Part Two: Country Studies

Chapter I

Environmental Industry Development in China: Major Policies, Issues and Prospects

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Summary and Recommendations

1) Summary of Findings

China's environmental deterioration emerged long before the World War II, resulting from rapid population growth and urbanisation, continued deforestation and the use of coal for power generation, factory operation and household heating. It has been accentuated during the postwar period by the government policy under socialist reconstruction which had given a top priority to industrialization without regard to environmental conservation and protection. The opening-up of the Chinese economy since 1978 under the leadership of Teng Xiao Ping to the rest of the world through foreign trade and investment, while accelerating economic growth, industrialization, and urbanization, tended to worsen China's environment throughout the 1980s and early 1990s in the absence of both environmental awareness of the people and a determined government policy to preserve the environment. It has been only recently since the mid-1990s when the government began a frontal attack on environmental destruction through national legislation and administration. Fruits of the new government environment policy has been yielding some welcome