institutions in respect of environmental policies of development, the environmental standards of China EXIM Bank appears comparatively low with rather simplistic guidance for practice and short history of implementation. At present, many renowned Chinese enterprises, including National Development Bank, have released social

responsibility report.

Besides, China Merchants Bank has been outstanding in policies, measures and information disclosure in environmental protection. In terms of environment-related policymaking, it has promulgated *Green Financial and Credit Policies* and *Marketing Guide of Renewable Energy Sector* and issued *Credit Policies 2009* with rigorous access criteria for high-energy-consumption and high-pollution (known as “Two High”) industries; in terms of responsible departments and staff, it has clarified departments responsible for environmental protection and their respective tasks and functions; while in terms of loans for “two-high” industries, the loan balance was disclosed with a drop of 1.95 percentage points compared to the year before; especially in terms of overseas investment, China Merchants Bank clearly requires the compliance with international environmental standards in overseas investment process in all industries involved (including petroleum and natural gas, mining, processing and manufacturing, renewable energy, overseas trade, etc.).

Moreover, Industrial Bank, Industrial and Commercial Bank of China and Shanghai Pudong Development Bank each delivers excellent performance in related fields. Industrial Bank is by far the only bank in China that has adopted *the Equator Principles*.

Generally speaking, environmental protection is integrated in numerous investment regulatory policies in China, despite the loosely-constructed and fragmented policy measures and much space for improvement in implementation and supervision. It may be stated that there still exists certain gap between the importance attached to environmental issues in domestic investment policies and the rapid development of international environment and that work in related areas needs to be strengthened. For instance, *Catalogue for the Guidance of Foreign Investment Industries* should be more detailed with more emphasis on environmental impact assessment and environmental and resource taxation. Work related to green credit should be strengthened in the financial sector and more large banks may be encouraged to adopt the *Equator Principles*. Large state-owned enterprises should strengthen their performance of social responsibilities with more attention given to environmental protection and information disclosure.

4.3 Environmental Provisions in International Trade Rules

4.3.1 Overview of International Trade Rules and International Environmental Rules

Generally speaking, the International Trading System is a complete system of rules for trading, while the Environmental Management System is a complete system of rules for environmental protection. The International Trade Rules aims to promote the liberalization of economic activities, while the Environmental Management Rules aims to restrict the liberalization of economic activities. The two serve for different objectives and essentially differ from each other, but consequently influence each other. It is such features that lead to the possible potential conflict between the two as well as cause the two to be consonant with each other. Therefore, it is necessary to seek a reasonable joint point between the trade rules and environmental management rules.

The environmental provisions in the existing International Trade Rules basically focus on WTO. Except for the particular ones (such as North American Free Trade Agreement (NAFTA)), other Regional Trade Agreements (RTAs) and bilateral Free Trade Agreements (FTAs) generally fail to include any separate environmental provisions. China has signed multi-lateral and bilateral FTAs with more than 30 countries, but at present, none of the trades thereof are linked to the subject of environment. Instead, the cooperation on environment appears often as an attachment to the protocol on FTAs.

In the meanwhile, trade development has not been completely excluded in numerous international environmental conventions, of which some have also set up the “Committee on Trade and Environment” and provided the specific trade obligations (STOs), taking trade an important measure to fulfilling the environmental convention. For instance, CITES (Convention on International Trade in Endangered Species) has especially specified such trade measures as restriction of ivory trade.

In general, the international organizations have attached great importance to the coordination between the trade rules and the environmental rules. This charter will first describes the environmental provisions of WTO system and its predecessor, GATT, and relevant agreements, then comments on the Doha Round Negotiation now under process environmental provisions likely to be formed in the future, and finally proposes for China to actively participate in formulating the international rules of WTO on environmental goods so to promote the environment protection.

4.3.2 Environmental Provision in GATT and Other Trade Treaties

Exceptional provisions of WTO Rules, relating to environmental protection, are mostly concentrated in Paragraphs (b) and (g) of Article XX of GATT. According to the provisions of Article XX (General Exceptions) of the General Agreement on Tariffs and Trade 1994, “subject to the requirement that such measures are not applied in manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures: (b) necessary to protect human, animal or plant life or health; (g) relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption.”

Provisions of other WTO agreements, involving environmental protection, are represented in GATT. The Preface to the Agreement Establishing World Trade Organization differs from the Preface to GATT 1947, by restricting the primary objective of “full use of the world’s natural resources” in the Preface to GATT 1947 and changing “full use” into “optimal use” so that the optimal use of the world resources should be consistent with sustainable development. It has defined the sustainable development and environmental protection as one of the objects of the new multilateral trade system.

Provisions, relating to environment and trade, of other agreements than GATT include:

(1) Agreement on Technical Barriers to Trade (TBT): its preface provides “no country should be prevented from taking measures necessary to ensure the quality of its exports, or for the protection of human, animal or plant life or health, of the environment, or for the prevention of deceptive practices, at the levels it considers appropriate, subject to the requirement that they are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail or a disguised restriction on international trade, and are otherwise in accordance with the provisions of this Agreement”.

(2) Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement): this agreement has further described the provisions on recommended measures to protect animal and plant life or health and applied higher as well as more specific material obligation on its members. However, in terms of application, SPS

Agreement is narrower than Para. (b) of Article XX. Article 2 of this agreement provides the basic rights and obligations: “members shall ensure that any sanitary or phytosanitary measure is not maintained without sufficient scientific evidence, except as provided for in paragraph 7 of Article 5.” Paragraph 7 of Article 5 provides: “in cases where relevant scientific evidence is insufficient, a Member may provisionally adopt sanitary or phytosanitary measures on the basis of available pertinent information, including that from the relevant international organizations as well as from sanitary or phytosanitary measures applied by other Members. In such circumstances, Members shall seek to obtain the additional information necessary for a more objective assessment of risk and review the sanitary or phytosanitary measure accordingly within a reasonable period of time.” This article has actually introduced the preventive principle of the Environmental Law and grants its members with the right to provisionally adopt the preventive measures.

(3) Agreement on Subsidies and Countervailing Measures (SCM Agreement): according to the provision of Subparagraph (c) of its Article 2, under certain conditions, members can subsidize any company with a heavier economic burden due to implementation of the new environmental regulations. Action shall be taken against any subsidy with the objective to protect environment only in the following circumstances: such subsidy benefits import that damages the interest of one industry in the importing country, or benefits the industry of one country, but damages the rights entitled to other countries according to GATT or trade interests of other countries.

(4) Agreement on Agriculture: this agreement shows direct concerns on the subject issue of environment, by admitting the “Green-box Policy” implemented by many countries: i.e., such domestic support measures of countries as ecological environment protection programme and direct green subsidies for farmers are not to be eliminated. However, two conditions shall be additionally complied with: governmental products with definite objectives and funds raised from the public are supported; such projects will not provide any help to producers in terms of prices.

(5) Agreement On Trade-related Aspects of Intellectual Property Right (TRIPS): Article 27 of TRIPS provides some circumstances relating to environment protection and for refusing to grant any patent right: to protect human, animal or plant life or health or to avoid serious prejudice to the environment, members must prevent commercial application of some inventions, such as diagnostic, therapeutic and surgical methods for the treatment of humans or animals.

(6) General Agreement on Trade in Services (GATS): Article 6 of GATS provides that each member to any agreement shall ensure that the general applicable measures affecting trade in services are implemented in a reasonable, just and objective manner. Such measures are generally deemed also including environmental protection. Copying Article XX, its Article 14 also provides the general exceptions, of which Para. (b) allows its members to adopt any measures necessary to protect human, animal or plant life or health, subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail or a disguised restriction on trade in services.

4.3.3 Possible Environmental Provisions in Future WTO Agreements

Establishment of environment-related articles and provisions in WTO rules has adequately indicated that sustainable development and environmental protection are one of the objectives for the new multilateral trading system, as has also determined environment, in the new WTO Doha Round Negotiation, as a major subject matter.

In 1995 when World Trade Organization (WTO), the Committee on Trade and Environment (CTE), under the General Council, for discussions of ten environmental issues, including:

1. Relationship between WTO rules specific trade rules set out in multilateral environmental agreements (MEAs);
2. Relationship between WTO rules and environmental policy;
3. a. Relationship between WTO rules and environmental tax; b. relationship between WTO rules and environmental requirements for goods;
4. Trade measures of environmental management and trade rules of environmental policy;
5. Relationship between dispute settlement mechanism of WTO dispute settlement mechanism of MEA;
6. a. Impact of environmental measures on market access of the developing countries; b. elimination of environmental benefits of trade restriction;
7. Export of domestically prohibited goods;

8. Relationship between environment and TRIPs;
9. Relationship between environment and trade in services;
10. Others.

In November 2001, the Ministerial Conference in Doha granted CTE with the special authority to start the negotiations on trade and environment. Such authorization for issues of trade and environment are particularly represented in paragraphs 31 and 32 of the Doha Ministerial Declaration, as follows:

- 31.1 Studies and negotiations on the relationship between existing WTO rules and specific trade obligations set out in multilateral environmental agreements (MEAs)
- 31.2 Observer status of MEA Secretariat
- 31.3 Studies and negotiations on the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environment goods and services
- 32.1 Studies and negotiations on the effect of environmental measures on market access
- 32.2 Countermeasures of the Agreement on Trade-Related Aspects of Intellectual Property Rights for trade and environment and position study
- 32.3 Studies and counterproposals on labeling requirements in negotiations on trade and environment

4.3.4 WTO Rules on Environmental Products: China's Active Role

China should play an active role in making international rules in terms of its WTO based environmental interests. The current WTO-CTE's environmental goods and services (EGS) negotiations are driven by trade interests rather than environmental ones. They are based on national agendas, and therefore lack a global perspective and are quite poor in terms of any coordination with Multilateral Environmental Agreements (MEAs). They lack an integral awareness of China's national and departmental interests, suggesting that the country's environmental interests have not been sufficiently considered. Hence, it is suggested that China should better prepare its international negotiations strategies to gain environmental benefits alongside its

trade and industrial development interests.

In light of the diversity and complexity of China's economic development and the urgency of environmental needs, it is necessary to discard the too simplified dichotomy of international trade for developing countries and developed countries. The environmental goods and services listed by this study reflect China's economic benefits (industrial benefits and trade benefits); environmental benefits; and social benefits. China is especially competitive in all three categories of environmental products, and will become more competitive over time. There are also interesting alignments of interests to be explored with other developing countries.

WTO expects to promote Doha Round CTE-Negotiations on Environmental Goods and Services for representing the demands of all the member countries. The most important issue is how WTO members will react for the challenge of global environment. In addition to the conventional dispute cases on trade and environment within WTO, more and more new cases are coming out, absolutely most of which are related to China, e.g., case on restricted export of raw materials, case on restricted export of rare earth elements and case on subsidies for blowers. These cases have not been included in the list of Doha Round Negotiations, but the judgment made by WTO Committees will lead a strong effect on formulation of the future rules.

Being authorized by Doha Ministerial Conference, WTO started the negotiations on 31.1, 31.2 and 31.3 of the Doha Development Agenda (DDA). Of all the subjects for negotiation, DDA 31.3 for opening up environmental goods and services is one of the most important. The directory of goods is under formulation according to the interests of WTO members, but even up to now, WTO has not provided a clear definition of environmental goods and services. What is most important is how to integrate environmental interests, especially global environmental interests, into the system of WTO as a new rule.

On April 21, 2011, WTO Director-General Pascal Lamy and chairpersons of different negotiation groups published reports on different issues of negotiation and existing negotiation case documents over the last decade since Doha Round started. Chairman of WTO/CTE, Ambassador Manuel Teehankee also presented a report to the Trade Negotiation Committee (TNC) (WTO, TN/TE/20).

The report provided TNC with the latest progress of CTE Special Session (CTESS). Regarding the environmental goods in DDA 31(iii), it made a special summary of the report (TN/TE/19) made by the chairman, in March 2010, to TNC, which provides a

summary list of environmental goods. The reference scope of quality environmental-friendly products included in its Appendix II.A provided for members is based on Customs HS-6 submitted by members, just as what has been represented in Appendix II to the report to TNC in March 2010 as well as JOB/TE/3/Rev.1 (January 5, 2011) and subsequent submittals.

Section 8 of the report mentioned particularly Appendix II to the report (TN/TE/19) to TNC in March 2010 and JOB/TE/3/Rev.1 (January 5, 2011). It was reaffirmed that environmental goods can be classified into six major categories: air pollution control, renewable energies, waste management and sewage treatment, environmental protection technology, carbon capture and storage.

This part aims to comment on the classification of environmental goods reported by WTO chairman, and propose, in view of environmental needs, our framework for classification of environmental goods, with which to theoretically resolve the problem of classifying environmental goods as well as practically promote the WTO negotiations on environmental goods in a proper manner.

With the common view and efforts of the international society, the demand for resolving global environmental problems will definitely continue to increase. What is most typical is the issue on ozone depletion. Due to the special institutional arrangement for elimination and reduction of ozone substances, especially with the support of effective financial mechanism, developing countries have made significant contributions in reduction of ODS, while China contributes to the total reduction of the world by over 50%.

Facing the current situation of global environmental protection that is still severe, all countries in the world shall continue to advance the process of cooperation on global environment. The developed countries shall fulfill their commitments and obligations to provide the developing countries with aid for environmental development and funds and technologies for fulfilling the international conventions. The developing countries are also willing to continue to, in line with the “common but differential responsibilities” principle, to join hands with the international society in responding to the challenge of global environment.

In our opinion, the current WTO-CTE negotiations on EGS are driven by interests of trading, instead of environmental demand, purely for national interests, but without global vision and harmony with MEAs. However, at present, the status of Chinese negotiations are short of overall understanding of national interest, departmental

interests influence the integrated interests of the state and environmental interests are not adequately represented.

4.4 Climate Change, International Investment, Trade, and

China's Involvement

Global climate change has been a fixture in international headlines in recent years, but still the challenge of construing of a fair and effective international climate change response after 2012—the end of the Kyoto Protocol commitment period—is still far from resolved. The international climate system involves a wide range of processes, frameworks, and mechanisms characterized by statements, laws, agreements, decisions, and standards. Some are legally binding; others are voluntary. Some countries have attached great importance to the commitments made at various international climate meetings, and have indeed change domestic policy to reflect them.

4.4.1 International Negotiation Process and Governance System to Address Climate Change

As a global environmental problem, global climate change is one of the most daunting challenges that the human society is collectively faced with. With international climate course in constant development and international climate regime still under construction, international actions in combating climate change shall inevitably exert significant and far-reaching influence on international trade, international investment and even the entire global economic and political pattern. As a major developing country and a major contributor to greenhouse gas emissions, China holds a crucial position in international climate negotiations and will inevitably assume increasing international obligations. Therefore, China must actively participant in the formulation of related international rules in respect to climate change with special attention to issues related to climate change and international trade and investment to safeguard long-term interests of China while contributing to the global transformation of green economy.

Since the commencement of international climate negotiations in 1990, the international climate course has undergone 20 years of vicissitudes. In 1992, *the United Nations Framework Convention on Climate Change* (UNFCCC, or FCCC in short) was adopted in Rio Conference and was open for signing; on March 21, 1994, UNFCCC officially entered into effect, legally establishing the ultimate objectives

and a series of fundamental principles of the Convention. UNFCCC is by far the most important international environmental regime with the most extensive participation and the most profound implications.

Kyoto Protocol is an important legal document that aims at implementing the objectives and fundamental principles established in UNFCCC, which, for the first time, stipulated quantitative emission reduction targets with legally binding power for the First Commitment Period (2008—2012) for Annex I countries (developed countries and economies in transition) while introducing three market-based flexible mechanisms to facilitate international climate cooperation. In addition, *Kyoto Protocol* has reiterated the general obligations of all signatory parties of UNFCCC and the obligations of signatory parties of Annex II to provide new additional funds for developing countries and to conduct technical transfer. International climate negotiations were challenged with complications and difficulties due to the announcement of withdrawal of the United States and the procrastination of certain signatory parties before *Kyoto Protocol* officially entered into effect on February 16, 2005, thanks to the tremendous endeavors waged by the international community. The 11th Conference of the Parties of UNFCCC convened in Montreal, Canada decided to launch a new round of negotiations on post-2012 international climate regime, turning a new leaf in international climate course.

The Bali Roadmap was concluded in the 13th Conference of the Parties of UNFCCC convened in Bali, Indonesia, where the basic pattern of parallel “dual-track” progress in international climate negotiations through negotiation model of two ad hoc working groups, namely Ad hoc Working Group—Kyoto Protocol (AWG-KP) for emission reduction target in follow-up period of commitment of Annex I countries and Ad hoc Working Group for long-term cooperation action (AWG—LCA), while defining the timetable of the conclusion of an international climate convention during the 15th Conference of Signatory Parties convened in Copenhagen by the end of 2009. However, despite certain political consensus and mid-term emission reduction goals proposed by various countries, the Copenhagen Climate Conference has obviously failed to fully accomplish this historical mission.

After the difficulties and setbacks of the Copenhagen Conference, *Cancun Agreement* was finally inked through difficult compromises at the 16th Conference of the Parties of UNFCCC convened in Cancun, Mexico at the end of 2010. This hard-won result played a critical role in restoring the confidence in collaboration of the international community in addressing the climate change. However, a reality that must be recognized is that *Cancun Protocol* features more procedural and institutional

arrangements that material contents, leaving numerous challenges to follow-up negotiations, indicating that there is still a long way to go before the critical task of building an equitable and effective international climate regime is finally achieved. However, reduction of greenhouse gas emissions, development of low-carbon economy and facilitating the global transition towards green economy has become an inevitable trend of world economic development, and low-carbon technical innovation has become a crucial part of new international competitiveness in the future.

The international climate regime consists of numerous key factors, and Bali Roadmap has proposed five key issues of negotiations under UNFCCC, namely: shared vision, mitigation, adaptation, technology and fund; however, the international climate regime is not limited to negotiations and related legal documents under UNFCCC and Kyoto Protocol, but a general term for various international rules in the field of climate change for standardized international actions in response to climate change on a global scope with a highly extensive coverage, including related international multilateral and bilateral cooperation mechanisms outside the Protocol framework, international agreements on a specific field (such as renewable energies), relevant standards formulated by international trade associations, etc. Such international rules may be in the form of statement, law, agreement, standard, etc., either with legal binding force or on a voluntary basis. With the guidance or constraint of the international climate regime, all countries have attached much importance to these issues, translating international obligations into domestic policies proceeding from reality, designing national strategies in addressing the climate change and promulgating multitudes of climate-related policies.

4.4.2 Climate Change and International Investments

The international climate regime is closely related with international investment and trade featuring two-way interaction. The climate change may cause changes in comparative advantages of certain countries through direct impact, and different climate policies adopted by different countries may influence international investment and trade pattern, hence modifying the size and direction of international investment and trade; while such investment and trade may facilitate or hamper international climate actions in turn. In the global transition towards green economy, potential conflicts and frictions between climate change and international investment and trade policies in the course of global transition towards green economy, and relevant cases have occurred in reality, requiring the coordination of international climate regime and international investment and trade rules in an effort to reduce frictions and create a win-win situation.

Stable and sustained funding is a guarantee for combating climate change from mitigation and adaptation to technical transfer. All-round expansion of channels of fund is crucial to facilitating the international climate course.

Financial Demand in Addressing Climate Change

What is the financial need for global response to climate change? Estimations vary greatly among different international institutions. For example, the estimation of the EU Commission is that the total financial demand of developing countries for adaptation and mitigation by for 2020 is approximately 100 billion euros (USD 145 billion) annually. The Africa Union estimates, in the proposal submitted to the UNFCCC Secretariat, that mitigation alone would require USD 200 billion and adaptation would require over USD 67 billion up to 2020. In 2008, the UNFCCC Secretariat updated its 2007 research report, estimating that by 2030, at least USD 65 billion is needed for mitigation efforts of developing countries and another USD 28–56 billion for adaptation. The world development report *Development and Climate Change 2010* issued by World Bank in 2009 estimated that USD 400 billion is needed for mitigation and USD 75 billion for adaptation (WB, 2009); while *World Economic and Social Survey* published by the United Nations Economic and Social Council estimates that the global investment needed for climate change runs as high as USD 600 billion (See Table 4.3).

Table 4.4 Different Estimations of Costs of Addressing Climate Change

	Estimate in 2030 (billion USD)
Mitigation costs*	
UNFCCC	100–105
McKinsey and Company	175
Pacific Northwest National Laboratory	139
Adaptation costs:	
UNFCCC	28–67
Project Catalyst	15–37
World Bank (Economics of Adaptation to Climate Change)	75–100
Notes: The UNFCCC estimates assume a 25 percent reduction in global GHG emission from 2000 levels. All other studies estimate financial needs based on stabilizing atmospheric concentrations at 450 ppm by 2020.	
*The incremental costs of a low-carbon project over its lifetime.	

Source: Pew Centre on Global Climate Change: Strengthening International Climate Finance. December 2010. <http://www.pewclimate.org/>.

International Public Finance for Climate

At present, international investment for climate change consists of two main parts: public finance and market-based private sector investment. Sources of public finance are mainly the four financial mechanisms under the existing UNFCCC and Kyoto Protocol (see Figure 1):

- **Global Environmental Fund:** initiated in 1990 and managed jointly by World Bank, United Nations Development Program (UNDP) and United Nations Environmental Program (UNEP) for investment in 4 key fields: bio-diversity, climate change, international waters and ozone layer. GEF has provided approximately USD 2.8 billion for climate change projects since 1991, accounting for 31% of its total financial power.

- **Adaptation Fund (AF):** financial mechanism under *Kyoto Protocol*, mainly from 2% of profits of Clean Development Mechanism (CDM) projects launched by developing countries and additional funds provided by non-signatory developed countries such as the United States. The current size of Adaptation Fund is merely USD 3.6 million annually, which is expected to reach between USD 80 and 300 million in future if CDM projects are in sound operation.

- **Special Climate Change Fund (SCCF):** voluntary donation under UNFCCC. Up to 2009, pledged donations reached approximately USD 120 million, of which about USD 90 million has been paid in.

- **Least Developed Country Fund (LDCF):** voluntary donation under UNFCCC mainly targeted at funding capacity building and other related activities of the least developed countries in climate change. Up to 2009, pledged donations reached approximately USD 180 million, if which about USD 120 million has been paid in.

The public finance also includes multilateral financial mechanism on the exterior of UNFCCC framework. For instance, the Climate Investment Fund (CIF) was initiated, funded by Britain, Japan and the United States and managed by World Bank, with an estimated fund of USD 7 to 12 billion, including three specialized funds, namely: Clean Technology Fund, Forest Investment Fund and Adaptation/ Climate Elasticity Demonstration Fund, and a Strategic Climate Fund, providing support for mitigation

and adaptation projects through cooperation with local development banks.

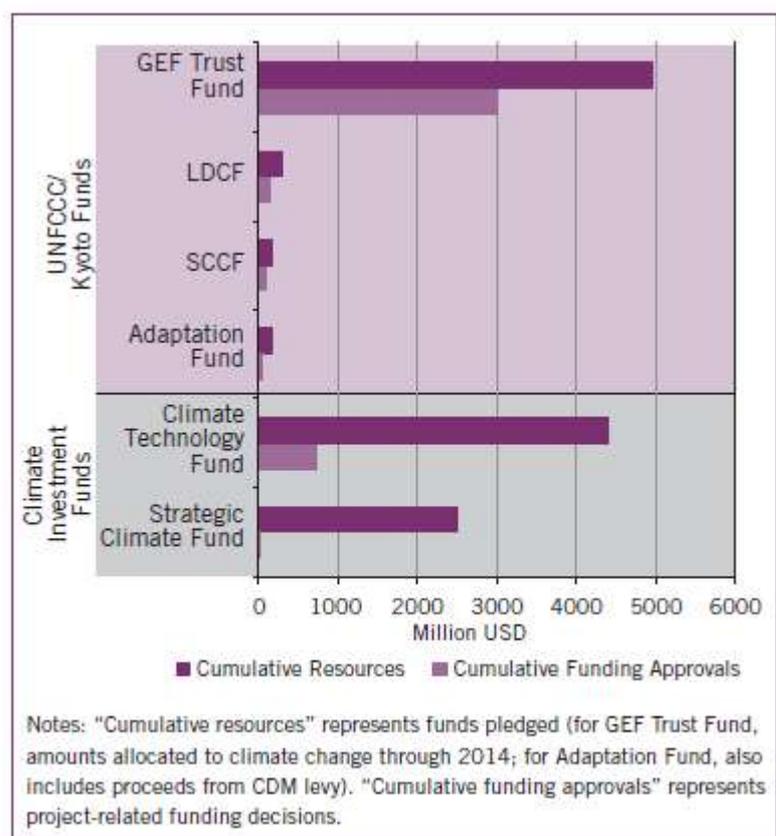


Figure 4.6 Public Finance of International Climate Change

Source: Pew Centre on Global Climate Change: Strengthening International Climate Finance, , December 2010. <http://www.pewclimate.org/>.

Besides, international bilateral cooperation has been thriving in recent years. Up to now, EU, Britain, Japan and Germany have all initiated bilateral climate funds or initiatives; while governmental development aid is playing a significant role in bilateral climate funding channels. For instance, Germany launched the International Climate Initiative (ICI) in 2008, providing support for mitigation and adaptation of climate change of transitional economies in Central and East Europe, developing countries and emerging industrialized nations through bilateral channels, with an annual budget of approximately USD 120 million⁷⁷. In September 2009, the Ministry of Foreign Affairs of Japan, together with some other public and private institutions,

⁷⁷ See <http://www.bmu-klimaschutzinitiative.de/en/results>

launched and operated Hayotama Initiative, aiming at providing support for the economic development of developing countries having adopted emission reduction measures and countries highly vulnerable to climate change. Japan's pledge for the Fast Initiated Fund is also part of the Initiative as the country pledges to provide USD 15 billion for the Fast-Start Fund by 2012, of which USD 11 billion comes from the public sector. On November 30, 2009, the 12th EU-China Summit further enhanced China-EU relationship in combating climate change. EU pledged to provide as much as 57 million euros for development and demonstration projects of CCS technologies, advanced near-zero-emission power generation technologies, etc.

From a holistic perspective, public funding is still in severe shortage and remains faced with massive financial needs. Therefore, while rationalizing the uses of existing funds, making every effort to expand financial channels and collecting more funds has become the key to facilitating international climate cooperation. In this regard, considerable differences in perspectives and positions exist between developed and developing countries, as the latter emphasize that the public finance is the main channel of international financing and that developed countries must perform their financial obligations stipulated in UNFCCC and provide additional public finance for the actions of developing countries to combat climate change, demanding for the establishment of new financial obligations and improving financial management; while the former emphasize on improved performance of the role of market mechanism, advocating for the establishment of global carbon market for fundraising and providing policy-based incentives to guide the private sector to invest in key areas facilitative to climate change mitigation and adaptation.

"G77 plus China" has put forward an initiative related to financial mechanism in international climate negotiations, demanding that developed countries should provide "sufficient, foreseeable and additional to official development aid" funds for developing countries of a size that equals 0.5% – 1% of GDP of developed countries, i.e. approximately USD 240 to 280 billion, with the establishment of an executive institution under the Conference of Signing Parties of UNFCCC reporting to the Conference, adding that the financial operations must be extensively representative and transparent. Such a proposal represents the demand of the numerous developing countries yet no positive response has been given by developed countries up to now.

Progress in international negotiations on financial issues has been achieved during the Copenhagen Conference, as developed countries pledged to provide USD 30 billion in the Fast Initiating Period 2010–2012 and defined the long-term target of an annual funding of USD 100 billion by 2020. Decision on the establishment of World Green

Fund was made and negotiations on fundraising, financial management and utilization are currently in progress. From a longer perspective, there still exist considerable uncertainties in the sharing of financial obligations of various countries and the implementation of funding, and the situation is far from optimistic.

International Carbon Market

Three flexible mechanisms, namely Joint Implementation (JI), Emission Trading (ET) and the Clean Development Mechanism (CDM), are introduced in *Kyoto Protocol*, among which CDM opens up new funding channels for developing countries while reducing emission reduction costs for developed countries through project-based cooperation between developed and developing countries. Besides, a voluntary trading market untaged to international emission reduction pledges is created where organizations and institutions purchase emission reduction on a voluntary basis as a trade-off of their carbon emissions. However, compared to CNM market, its trading volume is rather miniscule. According to World Bank data⁷⁸, in 2009, the CDM market witnessed a trade volume of 211MtCO₂ valued at USD 2.678 billion.

At present, international climate negotiations are in a stalemate with a nebulous future for the development of CDM. CDM is obviously flawed with its low efficiency of operation, lack of transparency and consistency in decision-making process, complicacies of all procedures from project verification and signature for approval with inadequate uncertainly, uneven regional distribution of projects, difficulty in the verification of additionality, prices prone to market impact, uncertainties in rules after 2012, etc⁷⁹. Other researches show doubt on the capability of emission trading system to realize global greenhouse gas emission reduction, its effectiveness in facilitating technical transfer and the feasibility of the pledge to guide investment towards new low-carbon technologies despite a certain volume of capital liquidity⁸⁰.

Low-Carbon Investment by Private Sector

The *World Investment Report 2010* published by the United Nations Conference on Trade and Development (UNCTAD) defines the transfer of low-carbon technologies, practices and products to host countries through foreign direct investment or

⁷⁸ World Bank (2010⁷⁸). State and trends of the carbon market. http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_of_the_Carbon_Market_2010_low_res.pdf

⁷⁹ Duan Maosheng, *2010 Clean Development Mechanism: Current Development and Future Reform*, published in *Report on Combating Climate Change (2010) Challenges of Cancun and Actions of China*. Social Sciences Academic Press p.85-97.

⁸⁰ Friends of the Earth (FOE), 2009. A dangerous obsession: The evidence against carbon trading and for real solutions to avoid a climate crunch.

multinational enterprises as low-carbon foreign direct investment, including investment in low-carbon processes and low-carbon products and services. The former refers to the reduction of greenhouse gas emissions in the production process, such as improving the operational quality of multinational enterprises and enhancing the global supply chain of enterprises. The latter refers to the use of related products or services to reduce emissions, such as electric buses, energy-saving home appliances, massive transit systems, technical solutions of new greenhouse gas emission circulation system designed for local companies, etc. The report estimates that international low-carbon investment features enormous potentials and rapidly expanding scale. It is estimated by UNDP that the FDI capital flow in three major low-carbon industries including renewable energies and energy efficiency, etc. has reached USD 9 billion, that low-carbon investment accounts for 10% of global FDI capital flow, of which at least 40% is directed towards developing countries through multinational enterprises⁸¹.

Attracting foreign low-carbon development is a double-edged sword for developing countries: on one hand, it helps to bring advanced technologies and funds and facilitates fundraising; on the other hand, it may exert negative impact on the economic and industrial development of developing countries, such as weakening the competitiveness of domestic enterprises, dependence on foreign technologies, etc. When addressing these negative impacts, inappropriate measures such as protective policies or standards adopted by developing countries may cause potential conflict with principles of international investment treaties such as national treatment, most favored nation treatment, indirect taxation, equal and fair treatment, etc, even incurring WTO disputes.⁸²

In order to build up their capacity to attract foreign low-carbon investment, developing countries should improve domestic environment, remove institutional and policy barriers for low-carbon investment by private sector and coordinate the relationship between foreign investment expansion and domestic economic growth on one hand, and receive guidance from relevant international rules on the other. At present, direct provisions standardizing international low-carbon investment are not yet included in the international climate regime, yet the United Nations Convention on

⁸¹ The three areas are respectively alternate/renewable energy power generation, recycling and manufacturing of environmental-friendly technical products.

⁸² Miles, K. (2008). International investment law and climate change: Issues in the transition to a low carbon world. *Paper presented at Inaugural Conference of the Society for International Economic Law, Geneva*; Marshall, F., Cosbey, A., & Murphy, D. (2010). Climate Change and International Investment Agreements: Obstacles or opportunities? *IISD Paper*.

Trade and Development (UNCTAD) has stated that international investment policies should be integrated into post-2012 framework of international climate change regime, which is the direction of long-term development.

It is noted that some international organizations have attempted to build relevant standards to encourage and guide overseas low-carbon investment. For example, at Copenhagen Conference, the Association of Chartered Certified Accountants (ACCA) required enterprises to adopt carbon accounting standards so that investors, shareholders and staff are more likely to take carbon emission and greenhouse gas management measures. In August 2010, the International Commission Synthesis Report (IIRC) released the motion on post-crisis commercial report reforms, analyzing the potential impact of climate change and other issues on corporate financial health, which is supported by International Accounting Standards Board (IASB) and U.S. Financial Accounting Standards Board (FASB); these two institutions are responsible for formulating rules for financial reports in EU and in North America. Once the factor of climate change is integrated into the rules of financial report, changes will occur in market values of enterprises involved and those in possession of more carbon assets will possess more financial strength. It is estimated that if rules of financial report are revised, approximately 145 Chinese enterprises respectively engaged in energy, power and aviation industries would be financially affected.

More concretely, there are two major obstacles confronted by the private sector in low-carbon investment.

(1) Regulatory risks in low-carbon investment⁸³. The private sector plays an important role in the implementation of Kyoto Protocol and will play an even more prominent role in international climate change regime in post-2012 period. Nevertheless, changes caused by regulated rules facilitating renewable energies and energy efficiency and flexible mechanism under KP. There are several obstacles affecting foreign low-carbon investment activities, including the instability of energy and climate rules in developing countries and transitional economies, as changes in relevant rules are very likely to hurt the economic interests of foreign investors due to the capital intensity and prolonged time for return on investment of energy and low-carbon investment.

⁸³ Boute, A. (2009). The Potential Contribution of International Investment Protection Law to Combat Climate Change. (May, 27 2009). *Journal of Energy and Natural Resources Law*, 2009. Available at SSRN: <http://ssrn.com/abstract=1410587>; Marshall, F., Cosbey, A., & Murphy, D. (2010). Climate Change and International Investment Agreements: Obstacles or opportunities? *IISD Paper*.

Regulatory risk refers to the probability of sink cost incurred by changes in existing investment rules by public authorities. Impact of regulatory risk is more severe in developing countries and transitional economics as investors are more sensitive to the investment atmosphere.

Developing countries and transitional economies are beginning to support plans facilitating the development of renewable energies and energy efficiency; yet these policies are equally likely to incur regulatory risks, hence producing negative impact on investment decision-making.

In other words, for foreign investors, a stable investment environment is crucial to reduce social transfer cost and risk premiums.

(2) Environmental regulation may violate investment rules⁸⁴. The exclusion of protecting the investment mechanism for low-carbon investment indicates the existence of potential regulatory risk and uncertainty in foreign investment returns. However, bilateral, multilateral and departmental investment treaties aim at ensuring the stability of investment environment. Opposition to taxation, fair treatment, national treatment and most favored nation treatment are all targeted at protecting foreign investors. Yet these rules may be challenged by the environmental rules of the host country.

a) Indirect taxation from environmental rules. International rules allow taxation on foreign commodities under the following three conditions: the commodity in question is intended for public purpose; the commodity is non-discriminatory and non-hegemony in nature; the commodity is compensated. When compensation occurs, the property right is reduced or the property interests are interfered without formal transfer of ownership. In this case, environmental rules lead to indirect taxation.

b) Equitable treatment principle. If there is any adjustment in the above rules, claims of unequal treatment would influence investment decisions. Therefore, investors would challenge the introduction of more stringent climate change regulation rules.

c) Regulatory chill. The interaction between the freedom of international investment and environmental protection may cause capital overflow and regulatory chill, which may in turn cause environmental standards to relax as host countries may

⁸⁴ Miles, K. (2008). International investment law and climate change: Issues in the transition to a low carbon world. *Paper presented at Inaugural Conference of the Society for International Economic Law, Geneva.*

relax their domestic environmental standards out of concerns for reduced investment.

Generally speaking, some measures are applicable to reduce the potential conflict between international investment rules and climate change mitigation measures. An important means is to modify the way environmental rules are involved in investment; another means is to provide a new understanding of fair treatment principle. Yet before these means are implemented in reality, the host country may facilitate the transition towards low-carbon economy by reducing regulatory risks.

4.4.3 Climate Change and International Trade

The impacts of climate policies on international trade are of great concern to the international community as they can lead to serious competitiveness issues and trade frictions around, subsidies, carbon tariffs, the liberalization of low-carbon products, and other contentious issues.

Based on the United Nations Framework Convention on Climate Change's (UNFCCC) principle of "common but differentiated responsibilities," developed countries and developing countries should assume different emissions reduction obligations. In terms of carbon leakage and competitiveness, developed countries in Europe and America have proposed to address the developing countries' competitive advantages in international trade and increased emissions to be compensated through carbon tariffs and other offsetting measures. These include the EU's decision to incorporate aviation emissions into the EU's trading system (EU-ETS) in 2012, a unilateral action that has caused great dispute in the international community and which will seriously affect China's aviation industry. The legitimacy of carbon tariffs under the WTO remains undetermined. Developed and developing countries have different positions, and there exist different opinions even within the EU. This could all lead to potential conflict at the intersection of the international climate system and international trade rules.

Climate change is closely related to international trade. In the field of climate change and international trade, key issues of international concern is not only the impact of climate policies on international trade, such as possible carbon leakage and competitiveness concerns incurred by differentiated climate policies among countries but also effects of trade policies on emissions, such as carbon tariffs, liberalization of low-carbon products, etc.

Carbon Leakage, Competitiveness and Carbon Tariffs

A fundamental principle of UNFCCC is common but differentiated responsibilities. To this end, different obligations are stipulated between developed countries and developing countries. Since the withdrawal of the United States from *Kyoto Protocol* in 2002, some scholars have expressed concerns over the consequences of some major powers' refusal to participate in emission reduction: first, it may weaken the competitiveness of countries performing their emission reduction obligations; second, emissions by countries lacking in emission reduction may increase, hence weakening the effectiveness of emission reduction efforts of countries fulfilling their obligations, i.e. the incurrence of carbon leakage. In recent years, a number of developed countries in Europe and North America proposed the so-called "carbon tariff" measures, i.e. imposing carbon tariffs on imported products with reference to the intensity of carbon emissions or requiring importers to purchase carbon quotas based on the quantity of imported commodities in the name of reducing carbon leakage, safeguarding the effectiveness of global climate policies and protecting the competitiveness of their domestic industries. In Article 10 (b) of *Climate and Energy Package* passed by EU in December 2008, the imposition of carbon tariffs is defined as a feasible policy to solve the carbon leakage problem⁸⁵. The American Clean Energy and Security Act passed by the U.S. Congress in June 2009 also explicitly stipulates that the United States shall implement border adjustment measures or carbon tariffs from 2020 in an effort to effectively control carbon leakage.

Carbon tariffs may appear in different forms. The tariff based on commercial carbon emission is known as carbon tariff in a strict sense, while other policies may practically influence the flow of international trade even though they do not appear in the form of tariffs, which are known as carbon tariffs in a broad sense. For example, the announcement of EU to integrate aviation emissions into EUETS by 2012, which has attracted much attention from the international community, indicates that airlines with destinations in EU countries must purchase carbon credit. Besides, an increasing number of enterprises impose discrimination on products and services based on embedded carbon in products and services through voluntary carbon labeling or similar measures. The imposition of carbon tariffs in whichever form will cast inevitable impact on numerous developing countries, especially China.

At present, no definite conclusion is yet made regarding the legitimacy of carbon tariffs under WTO. Developed and developing countries are in drastically conflicting positions on this issue, and different opinions exist even within EU. There are mounting possibilities of potential conflicts in practice between international climate

⁸⁵ See <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2003L0087:20090625:EN:PDF>.

regime and international trade rules.

Liberalization of Low-Carbon Products and Subsidy Policies

In recent years, various incentives are designed by countries to encourage the development of renewable energies, and international trade frictions triggered by low-carbon products and technologies are increasing in number. An earlier case was the high anti-dumping tax imposed by EU on energy-saving light bulbs manufactured in China since 2001, followed by a 1-year prolongation ruled by the EU Commission in 2007 when the policy expired. In fact, this energy-saving light bulb account for merely one quarter of the market demand in EU, which prioritizes the enhancement of energy efficiency, thus protecting the interests of a small number of enterprises (such as Siemens). Another example took place in September 2009 when manufacturers of PV components in Germany lobbied the German government and the EU Commission to launch an anti-dumping investigation of PV cells manufactured in China, claiming that the Ministry of Finance of China subsidized PV power plant projects at 50% of the total investment, which means direct subsidies were granted to PV enterprises in China. In fact, Germany is one of the first countries to provide policy support for PV power plants. Faced with Chinese manufacturers' competitiveness of lower costs, developed countries have instituted trade barriers in the PV sector to protect the interests of domestic enterprises. A more recent case is the lawsuit filed by the United Steelworkers of America against China subsidizing the export of wind farm equipment which has caused unfair competition, and the United States launched a countervailing duty investigation of China's clean energy sector based on Article 301.

Trade liberalization of low-carbon products and services constitutes one of the key topics in the Doha Round of WTO. Trade liberalization has positive implications on mitigation of climate change as well as increased trade volume between developed and developing countries. Yet the negotiations are in a stalemate as severe conflicts exist between the positions of developed countries and their developing counterparts due to concerns over their respective interests.

Intellectual Property Right (IPR) and Technical Transfer

It is commonly acknowledged that technology plays a key role in international response to climate change. However, due to severely conflicting standpoints of various parties, progress in technical issues has been very slow in the international climate negotiations, among which intellectual property right is a focal point.

Developed countries hold that it is enterprises rather than the government that possess the intellectual property right of low-carbon technologies, and that related rules of IPR protection must not be violated, proclaiming the role of the private sector and the market so as to translate the obligations of technical transfer explicitly stipulated in UNFCCC into technical trade in business model. Meanwhile, developed countries emphasize that developing countries are also responsible for ameliorating the domestic institutional environment which is unfriendly to technical transfer and removing major obstacles hampering the absorption, digestion and application of environmentally-friendly technologies.

Developing countries, on the other hand, emphasize that the objects of technical transfer under UNFCCC are environmentally non-hazardous technologies related to adaptation and mitigation of climate change whose application will generate global benefits, while some technologies merely feature global environmental benefits and some even pursue such global benefits at the cost of interests of the host country. Besides, technical transfer under UNFCCC is an obligation of developed countries and an important reflection of “common but differentiated responsibilities, thus should be on a free or favored basis rather than transfer activities on a purely business basis. Regarding intellectual property rights, although developing countries acknowledge the necessity of IPR protection to facilitate investment in technologies by the private sector, yet due to the special properties of environmentally-friendly technologies and the urgency to address the climate change, it would be inappropriate to implement IPR protection measures such as patent arrangement identical with general commercial technologies; instead, new methods to overcome these obstacles should be pursued, such as compulsory patent approval, common technical research and contribution of patent, etc.

Effective financial mechanism is the most fundamental guarantee for successful technical transfer. Developing countries call for a global technology fund to be established to facilitate technical development and transfer relying on non-market multilateral public finance. To this end, relevant parties in Copenhagen Agreement have agreed on the establishment of a technology mechanism facilitating technical development and transfer; yet the creation of new mechanisms and institutions cannot essentially solve problems and functions, procedures of implementation and executive power of such a mechanism must be clarified in the follow-up negotiations.

4.4.4 China’s Status, Role, and Strategic Choices

As is seen from above, international trade and investment rules are particularly

important for the climate issue, and China, as a major participant and one of the emitters, should integrate itself in the rulemaking process. With rising political and economic power as well as increasingly prominent status of China in the international arena, voices exaggerating China's strength and demanding it for more international obligations are constantly heard. Such pressure comes from developed countries and certain developing countries as well, and some Chinese nationals, filled with pride of the tremendous achievement of the country, have become rather arrogant. In this regard, we should be aware of the fact that China is still in a process of urbanization and industrialization without fundamental changes in its identity as a developing country. For China to become a responsible major power, it must first be clearly aware of its position as a developing country before actively fulfilling its international responsibilities accordingly.

As a major developing country, China still has a long way to go before ascending to world power in a real sense, and poverty elimination and economic development are still the priorities of the country. Balanced social development, well-constructed and comprehensive social security system, structuring of a fair distribution system and efficient administrative system, coordination between development and population, resources and environment and facilitation of industrial upgrading are all daunting challenges that must be addressed in the course of development. The target of reducing carbon density by 40%—45% by 2020 on the basis of 2005 is a voluntary target of mitigation that China has set proceeding from its national reality and a solemn pledge to the international community as a responsible major power. China shall proclaim the truth through its own efforts that China's development requires a peaceful and stable international environment and its development is contributive to global peace and stability.

In regard of facilitating financing for environmental-friendly and low-carbon projects and formulating standards for low-carbon products and services, China should provide more incentives on the domestic side to attract low-carbon investment and facilitate trade and investment liberalization of low-carbon products and services (technologies). On the other hand, we should oppose to tariff or non-tariff trade discrimination based on embedded emissions. It may serve the interests of China to introduce environmental responsibilities or climate-friendly principles into BITs while it is necessary to open tariff-related discussions in WTO and UNFCCC in a timely manner.

Therefore, China must actively participate in international climate negotiations, strengthen international cooperation and play a more active and constructive role in

structuring international climate regime. Special attention should be given to the relationship between climate and international trade and investment, study and analyze its potential influence on China, clarify China's standpoint and strategies in international negotiations in related issues and actively participate in international rulemaking so as to safeguard China's long-term interests and contribute to the global transition of green and low-carbon economy.

Considering China's prominent position in the international society and its status in international trade and investment, the future development and trend in this regard are most influential to China and China cannot be excluded from the scene. However, to participate in relevant international rulemaking and safeguard its interests, an accurate and clear review of the abovementioned issues as well as an in-depth analysis of their impact on China must be completed so as to determine China's standpoint and strategies in international negotiations on related issues. Key issues in several aspects are selected respectively in the fields of international trade and investment for detailed analysis below.

Chapter 5 China's Green Transformation through Investment and Trade

5.0 Introduction: China in the world's economy

China's economic development has entered a key phase of green transformation. In 2010, China scored a GDP of USD 5,878.6 billion, overtaking Japan's GDP of USD 5,474.2 billion to become the second largest economy in the world (official statistics of China and Japan, 2011). In the same year, China topped the world in emitting 8.33 billion tons of CO₂ (BP, 2011) and consuming 3.25 billion tce of primary energy (WRI, 2011). While Japan scored almost the same GDP as China, it only consumed 660 million tce of primary energy. From 1999 to 2009, China saw an increase of 130% in its energy consumption, with the annual growth rate at 8.8%. China's per capita GDP in 2010 was USD 4,382, ranking No. 95 in the world (IMF, 2011). The country now plans to achieve a per capita GDP of USD 10,000 in 2020, reaching the level of the moderately developed countries.

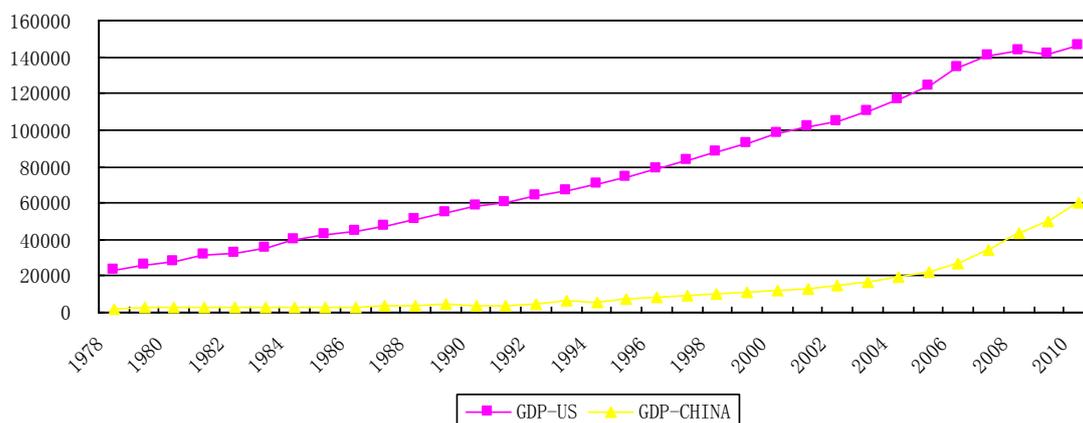


Figure 5.1 GDP of US and China 1978–2010

Foreign investment and foreign trade have made a great contribution to the GDP growth of China. In 2010, the total imports and exports of China reached USD 2972.8 billion, up by 34.7% from last year. Specifically, exported goods totalled USD 1577.9 billion in worth, up by 31.3%, and imported goods totalled USD 1394.8 billion in worth, up by 38.7%. The net export volume was USD 183.1 billion, marking a decrease by USD 12.6 billion compared with the last year. In 2010, 27,406 approved FDI enterprises were set up in the non-financial sectors, up by 16.9% from the last year. The actually utilized FDI reached USD 105.7 billion, marking an increase by 17.4%. The non-financial FDI totalled USD 59 billion in 2010, up by 36.3% compared with the last year. China also scored USD 92.2 billion of revenue through foreign contracted projects, which marked an increase by 18.7%, and USD 8.9 billion through labour service cooperation contracts, which levelled off with the last year.

The current status of pursuing market development and growth at the expense of resources and environment demands prompt adjustment. As the resource intensive,

energy intensive and pollution intensive products with low added value make up a large proportion in the export structure in China, they will bring forth net losses to China's environment. Therefore, a major theme of China's future development will be how to realize the green transformation through investment and foreign trade. The green transformation is a strategic choice in China's adjustment of growth path and a necessary solution to realize sustainable, environment-friendly development. It is foreseeable that investment and foreign trade will become a driving force for the green transformation in China.

Green transformation is a comprehensive concept that combines low carbon economy, ecological economy, and recycling economy. OECD defines green growth as "a way to pursue economic growth and development, while preventing environmental degradation, biodiversity loss, and unsustainable natural resource use"⁸⁶. On the basis of this definition and under the guidance of the Twelfth Five-Year Plan, we may define China's green transformation as a shift from the imbalanced, uncoordinated, and unsustainable mode of economic development towards balanced, coordinated, and sustainable mode of economic development, so as to loosen and eliminate the resource and environmental constraints on economic development⁸⁷. This is a transformation from the traditional mode to the intensive mode of economic development. In order to develop the economy along the balanced, coordinated and sustainable track, it is vitally important to utilize investment, foreign trade and environmental measures. The misuse of these measures may result in lack of balance, coordination, and sustainability, whereas the appropriate designing and utilization of the measures will provide the boost and guarantee for the green transformation.

The global green transformation is of tremendous significance. It can not only reduce the emission of greenhouse gases, deal with extreme weather conditions caused by climate change proactively, and reduce the related losses, but also bring forth enormous potential income. Green transformation serves the fundamental interests of all countries in their economic and social development. China and the rest of the world need to recognize the significance of green development and transformation as early as possible, and formulate corresponding development strategies to promote South-South and South-North cooperation and achieve common development. OECD has conducted a simulation analysis on the basis of the ENV-Linkages model on the objectives, actions and income potential in the greenhouse gas emission reduction projects of various countries. While US promised to reduce its greenhouse gas emission by 17% in 2020 on the basis of the emission in 2005, the objective simulation revealed a deviation of -5.5% from the base year, which was 11.5% higher than the promised objective. China promised to reduce its greenhouse gas emission by 40% to 45% in 2020 on the basis of the emission in 2005, whereas the objective simulation revealed a deviation of 62.3% from the base year, which was 102.3% to 107.3% higher than its promise objective. Therefore, both China and US have

⁸⁶ OECD Ministerial Meeting, May 27-28, 2010.

⁸⁷ P.5, The 12th Five-year Plan. "3-noes".

overestimated their greenhouse gas emission reduction capabilities and made highly optimistic promises. This adds both difficulties and impetus for the green transformation. Green transformation goes hand in hand with the national interest. According to the same OECD report, the potential income of the green transformation of US is USD 253 billion, and for China the figure is USD 81.9 billion. The earlier countries recognize the necessity and importance of green transformation, analyze the focuses and intricacies, and identify a reasonable path to green transformation, the earlier will they formulate green development strategy, rise to the challenge and benefit from it.

Western countries have noticed China's increasing strength in the competition for the overseas resources and market as a result of its growth in economic and trade activities. In criticizing China's investment in Africa, German Minister Niebel for Economic Cooperation and Development said, "I call the Chinese practice of 'no-interference' indulgence. Germany will pay more attention to human rights and fighting corruption."⁸⁸ When the US Secretary of State Hilary Clinton visited Africa, she even warned in her speech to "keep a vigilant watch for China's 'neocolonialism'."⁸⁹ Obviously, Western countries have paid close attention to China's investment and trade activities and are powerful opponents in our international economic and trade development.

In his keynote report at the 17th CPC National Congress⁹⁰, Chairman Hu Jintao pointed out, "we must pursue comprehensive, balanced and sustainable development. In accordance with the overall arrangements for the cause of socialism with Chinese characteristics, we will promote all-round economic, political, cultural and social development, coordinate all links and aspects of our modernization drive, and balance the relations of production with the productive forces and the superstructure with the economic base. We must adopt an enlightened approach to development that results in expanded production, a better life and sound ecological and environmental conditions, and build a resource-conserving and environment-friendly society that coordinates growth rate with the economic structure, quality and efficiency, and harmonizes economic growth with the population, resources and the environment, so that our people will live and work under sound ecological and environmental conditions and our economy and society will develop in a sustainable way." In his evaluation of the achievements of the 11th five-year plan and introduction of the objectives in the 12th five-year plan, Chairman Hu put forward the idea to promote and achieve green transformation through adjustments of the investment and trade policies.

The trend of Global Green Transformation is quite obvious. The up-coming Rio+20 UN conference will further promote green global transformation, which will be

⁸⁸ *Global Times*. 5 Dec. 2010.

⁸⁹ Reuters. 11 Jun. 2011.

⁹⁰ Chairman Hu Jintao's keynote report at the 17th CPC National Congress:

http://news.xinhuanet.com/newscenter/2007-10/24/content_6938568.htm

another step after Copenhagen, Cancun, and Durban for the world to move towards Green. China has inner motivations in green transformation. During the Copenhagen Conference, the Chinese government committed the its 40-45 targets to the world, and will implement these low carbon, green policies in its 12th and 13th five year plans. These whole series of international agreements and domestic policies will have strong impacts on investment and trade, change their structure and promote the Chinese economy towards green. First, large volume of investments will be guided towards new energy sectors; second, international trade protection appears in the form of Carbon Tarriff; third, greenhouse gazes are going to be treated as local pollutants, which will promote industrial upgrading and economic transformation.

5.1 Achievements and Objectives of China's Green transformation

A review of the achievements and the accomplished objectives during the 11th five-year plan can reveal the intricacies and challenges in China's future green transformation, as the green transformation is mainly guided by the five-year plans throughout all the development phases. During the 11th five-year plan period, China has scored outstanding achievements in environmental protection, but it will still face a great number of challenges and hurdles in the future.

5.1.1 Achievements in Eleventh Five-Year Plan Period (2006-2010)

The 11th five-year plan set down the development objective of building a resource-conserving, environment-friendly society. Specifically, the plan laid down 7 environmental objectives, 6 of which have been accomplished on time. The following table shows the major achievements in environmental protection during the Eleventh Five-Year Plan period. China's utilization of wind and solar power is growing at a far faster speed than that of developed countries. Currently the emphasis of China's economic growth has gradually shifted from expansion of quantity to enhancement of quality. The significance of manufacturing will decline continuously while the services will rise in proportion. To maintain the same economic growth speed will demand far less energy consumption. Therefore, although greenhouse gas emission in China will increase with its economic development, but it is unlikely to grow at the rate of 10% or more.

Table 5.1 Achievement of Major Environmental Indices in Eleventh Five-Year Plan Period

Indices	2005	Objectives		Achievement		
		2010	Change Rate (%)	2010	Change Rate(%)	
Reduction of Energy Consumption per unit GDP (%)	NA	NA	Around 20	NA	19.1	
Reduction of Water Consumption per Unit Industrial Added Value (%)	NA	NA	30	NA	36.7	
Effective Utilization Coefficient of Irrigation Water	0.45	0.5	0.05	0.5	0.05	
Comprehensive Utilization Rate of Industrial Solid Wastes (%)	55.8	60	4.2	69	13.2	
Reduction of Total Volume of Major Pollutants (%)	SO2	NA	NA	10	NA	14.29
	COD	NA	NA	10	NA	12.45
Forest Coverage Rate (%)	18.2	20	1.8	20.36	2.16	

As the table shows, while the actual reduction of energy intensity fell somewhat short of expectations, China has done better than expected in such areas as the reduction of air and water pollution, waste water treatment, treatment of industrial solid wastes, improvement of water utilization, and expansion of forest area, etc. This means that during the five year period, China had made tremendous achievements in the treatment of certain pollutants through green investment.

However, the reduction of energy intensity is very different from the control of pollutant discharge. Pollutant discharge standards and objectives can be met by putting in adequate money, making pollutant treatment a policy-sensitive index. Meanwhile, the objectives of energy intensity and efficiency can hardly be achieved by increasing input alone. The realization of these objectives demands long-term investment and is a process of constant improvement. The objective of energy intensity is of vital importance to the realization of China's green transformation and will serve as a key index in the assessment of the success of green transformation.

5.1.2 Objectives of Twelfth Five-Year Plan (2011–2015)

By emphasizing the stimulation of domestic demand, China is gradually transforming its current mode of economic growth, that mainly relies on export and investment, into a mode that relies on export, investment and domestic demand simultaneously. The Twelfth Five-Year Plan gives priority to the increase of income and the closing of the income gap. The Chinese government is committed to the adjustment and

balancing of the economic structure and the promotion of social fairness, so that the majority of Chinese population would enjoy the benefits of economic development.

Green transformation is one of the highlights of the Twelfth Five-Year Plan. The following table lists out the specific objectives on green transformation in the Twelfth Five-Year Plan.

Table 5.2 Green Transformation Objectives in Twelfth Five-Year Plan

Indices		2010	2015	Change Rate (%)	Nature
Proportion of Non-fossil Fuels in Primary Energy Consumption (%)		8.3	11.4	3.1	Binding
Reduction of Energy Consumption per Unit GDP (%)		NA	NA	16	Binding
Reduction of CO ₂ Emission per Unit GDP (%)		NA	NA	17	Binding
Reduction of Water Consumption per Unit Industrial Added Value (%)		NA	NA	30	Binding
Effective Utilization Coefficient of Irrigation Water		0.5	0.53	0.03	Prospective
Reduction of Total Volume of Major Pollutants (%)	SO ₂	NA	NA	8	Binding
	COD	NA	NA	8	
	Ammonia Nitrogen	NA	NA	10	
	Nitrogen Oxide	NA	NA	10	
Forest Expansion	Forest Coverage (%)	20.36	21.66	1.3	Binding
	Forest Reserves (100 million cubic meters)	137	143	6	

The objectives set down in the Twelfth Five-Year Plan provide an important guarantee for China to achieve the 40-45 objectives. Chinese government plans to reduce its carbon dioxide emission by 40% to 45% in 2020 as compared with 2005, increase the proportion of non-fossil fuels in primary energy consumption to 15%, expand the forest cover by 400 million hectares, and enhance the forest reserves by 1.3 billion cubic meters. Compared with the Eleventh Five-Year Plan, the Twelfth Five-Year Plan added certain key binding indexes to promote green transformation, such as the proportion of non-fossil fuels in primary energy consumption, and the reduction of emission of CO₂, ammonia nitrogen and nitrogen oxide, etc. The Twelfth Five-Year Plan includes 11 indices of green transformation, 10 of which are binding.

The focus and the most difficult part of the indices is the energy-related objectives, such as the proportion of non-fossil fuels in primary energy consumption, the

reduction of energy consumption per unit GDP, and the reduction of CO₂ emission per unit GDP. While the other indices can be realized through investment and strict implementation of energy-conserving standards, these energy-related indices cannot be met with investment alone in the short term.

For instance, China plans to raise the proportion of non-fossil fuels in primary energy consumption to 11.4% in 2015. As this index was 8.3% in 2010, this means that the proportion needs to grow by 3.1% in the next five years.

Meanwhile, China plans to reduce the energy consumption per unit GDP by 16% in the period between 2010 and 2015. As in the Eleventh Five-Year Plan period China barely managed to meet the objective of reducing the energy consumption per unit GDP by 19.1% through closing down almost all backward production capacity, there is little potential left for Chinese government to fulfil the new objective through administrative orders.

5.1.3 Difficulties and Challenges

The difficulties and challenges of China's Green Transformation lie in its resource endowment, energy structure, population basis, technology, development stage and other aspects. The energy consumption per unit GDP (or energy intensity) and the proportion of non-fossil fuels in primary energy consumption are the most challenging objectives in China's green transformation. Table 3 lists out the per capita energy consumption and intensity of China and other major countries in 2008. The per capita energy consumption can more accurately reflect the actual energy supply and demand of a country than total energy consumption.

Table 5.3 Per Capita Energy Consumption & Intensity of Major Countries in 2008

Countries/Areas(N)	Per Capita Energy Consumption	N(China)/N(n)	Energy Intensity	N(China)/N(n)
	(ton/person)		(toe/ USD 2,000)	
World	1.83	0.9	0.3	2.5
China	1.6	1.0	0.75	1.0
India	0.54	3.0	0.75	1.0
South Africa	2.76	0.6	0.73	1.0
Brazil	1.29	1.2	0.29	2.6
USA	7.5	0.2	0.19	3.9
UK	3.4	0.5	0.12	6.3
France	4.16	0.4	0.18	4.2
Japan	3.88	0.4	0.1	7.5
Germany	4.08	0.4	0.16	4.7

Source: IEA, 2010 Key World Energy Statistics.

Compared with the other BASIC countries, China is high in per capita energy consumption while low in energy efficiency. The per capita energy consumption of China is 3 times that of India, 1.2 times that of Brazil, and third fifths that of South Africa. China's energy intensity is 2.6 times that of Brazil and maintains the same level as that of India and South Africa. Compared with the major developed countries and the world average, China is low in per capita energy consumption and extremely low in energy efficiency. Its per capita energy consumption is below the world average and is only one fifth that of US, two fifths that of Germany, France and Japan, and one second that of UK. Meanwhile, China's energy intensity is as high as 2.5 times that of the world average, and is respectively 3.9, 6.3, 4.2, 7.5 and 4.7 times that of US, UK, France, Japan and Germany. There is still plenty of room for growth in the demand for energy consumption in China, and the room for enhancement of energy efficiency is even greater. Although China's energy intensity declined after it implemented the energy-saving and emission reduction scheme in the Eleventh Five-Year Plan, we still need to step up to enhance energy efficiency and promote green transformation energetically to shorten the gap between us and the world average level and the developed countries.

Green transformation requires the guidance of green strategy and the pull of green technology. It is a complex social, economic development process and can be divided into different phases with distinct characteristics. It can be observed from Figure 1 that US and other developed countries have passed the peak period of energy intensity growth and developed into a highly developed phase marked with gradual reduction of energy intensity, maturation of green technologies, and abundant knowledge reserve. Under the pull of the developed countries, the energy intensity of the whole world has passed the peak period and gradually declined. Time is ripe now for global green transformation. However, developing countries represented by China and India started their economic development rather late and are now undergoing a phase of accelerated increase in energy intensity and rapid, industry-dominated economic development. Among the major industrial products in China in 2010, the output of crude steel and steel were respectively 626.959 million tons and 797.755 million tons, marking a rise by 9.6% and 14.9% respectively compared with the previous year. China is still developing its economy in the survival mode, and lacks adequate technological means and knowledge reserve in green transformation. At this special historical juncture, we are still faced with many difficulties and challenges in green transformation and in need of more international cooperation and support from the international community.

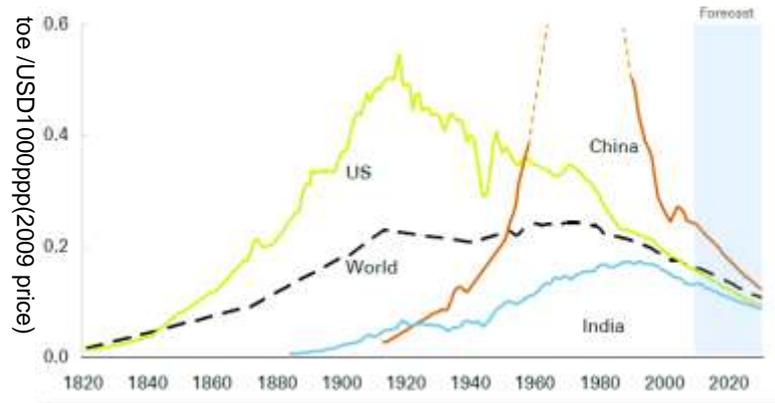


Figure 5.2 Average Energy Intensity of China, USA, India and World
Source: BP Energy Outlook 2030.

In terms of the characteristics of the natural fossil fuel resources, China is rich in charcoal deposits while poor in oil and gas. This may be a tremendous driving force for China to realize its green transformation in the long term, but has posed many difficulties in the adjustment of energy structure in the short term. Currently imported oil has made up over half of the oil consumption in China, while the private car ownership rate in China is about 50 per 1,000 persons, which is one fifteenth that of USA and one tenth that of EU and Japan. The known oil reserves in China can only support 11.3 years of consumption, and even if we include imported oil into the picture, the global oil reserve and production ratio is merely 42. The gas reserve and production ratio of China is three times higher than that of oil, but the figure is still relatively low (32.3), just over a half of the world average of 60.4. The charcoal reserves of China are relatively abundant, but the reserve and production ratio is only 41 on the basis of the current speed, which is only one third of the world average level (122 years). Certainly, the ratio is a dynamic figure and the known energy reserves will increase, but the spatial limitation on the earth determines that the reserves will by no means increase infinitely. With a population of 1.3 bn, China cannot rely on the international market alone to support its tremendous economic scale and energy demand. Furthermore, charcoal mining has destroyed the underground water system, triggered geological disasters and frequent accidents, and took a heavy toll on people's lives. In 2010, the average casualty per million tons of coal was 0.749 in Chinese mines, and the SO₂, nitrogen oxide, Hg, dust, and solid wastes resulting from coal burning caused enormous damage to the environment. Energy security, environmental protection and sustainable development objectively require us to transform our economy rapidly and extensively. Low carbon or carbon-free development is both inevitable and necessary even without climate change.

The coal-rich energy structure is not conducive to China's achievement of green transformation objectives. However, the natural characteristics will not change significantly and the energy structure cannot go "green" in the short run. Let us take the power industry for example. Hydroelectric power takes up only 20% of the total

power production, whereas thermal power accounts for over 77% of the overall volume. Thermal power, which is dominated by fossil fuel burning, still occupies an overwhelming position in the power industry. In the future, Chinese government will increase its investment in the power industry to USD 1,800 billion, and the still growing thermal power industry will create a tremendous impact on the environment. China accounts for 25% of the total greenhouse gas emission around the world. According to the IEA statistics, China accounts for 45% of the increase of world energy consumption, 75% of the increase of world coal consumption, and 60% of the increase of world CO₂ emission.

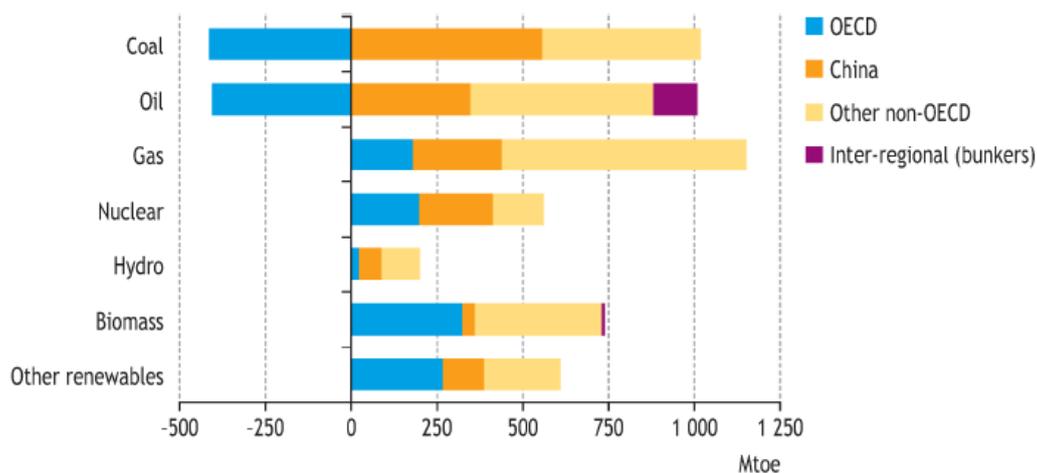


Figure 5.3 Increase of Primary Energy Demand

Note: Demand for all types of energy increases in non-OECD countries, while demand for coal and oil declines in the OECD.

The utilization of renewable energy resources is 250 million tce in China, which occupies less than 10% of the total primary energy consumption. By the end of 2008, China has provided access to biogas for 30.5 million rural households, constructed 39,500 biogas projects for agricultural waste disposal (including 2,700 biogas projects for breeding farms), and 70,000 rural biogas service bases. The annual biogas output of the 30.5 million household biogas facilities and the biogas projects for breeding farms was about 12.2 billion cubic meters, producing about 385 million tons of fermentation residue (in both solid and liquid forms). The amount of utilized biogas was equivalent to 18.5 million tons of coal, marking a reduction of CO₂ emission of over 45 million tons. The resulting substitute firewood was equivalent to 110 million mu of forest reserves, saving 15 billion RMB for rural households annually. The following figure shows that in the future, there will be an increase in the proportion of hydroelectric power, nuclear power and other cleaner energy types in the overall power structure.

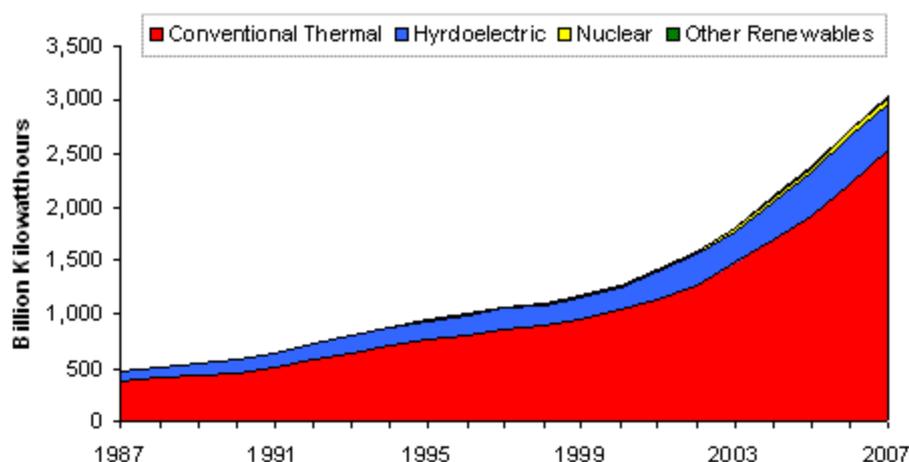


Figure 5.4 Development of Thermal Power, Hydroelectric Power, Nuclear Power and Other Renewable Energy Resources in China

Source: EIA International Energy Annual

To realize green transformation, China shall avoid the lock-in effect of the opportunity cost. Developed countries have passed the period of rapid industrialization and large-scale urbanization, while China is still in the middle of this process, and the industrialization and urbanization will inevitably result in large-scale CO₂ emission and pollution intensity. China obviously needs to learn from the lessons and experience of the developed countries in its green transformation so as to circumvent certain problems in the development process. How to carry out systematic and policy reform and innovation and lift the bottleneck on development remains an important problem in our social and economic development⁹¹. The essence of the “lock-in” effect is a form of “path dependence” during the life cycle of an industrial cluster. The adoption of new technologies often has a mechanism of increasing returns, in which the technologies developed earlier can usually exploit their early advantage and beat their opponents in the competition by realizing a self-enhancing virtuous circle. Meanwhile, more advanced technologies may get stuck or locked in passively in a vicious circle due to their late advent and lack of enough supporters. China owes its rapid development to a large amount of investment. If it cannot prevent the lock-in effect in its investment, the backward production capacity and the high-emission technologies and equipment may lead China into a blind alley in the future.

5.2 Impact of Investment and Trade Policies on China’s Green Transformation

5.2.1 Impact of Foreign Investment Policy on China’s Green Transformation

⁹¹ Zhuang Guiyang. The World’s Experiences and Development Trends of Low Carbon Economic Restructuring, in Green Book of Climate Change: Annual Report on Climate Change Actions, 2009.

Since the reform and opening to the outside world, Chinese government has offered many favourable policies in taxation and administrative approval procedures to attract foreign investors. China has opened itself to the outside world in a step-by-step way by setting up the special economic zones, open coastal cities, economic development zones, and open riverside ports successively. Foreign investment has been gradually directed from the coastal and riverside cities in South and East China to the inland areas in Midwestern China, from the first-tier cities to the second and third-tier cities, and from a link in the industrial chain to the upstream and downstream industries.

Foreign investment has brought forth vigor and creativity to the Chinese economy. A large amount of the Chinese workforce has received modern enterprise training, gradually accepted the advanced ideas of business operation, and formed a human capital reserve of some depth and width. The steady progress of the Chinese economy also owes a lot to the stimulation and pull of FDI. Foreign investment has boosted the diversified development of the country's economy and accelerated the integration of Chinese economy with the rest of the world.

However, with the increase of foreign investment, foreign-funded enterprises have posed constant challenges to domestic enterprises, exploited the cheap natural resources, energy, and labour in China, and brought forth excessive competition for its economic development. Some foreign enterprises have even caused environmental degradation, which is not conducive to China's sustainable development. Under such circumstances, one needs to re-examine the impact of foreign investment on the society, economy and environment of China, and, through adjustments of investment policy, guide the foreign enterprises to develop in a way that is conducive to China's green transformation. There is a typical case about Conoco Phillips in China, June, 2011.

Table 5.4 Cases of Oil Leakage between Confro and BP

	Confro in China Bohai See	Bpin Mexico Gulf
Time and state	June 4 th 2011to September 2011, still have some leakage points	April 20 th 2010, explore and oil leakage July 15 th 2010, no more crude oil into Mexico Gulf Sep.14 th 2011 US Seashore Guard and Ocean Energy Administration publicized the investigation report
The company	Conoco Philips, COPC China National Offshore Oil Corporation, CNOOC	British Petroleum, BP Swiss Oversea drilling Company US HarryBottun Company

Handling Process	<p>June 4th 2011, COPC report to State Oceanic Administration about the oil leakage point. SOA engaged into the investigation.</p> <p>July, 2011 COPC proposed a plan.</p> <p>August, 2011, SOA asked COPC to apologise to the public, and examine the risk points and cut the leakage origin to the backbone.</p> <p>August, 2011 New leakage points showed up, COPC admitted after deny.</p>	<p>April 20th 2010, exploration</p> <p>April 24th 2010, oil leakage</p> <p>June 16th 2010 BP committed to establish a USD 20 billion fund to pay for the leakage accident</p> <p>May 27th Obama office engaged into the deal</p> <p>May 29th 2010, Cap solution failed</p> <p>End of May, Director of Mineral Management, US Interior Department, resigned.</p> <p>June 1st, 2010, federal government and law department engaged into the investigation.</p> <p>July 15th 2010, Hat solution succeeded</p>
Ecological Loss	<p>Up to Sep 6th 2011, accumulated oil leaked into Bohai Sea is around 5500 square kilometres</p> <p>The quantity of leaked oil is about 50 thousand ton.</p> <p>Pollution intensity of Bohai Sea is up to 28.9 ton per cubic thousand meters.</p>	<p>Pollution intensity of Mexico Sea is about 2.7 ton per cubic thousand meters.</p> <p>11 workers died.</p>
Results	<p>COPC was punished by Administration for USD 2 billion</p> <p>COPC committed to establish a EcoFund for payment</p> <p>COPC CNOOC apologised</p>	<p>Obama apologised, high level officers resigned</p> <p>BP was punished for USD 69 million, approximately 0.47 billion RMB.</p> <p>The cost of manage the leakage and clear the oil of BP is about USD 40.7 billion.</p> <p>BP established a 20 billion ecological recovery fund, which will be use as compensation.</p>
Review	<ul style="list-style-type: none"> ● COPC did not report to SOA at the very first begging of the accident. In June 4th when they report to SOA, the oil leakage had been there for a few days, there are absolutely big holes in the monitoring system of SOA. The Reporting Mechanism and Regulation urgently need upgrade. ● Chinese government did not respond and engage into the investigation quick enough. SOA alone can only provide monitoring service to the public, leaving all the rescue job to COPC, which objectively prolong the right time for the ecological protection and recovery. ● COPC and CNOOC are partners in exploring the oceanic oil resource. CNOOC is out of any responsibilities, which could not be an excuse as 	

a state owned company. SOEs are occupying the public resources when cooperating with FDI enterprises, and should lead the role to protect and monitoring the environmental impact.

- The responding action of COPC was not quick enough. In this case they pay little attention about their public image. Instead they pay high profit to their stakeholders and pay high rent for advertisement, which did nothing good to their public image. In another way, it reveals that the petroleum market of China is premature. It is urgent to review China's present market mechanism.
- The administrative punishment is too low comparing to the damage they made. Besides, the implementation is rather weak which left the space for COPC's low expectation of punishment. Only if the situation of no laws or not following the laws respectively could be changed, the enterprises would not pay enough attention to the environmental behaviors.

Source: China-Conoco explosion-Google

5.2.2 Impact of “Going Global” on China’s Green Transformation

Due to the constraints of the planned economy and the limitations of the current phase of economic development, Chinese overseas investment is lagging far behind that of Western developed countries and some developing countries in time, scale, geological coverage, and industrial coverage. Under the guidance of the “going global” strategy in 2000, China has gradually opened up the overseas investment market, expanding it from infrastructure to resource exploitation, energy development, and financial service, etc. In recent years, China has even extended its overseas investment to manufacturing, processing, agriculture and services, etc. The implementers of the “going global” strategy have also changed from predominantly state-owned enterprises to a diversified investor group of state-owned enterprises, private investors and partner investors.

The “going global” strategy has tremendous implications for China’s green transformation. The overseas exploration can find a market for Chinese products, technologies and services; the opening up of overseas material supply channels can provide support for domestic production; the establishment of overseas manufacturing bases can gain more room for industrial upgrading and green transformation. Therefore, we shall pay adequate attention to the problems and conflicts in overseas investment and protect the international image of Chinese overseas investment. The “going global” strategy shall be specified and consolidated into a concrete, clear framework of policy guidance. This is not only a requirement of China’s own green transformation but also a demand of green transformation around the world.

Table 5.5 Main Questions of Field Tirps of the Task Force

	Indonesia	South Africa	Zambia
Time	Feb., 2011	June, 2011	June, 2011
Destination	Sinopec Group in Indonesia	Sen Li Da Chemical Fabric Co.	CNMC
Review	<ul style="list-style-type: none"> ● Chinese ovesea investment is a kind of opportunity to host countries. It is urgent for Chinese enterprises to improve the image. SOEs and private enterprises behave differently, of which Chinese government should improve the monitoring and supervising mechanism, in order to provide the right information to the public in both countries. ● The preparation of Chinese oversea investment enterprises is insufficient. Even SOEs are also facing the challenges from local labour union. Preparations in the fields of language, culture, legislation and others are quite necessary. ● Chinese enterprises are gradually familiar with local law and legislation system. What we have learnt from these three countries is that they are following the western environmental standards. Conparing to China’s domestic environmental standards, these stadards are high in term of regulating level, and they are much more strictly implemented. ● Chinese government should provide more environmental monitoring on the oversea investment enterprises where the host countries are lack of supervision capacity. 		

5.2.3 Impact of Trade Policy on China’s Green Transformation

The trade policy in China underwent three major phases. During the first decade since the reform and opening to the outside world (i.e.. 1978–1990), China began to transform the planned economy into market economy. Chinese government decided to “utilize the two resources and two markets to develop the economy”, and adjusted the foreign trade objective into “active participation in the global division of labour”. This is a trailblazing decade for foreign trade. Under the stimulus of a series of trade encouragement policies, China’s seat in global trade market rose from No. 32 in 1978 to No. 15 in 1990. China’s dependence on foreign trade constantly increased, rising from 12% in 1978 to 40% in 1990. During this period, Chinese government carried out the foreign trade policy of severe import restrictions and limited scale of opening through national regulation, and did not emphasize the driving force of the trade of advanced technologies and equipment for the economic development or the scale effect that such trade may create. As a result, the rapid expansion of trade scale brought forth but limited benefits for the domestic technological innovations and industrial upgrading.

During the 1990s (1990-2000), China adjusted its foreign trade policy objective into “promoting economic growth”. However, the pull of foreign trade on China’s economic growth was realized solely through expanded export. China intensified its efforts to encourage exports and implemented such measures as raising export tax rebates, retaining foreign exchange, and depreciating RMB considerably, etc. These policies created immediate effects. Under the stimulus of the policies, China rapidly expanded its export scale. The provision of abundant export subsidies enabled export enterprises to make profits by selling their products overseas, sometimes even below the break-even point. However, the overall foreign exchange reserves declined rather than increased, and the export enterprises did not learn advanced technologies or management expertise in the foreign trade. The trade policy that aimed solely at the promotion of economic growth could not help enterprises to achieve green transformation. On the contrary, the exported goods embedded a lot of resources and energy, which even negatively affected China’s economic development.

Since its entry into WTO in 2001, China has steadily implemented its promises to lower tariffs, eliminate import quotas, simplify administrative procedures and open its market. By 2010, China has fulfilled all the promises it has made upon its entry into WTO. In 2010, China scored an import and export volume of USD 2,972.76 billion, marking a 34.7% increase over the same period the previous year. Specifically, the exports reached USD 1,577.93 billion, up by 31.3% and ranking No.1 in the world; the imports reached USD 1,394.83 billion, up by 38.7% and ranking third in the world. Through the long-term surplus in foreign trade, China has accumulated a large foreign exchange reserve and exported a large amount of natural resources and embedded energy. Meanwhile, China is subject to the most numerous anti-dump investigations in the world. The negative impact of trade on China’s sustainable development has been constantly on the rise and caught the attention from all sides. Therefore, China needs to draw lessons from the failures in the past, recognize the impact of globalization on the sustainable development of Chinese economy, and reassess the role and influence of product competitiveness, brand awareness, and embedded energy in trade. The trend of economic development towards globalization and diversification requires more specific and concrete trade policies. In the face of such challenges as the repercussions of global financial crisis, the economic recovery, the rise of green barriers, the increase of global energy and resource costs, and the fierce competition, China should adjust its international trade policy proactively to facilitate green transformation.

China’s green transformation has made the country one of the major seriously engaged green global competitors. It has also brought important new developing opportunities to the global society. China’s green transformation is facing some severe competition. After entering WTO, its international traders are continuously facing double accusations of anti-dumping and anti-subsidies. The going out strategy

of Chinese enterprises are a step forward towards reducing the country's hurdles both in terms of international trade and investment.

5.3 Facilitating Green Transformation Through Investment and Trade

China's green transformation can be promoted by better adjusting the foreign investment and trade policies. These policy adjustments can be specified into the objectives in the Twelfth Five-Year Plan.

Table 5.6 **Impact of Foreign Investment and Trade on China's Green Transformation**

Index	Targets	Investment				Trade		Rules
		FDI	Export-oriented FDI	ODI	Import-oriented ODI	Import	Export	
Proportion of Non-fossil Fuels in Primary Energy Consumption (%)	8.3% -11.4%	+	+	NA	NA	+ Equipment, Technology	NA	reduce barriers
Reduction of Energy Consumption per Unit GDP (%)	16	+	+	NA	+	+ Equipment, Technology	Prohibition on PER*goods	+
Reduction of CO ₂ Emission per Unit GDP (%)	17	+	+	NA	+	+ Equipment, Technology	Prohibition on PER goods	+
Reduction of Water Consumption per Unit Industrial Added Value (%)	30	+	+	NA	+	+ substitution	-	+
Effective Utilization Coefficient of Irrigation Water	0.03	NA	+					
Reduction of Total Volume of Major Pollutants (%)	SO ₂	8	+	-	NA	+		
	COD	8	+	-	NA	+	+ Equipment, Technology	-
	Ammonia Nitrogen	10	+	-	NA	+		+
	Nitrogen Oxide	10	+	-	NA	+		
Forest Expansion	Forest Coverage (%)	1.3	NA	-	NA	+	+ substitution	-
	Forest Reserve (100million cubic meters)	6	NA	-	NA	+		+

The policy system for regulating China's international trade and investment could be taken as if it were the implementation of a Carbon Tax. Carbon tax could be introduced through different policy instruments, that can either be specific policies aiming directly at adjusting investment and trade, or can also integrate the idea of a

carbon tax into the macroeconomic policies. This implementation can be done either in the form of a carbon tax, or in the form of an exchange rate adjustment. Among other policy options used to influence investment and trade.

5.3.1 Facilitating China's Green Transformation Through Foreign Investment

Since its reform and opening to the outside world, China has greatly benefited from FDI, which propped growth, technological advances and social development. FDI has played a particularly significant role in China's administrative improvement and technological advances in the field of environmental protection. Foreign investment will continue to be an important pulling force for the economic growth and transformation in China.

Foreign investors are the first to perceive the trend of China's green transformation. In 2010, the country received a total volume of USD 105.74 billion of non-financial FDI, up by 17.4% compared with the previous year. Specifically, the FDI that went into manufacturing and the production and supply of power, gas, and water totalled USD 52.71 billion, marking an increase of 6% and 0.6% respectively, both well below the GDP growth rate. The FDI that went into communications, warehousing and postal service, information transmission, computer service and software, wholesale and retail, real estate, rental and business services, residential service and other services totalled USD 44.5 billion, accounting for a robust annual increase rate of -11.2%, 10.7%, 22.4%, 42.8%, 17.3%, and 29.4% respectively. The secondary and tertiary industries attracted 49.8% and 42.1% of the FDI respectively. Foreign investment in China has begun a shift from the secondary industry to the tertiary industry.

The flow of foreign investment into the service industry can bring advanced management philosophy and expertise to the corresponding sectors in China, lead the industry-wide improvement of service quality and management standard, and create a positive environmental influence by promoting energy conservation and pollution abatement. As Table 4 shows, the growth of foreign investment in the service industry in China will promote the achievement of such green transformation objectives as the reduction of energy consumption per unit GDP, the reduction of CO₂ emission per unit GDP, the reduction of water consumption per unit industrial added value, and the reduction of the total volume of four major pollutants, etc.

If foreign investment is directed to the field of new energy, it will directly elevate the proportion of non-fossil fuels in primary energy consumption and help solve one of the major problems in the green transformation objectives of the Twelfth Five-Year Plan.

On the other hand, the foreign enterprises are also predominantly export-oriented, which can stimulate the demand, provide more employment opportunities, pull market development and boost technological progress. The FDI enterprises in the field of new

energy, in particular, will open up market opportunities and provide broad development space for the sectors related to non-fossil fuels by exporting energy-saving, environment-friendly products. However, attention needs to be paid to control the threshold limits for the high-energy-consumption, high-pollution and resource-related products and sectors, so as to avoid the environmental degradation and ecological destruction resulting from the investment and export practices of FDI enterprises. In 2010, foreign-funded enterprises in China scored an export volume of USD 862.3 billion, up by 28.3% compared with the previous year, whereas the other enterprises only exported USD 481.3 billion worth of goods, slightly over a half of the volume of FDI enterprises. The export of high-energy-consumption, high-pollution, and resource-related products will inevitably increase the discharge of major pollutants. The export of forest products will also negatively affect the forest-related index. Besides, the high-energy-consumption, high-pollution and resource-related products embed a large amount of virtual water and other resources that are hard to price, and increasing the export of such products will add further pressure on our ecological system and hinder the green transformation.

5.3.2 Facilitating Green Transformation of China and Host Countries Through China's ODI

China's ODI will create a positive influence on the sustainable development and green transformation of the local economy, society and environment. However, it cannot influence China's green transformation directly. It is only the import-oriented ODI that will promote the green transformation in China. In 2010, China scored a total volume of USD 59 billion in ODI, marking a rapid annual increase by 36.3%. The absolute ODI volume was about half that of the FDI in China and fell short compared with the scale of our economy and the overall energy consumption. There is still plenty of room for development from the perspective of investment balance.

China's ODI is concentrated in such fields as resources, energy, raw materials, and agricultural products, which are highly complementary to the country's domestic economy. In 2009, the increase of crude oil imports in China made up 60% of the total increase in the world. The import of such products can facilitate the further implementation of the resource conservation, water source nourishing, land protection, and other aspects of environmental protection. The overseas resources, especially the mineral resources, are high in grade terms and processed with advanced technologies. They can compensate for such problems as the large proportion of unproductive mines, backward technologies, low production efficiency, and high pollutant discharge in China. For instance, the copper from the Zambian Copper Belt, is very rich with an average ore content of 2% to 13%. This means that those Chinese enterprises that "go global" can have access to copper resources with a copper content of at least 2% or over, whereas the domestic copper mines are mostly poor with an ore content quite below 2%. The import-oriented Chinese ODI is not only conducive to

the realization of all the aforementioned green transformation objectives that foreign investment can help to achieve, but can also increase forest cover and reserves from the perspective of resource and energy substitution while enhancing the effective utilization coefficient of irrigation water by importing from overseas energy sources, minerals, timber, food and other raw materials.

On the other hand, the Chinese ODI enterprises that “go global”, within the large state-owned enterprise and central enterprise system, may carefully and systematically study the local environmental standards and legal systems. With such learnings, they will be better prepared to promote the development and green transformation of the state-owned enterprises back home, spread the technologies and philosophies to the related sectors, and facilitate technological diffusion and the green transformation of the industry.

5.3.3 Facilitating China’s Green Transformation Through Foreign Trade

Similar to the export-oriented FDI and import-oriented ODI, independent foreign trade can create a direct and extensive effect on the facilitation of China’s green transformation.

Foreign trade involves a wider range of partners and a richer variety of imported and exported goods. The imported raw materials can complement the domestic material market. In 2010, China imported 239 million tons of crude oil, up by 17.5% over the same period of the previous year. As the foreign trade dependence approached 55%, the oil security problem was exacerbated. The crude oil imported from the Middle East and Africa made up 60% of the total imports of China. In the soft commodity bean market, imported beans have occupied one third of the market share. As genetically modified beans are cheap with a high extraction rate, and their import embeds virtual water that alleviates the burden on the arable land in China, the import of beans can facilitate the industrial transformation. It has certainly seriously affected the non-genetically modified beans, but this is an inevitable temporary difficulty arising from the industrial transformation process. China’s policy makers shall take the impact of the competition into full consideration. Meanwhile, attention needs to be paid to the import and export of virtual resources and energy in foreign trade. Due to China’s role of world factory and the predominance of low-added-value, high-carbon-intensity exports, a lot of embedded CO₂ has been transferred and consumed abroad with the exports. According to the statistics of Tyndall Center for Climate Change in 2007, China exported a net volume of embedded CO₂ of 1.1 billion tons per year. This means that one fourth of the greenhouse gas emission in China was exported.

Different from the export-oriented FDI, independent export provides but a weak pull to the industrial development and creates little effect on the development of non-fossil

energy and the achievement of other green transformation objectives. On the other hand, different from the import-oriented ODI, independent import can choose to directly import those efficient, energy-saving, and environment-friendly technologies and equipment without considering the investment policy and market threshold, etc, of the host countries. The introduction of these technologies and equipment to the domestic market will directly and indirectly reduce the proportion of non-fossil fuels in primary energy consumption, promote the upgrading and transformation of the related sectors, and facilitate China's green transformation through the technology effect and the structure effect. The import part of foreign trade can facilitate the realization of all the green transformation objectives in the Twelfth Five-Year Plan.

5.3.4 Facilitating Green Transformation of China and the Rest of the World Through China's Participation in Formulation of International Rules

While foreign investment and trade have made tremendous contribution to the development of China, China's growing dependence on foreign trade creates an energy security problem that is worthy of our careful consideration. There is an increasing need for China to cooperate with the other countries. China needs the rest the world, and vice versa. Among the major imported commodities of China in 2010, imported beans reached 54.8 million tons, up by 28.8%, and totalled USD 25.1 billion in value, up by 33.5%. China's primary energy consumption reached 3.25 billion tce in 2010, marking an annual increase rate of 6.3%. The imported coal and crude oil reached respectively 165 million and 239 million tons, marking a yearly increase of 30.9% and 17.5% respectively. The import of processed oil reached 37 billion tons, down by 0.1% over the previous year.

Despite the rapid increase of the foreign trade volume, China has no control over the rates in the world material market and has been put into the position of price taker. Let us consider the importation of crude oil for example. In 2010, China imported 239 million tons of crude oil, up by 17.5%; the total value reached USD 135.2 billion, up by 51.4%. The increase of imports came with a higher rather than a lower price. The tension in North Africa in 2010 caused the oil price to shoot up, as China had to spend USD 50 to 60 million more per day than the case prior to the latest price adjustment. China spends USD 61 a barrel on the average every year, totalling USD 400 million every day. Such a trade situation of large import quantity at a high price serves to demonstrate that China is by no means a "neocolonialist" country.

While China is by no means a colonialist country, it is constantly subject to challenges in the international arena. For instance, in Jan. 2009, US Customs and Border Protection declared that certain solar panels equipped with a type of diodes fell into the category of "electric motors and generators" (HTS8501.31) in HTS, rather than "diodes, transistors, and similar semiconductor devices" (HTS8541.40). The re-categorization imposed a tariff of 2.5% on each of these panels, while according to the categorization of HTS8541.40, these panels should have been tariff-free. This

decision is in conflict with the free trade principles surrounding environmental goods and services as defined by the USA under the Doha talks. In 2009, the USA imported USD 100 million of electric motors and generators (HTS8501.31), accounting for 17.9% of the USD 800 million of US's total import in this category, and 21.1% of the USD 700 million of China's total export in this category. As another example of this, on June 23, 2009, the USA and EU requested a revision of a trade dispute settlement with China and claimed that China's export restrictions protected Chinese enterprises and gave European and American enterprises a competitive disadvantage. WTO ruled in July 2011 that China violated the international trade rule by restricting the export of nine industrial raw materials. The materials include bauxite, coke, fluorite, magnesium, manganese, metallic silicon, silicon carbide, yellow phosphorus, and zinc, some of which are widely used in steel industry, aluminium processing, automobile manufacturing and chemical industry. The decision will give an advantage to European countries and USA in the disputes over the prevention of China's export restrictions of rare earth materials. The known rare earth reserves of China are at 52 million tons, making up 90% of the total reserves on the earth and contributing about 80% of the rare earth consumption around the world. While the USA and France also have abundant rare earth resources, they have closed down their own rare earth mines and relied on China's export of rare earth.

It can be concluded from these two examples that China will have to incorporate a strong knowledge of the international rules in order to protect its trade interests and maintain a certain advantage in international trade. This not only means studying closely the existing international rules, but also actively participating in the process of the formulation of the rules and becoming a stakeholder in the formulation.

5.4 Facilitating Green Transformation Through Adjustments of Investment and Trade Policies

First, establish the image of China as a responsible developing power, guide and regulate investment and trade activities with the green transformation objectives, and clarify China's role as the leader and promoter of global green transformation rather than a follower and recipient of it.

Green transformation has always accompanied the industrialization and urbanization progress in China. However, in the Eleventh Five-Year Plan period, there was a shift in China's role in the global green transformation from a follower and recipient to a leader and promoter.

The shift of China's role stems from many factors. (1) The speed and scale of the urbanization and industrialization process in China shows that there is no existing model of development for us to follow; (2) the passive acceptance of green

transformation can no longer satisfy the demand of the sustainable development of China and the rest of the world; (3) the expectations of the international community for China have been raised; (4) as an integral part of economic globalization, China needs to utilize two resources and two markets to facilitate its economic restructuring; (5) China has already played the actual role of world leader in many of its transformation practices.

Investment and trade are the pulling forces and carriers of this transformation. If China played more or less the role of follower and recipient of green transformation when it welcomed foreign capital and technologies into the country, since the reform and opening to the outside world, it must assume the role of leader and promoter of green transformation when it “goes global” with its investment and technologies in the 21st century. During the Eleventh Five-Year Plan period, China implemented the policies of attracting foreign investment and going global simultaneously and basically achieved the periodical objectives of green transformation. The green transformation practices in the Twelfth Five-Year Plan requires that China be a more active leader and promoter of green transformation when it attracts FDI and when it goes global.

The practices of China’s green transformation have also been widely recognized in the international community. China is in the forefront of green development, taking a lead internationally in renewable energy resource utilization, many traditional manufacturing sectors, and ecological protection, etc. The green transformation objectives set down in the Twelfth Five-Year Plan have actually set up a model for the global green transformation. The clarification of China’s leading and promoting role in green transformation is an effective response to the doubts of the international community over China’s image and could serve to rectify various misperceptions of China. However, China’s assumption of the leading role in global green transformation does not mean that China will shoulder the same responsibility as developed countries. The principle of collective yet differential responsibility is also suitable for green transformation. China still remains a developing country.

Secondly, change the ideas and guide the foreign investment to develop in a way conducive to China’s green transformation and sustainable development.

The sectoral and geographic distribution of foreign investment is not even. A large amount of foreign investment went into resource and environment-sensitive industries and is gradually shifting to the underdeveloped or backward areas in Middle and West China, creating tremendous difficulties for the pollution treatment in China. Foreign enterprises in China mainly follow Chinese environmental standards, which are below the environmental standards in developed countries and international standards to a certain degree. The favourable policies to attract foreign investment in pollution intensive industries and high energy and resource consumption industries have been left behind the times. Therefore, following suggestions are put forward:

(1) Formulate a policy guideline on foreign investment attraction and direct foreign investment to the promotion of China's green transformation. Compared with engaging foreign investment solely in the promotion of economic growth, employing it as a facilitator of China's green transformation creates a more positive effect on Chinese economy and will play a more vital role in the future development of China. China's green transformation requires that it break away from the blind pursuit of foreign investment and change its role as a passive recipient. Rather, it needs to guide, regulate and promote foreign investment according to its transformation objectives. The development of China is still in need of a large amount of overseas investment, and the provision of policy guidance to direct the flow of foreign investment will enhance the energy efficiency and carbon productivity.

(2) Strengthen the regulation of FDI in China and establish a related environmental monitoring and reporting mechanism. China shall have a dynamic control of the contribution of FDI to green transformation, track its performance, and impose severe punishments for enterprises that cause environmental pollution and harm the ecosystem. It shall reform the evaluation index system of the local governments by setting up an ecological performance evaluation index and including the ecological quality index into foreign investment evaluation, with particular emphasis on the protection, treatment and monitoring of environmental resources. The reformed evaluation system can enable the local governments to carry out their social, economic and political functions in a coherent way, and overcome short-sightedness in the approval of foreign investment projects and the regulation of enterprise behaviour.

(3) Guide the flow of foreign investment in China to optimize the industrial structure and elevate the market threshold standard. China shall reduce or abolish the preferential tax policies for foreign investment in the coastal areas and increase the preferential tax policies for foreign investment in certain inland cities; abolish industry-wide preferential tax policies and increase preferential tax policies for emerging strategic industries; abolish the preferential tax policies for low-added-value industries, and increase preferential tax policies for high-added-value high-tech industries. It shall demand the FDI that is flowing into the heavy industry sector in China start to conserve energy and protect the environment while restraining foreign investment from flowing into traditional manufacturing and high-pollution sectors. Abolish the super-preferential policies for foreign investment in such labour-intensive, pollution-intensive sectors as textile, clothing, and household appliance manufacturing, etc, and withdraw its encouragement of FDI into sectors suffering from overcapacity. China should impose stricter administrative examination procedures in certain areas, sectors, and centers of industrial chains, accepting foreign investment on a selective basis. It shall impose the strictest industrial technology demands and environmental protection standards in energy-intensive, resource-intensive, and pollution-intensive industries, raise the penalty for violation of

the standards, and adopt measures to ban or rectify the enterprises where the case is serious, so as to facilitate environmental protection through the punitive policies.

(4) Implement policies related to the cultivation of strategic emerging industries and facilitate the introduction of green technologies through FDI. China shall appropriately subsidize technological transfer and the introduction of cutting-edge equipment, guide the direction and structure of foreign investment in the country, and make full use of the advanced overseas product concepts and technologies to make them serve its overall objectives and the development of priority sectors, so as to facilitate the industrial restructuring. China shall emphasize the importance of green technologies and promote the introduction of them through FDI. It shall open up all the vital links in the industrial chains and avoid inadequacies in the restructuring drive resulting from sole reliance on technological innovation. It shall promote the green transformation of the society as a whole by facilitating the green transformation of entire industrial chains of the strategic emerging sectors.

(5) Strengthen the environmental responsibility of foreign enterprises and encourage the establishment of “fair-to-all” environmental information release systems. As a developing country, China still has a long way to go in terms of the environmental standards and environmental responsibility system compared with developed countries. Foreign enterprises, particularly influential multinational ones, are more experienced in fulfilling their environmental commitment. If they can adopt mandatorily environmental information release mechanisms for their branches in China, similar to what they do at home, it will set up a significant model for Chinese enterprises and create a positive influence in stimulating the environmental awareness of Chinese enterprises and the self-motivated establishment of environmental responsibility systems and mechanisms of enterprises.

Thirdly, take the initiative to encourage China’s ODI to facilitate the green transformation of China and the host countries.

China has prepared adequate technologies and funding resources for its ODI, however, it still lags in “soft” preparations, such as better knowledge of local languages, codes, ideologies, social customs, industrial culture, and means of communication, which are all very inadequate. This handicap affects the thorough development and expansion of China’s ODI in many negative ways. The bureaucratic practices of state-owned enterprises and their reticent mode of behaviour have posed serious barriers to Chinese investment and trade in their effort to integrate into the local economy. State-owned enterprises and private enterprises behave rather differently in China’s overseas investment, and the bad conduct of some private enterprises may damage the overall image of Chinese investment and trade. State-owned enterprises attach greater importance to environmental protection and follow the local laws strictly. Therefore, the environmental issue is not a major problem in their investment and trade. However, a small number of private enterprises randomly dumped and buried the

wastes and waste on the roadside, and hence created a bad social influence even if the environmental impact was limited. Some few private enterprises even attempted to evade liability by such means as bribery, forgery of accounting fraud. They employed illegal labour, etc, which created very bad social effects. China's ODI is faced with the latecomer disadvantage in other developing countries. Chinese enterprises entered the international investment market later than their European and American counterparts and occupy a disadvantageous position in terms of their access to resources. On the other hand, the technological systems and management measures that Chinese enterprises developed independently on the basis of the relatively low development level and the backward infrastructure conditions are more valuable for developing countries. Therefore, one can make the following suggestions:

(1) **Fully recognize the dual function of enterprises that “go global” as the promoter of domestic and global green transformation.** Although China's ODI cannot directly influence the domestic green transformation, it can play an important role in facilitating the achievement of the Twelfth Five-Year Plan objectives and green transformation. The import-oriented ODI can substitute the high-energy-consumption industries back home with the import of resources, energy, and energy-intensive, resource-intensive products and therefore indirectly enhance the energy efficiency and carbon productivity. Such an environmental effect of overseas investment calls for appropriate policy guidance. Close attention should be paid to the import-oriented overseas investment, as it involves the adjustment of both investment policies and trade policies and will arouse the concerns of the international community.

(2) Strengthen the policy guidance for the overseas investment enterprises. The related departments and ministries shall formulate and improve the laws, regulations, policies and standards on “going global”. To encourage enterprises to go global and explore “two resources and two markets”, China needs to formulate related regulations and establish corresponding standards. The Ministries of Commerce, Foreign Affairs and Education, as well as the SACAC and NDRC, need to coordinate with each other in the formulation of the standards and guidelines on the preparations, consultation, training, financing and information follow-up of enterprises that “go global”.

(3) **Strengthen the administration of Chinese ODI enterprises.** China should carry out proactive regulation and supervision over the enterprises that “go global” and impose stricter qualification examination of ODI enterprises. As regards the overseas investment of large and medium-scale state-owned enterprises, it should carry out a strict examination of projects and register and track the geographical and sectoral distribution of the investment, so as to avoid the wasteful competition between Chinese enterprises. Furthermore, China we should monitor the enterprises, and limit the number and sectoral distribution of investment projects, so as to control the number of competitors and the sectors into which ODI flow. While it should

encourage the overseas investment of medium and small-sized private enterprises in principle, it needs to strengthen its communication with the host governments and examine with the local Chinese embassy the corresponding qualifications of these enterprises before they register and operate, as it lack the means to monitor them back home. The development banks and commercial banks need to tighten their environmental and social regulations when they provide financing to Chinese overseas investors.

(4) Guide the enterprises in making preparations for “going global”. China should organize training sessions for state-owned enterprises that “go global”, provide information channels, enhance the leadership capacity of Chinese overseas enterprises, and deepen their understanding of the local languages, legal systems, environmental standards, cultures and customs, religions and taboos, as well as the social responsibility of enterprises. It should provide an information platform for private enterprises that “go global” and enhance the availability of various information. It should encourage Chinese overseas enterprises to actively shoulder up their environmental and social responsibilities and promote the local green transformation and sustainable development. It should extend Chinese overseas investment to the downstream of the industrial chain and to the grass roots of the host countries, so as to improve the social image and credibility of the Chinese enterprises.

(5) Intensify the scientific research cooperation and exchanges in education and training. China should strengthen research on the host countries in basic sciences and social sciences, emphasize the research and advancing of applied sciences, especially the adaptive technological researches in South-South cooperation, and strengthen the exchanges and mutual learning between researchers and enterprises. It should focus on the quality rather than the quantity of the foreign-aid education and training. To enhance the standard of foreign-aid education, it needs to pay attention to the quality and source of the overseas student candidates and strengthen the cultivation of the ability of the local technological and engineering personnel.

(6) Emphasize communication and exchanges and establish a platform for dialogue in order to take the initiative in publicity, enhance credibility and clarify doubts. China should encourage overseas investment enterprises to work closely with non-governmental organizations and business consulting agencies and design their overseas investment behavior commercially. Meanwhile, it should strengthen media publicity and spread the information of China to the host countries via various channels. It should take the initiative to contact local media organizations, make use of the Chinese media correspondents, and utilize various media platforms comprehensively to communicate Chinese culture and China’s green transformation practices and produce a voice of its own in the international arena.

(7) Make full use of the latecomer advantage of Chinese investment and trade in Africa, explore the African market for low-carbon adaptive technologies and

enhance South-South cooperation. Chinese low-carbon adaptive technologies have a bright prospect and contribute greatly to the promotion of the green transformation of China and the rest of the world. While the technologies of developed countries are costly in implementation and low in adaptability, Chinese low-carbon technologies are more suitable for the natural conditions and infrastructure standards of developing countries with such advantages as inexpensiveness, simplicity in implementation, convenience in maintenance, and low infrastructure requirements, etc. As members of the South camp, China and the other developing countries, especially African developing countries, share a lot of interests and are in similar stages of development, which provide a foundation for South-South cooperation.

Fourthly, adjust the trade structure to make the foreign trade serve the green transformation of China and the rest of the world.

China has remarkably increased its imports and exports and expanded its share in the international market. As a result, there will be a broader market for foreign trade. Meanwhile, there has been a change in the structure and trade mode of the imports and exports, as processing trade is quickly expanding, overtaking the other trade modes in growth. High-energy-consumption industries not only saw increase in exports but also in their proportion in the total exports. As a result, a large amount of energy has been implicitly exported while a lot of pollutants have been left back at home, imposing pressure on the energy conservation and environmental protection in China. The various forms of environmental regulation costs will change the costs of domestic products. The implementation of the list of green products is an effective method of environmental regulation. Natural resources and energy will flow in virtual forms in the direction of the foreign trade. Policy makers shall take the factor of embedded energy into full consideration and adjust the foreign trade policy accordingly. Specifically, China should consider the following two policy suggestions: (1) formulate a green trade list, reduce and abolish the system of export tax rebates, and control the export of high-energy-consumption, high-pollution, and resource-related products; (2) encourage the import of green technologies and equipment and the introduction of green talents by providing policy support in administrative procedures and appropriate subsidies.

Lastly, shift China's role and actively participate in the formulation of international rules to facilitate global green transformation.

To shift its role from the recipient to the formulator of the international rules does not only lie in the protection of the development rights and interests of China and all the other developing countries, but also in the commitment to global green transformation and the promotion of the establishment of the international system in the process of global sustainable development. China should participate in the formulation of international rules more vigorously, so that the interests of developing countries are embedded and protected in international negotiations.

(1) Actively participate in WTO talks and promote the formulation of standards for environment-friendly products and technologies.

Considering the diversity and complexity of the economic development of China and the urgency of its environmental requirements, it should make necessary adjustments on the oversimplified dichotomy of developing vs. developed countries when it approaches the international economic and trade relations in trade talks. For certain WTO member states, especially the developing countries, it is advantageous for them to list out the goods and services in affirmative statements; however, due to the competitiveness of Chinese products, it is better for it to list out the goods and services in negative statements. As the trade talks do not allow it to use such statements, the more extensive the list of goods and related services is (with the exception of local goods and services), the better it will be for its enterprises. Among the three kinds of environmental goods and services, namely, global environmental goods and services, local environmental goods and services and indoor environmental goods and services, China is very competitive and will be more and more so in the future in the provision of all but local environmental goods and services. As Chinese environmental goods and services enjoy a similar advantage as that of Japanese and Korean ones, China shall form an interested community with Japan and Korea in EGS talks.

Currently the EGS talks in WTO's Doha round have reached an impasse. China shall proceed from the requirements of environmental protection and development and formulate its own strategies in the current EGS talks of WTO-CTE on the basis of a clear assessment of the comprehensive interests of China in economy, trade, environmental protection, industrial development, and international diplomacy, etc. Specifically, it shall divide the environmental products into indoor environmental products, regional environmental products, and global environmental products, put forward the development requirements of the developing countries, and formulate an integrated strategy in the negotiations according to its own interests and the demand of global environmental cooperation. The country shall not only stand side by side with other developing countries to demand for special and differential treatment, but also demand for new membership treatment, as China's entry into WTO is fairly recent.

(2) Actively participate in the negotiations on the International Investment Agreement, and include appropriate provisions related to the environmental and social impact on the basis of the practical conditions of China and other developing countries.

First, China should intensify researches on the development trend of international investment rules and pay special attention to the legal problems related to the host

countries when it signs bilateral or multilateral international contracts with developed countries. Secondly, it should adhere to the principle of collective but differential responsibility. It should adopt effective preventive measures to counteract those provisions of the existing investment agreements that harm the interests of developing countries, so as to protect its own interests and regulate the foreign enterprises that pollute the environment. Thirdly, it should promote its dialogue with other countries more vigorously, solve potential environmental problems through high-level dialogues with major investment partners, and adapt itself to the changes by establishing special channels of cooperation. Fourthly, it should improve the domestic environmental legislation to be adapted to the changing international investment rules, so as to avoid any violation of the investment agreement for failing to fulfil the requirements of environmental protection.

(3) Actively participate in the negotiations on the provisions related to trade and funding rules under UN Framework Convention on Climate Change.

China should fight for its interests and those of other developing countries in such issues as public funding, private investment, trade of renewable resources and related products and technologies, carbon tariff, etc. It should not only demand that developed countries set up a good model, but also promote the green transformation of developing countries and protect the development interests of developing countries. Meanwhile, it should pay attention to the embodiment of the integration of the related interests and rules, so that they can promote each other and serve China's green transformation.

(4) Explore the mode of multilateral cooperation of China, African countries and European countries, so as to deal with climate change and facilitate the global green transformation.

The green transformation of developing countries needs the technical and financial support of EU countries, whereas developed countries also need space for carbon emission. On the one hand, the cooperation can bring the cheap, highly adaptive technologies from China to African countries and other developing countries; on the other hand, developed countries can transform South-South projects into CDM projects in the form of capacity building and acquire space for carbon emission through the purchase of CER. Such a mode can produce a win-win result for the three or more parties and is worth China's thorough investigation and unremitting efforts. China should promote this idea in various international negotiations and put forward a scheme of its own.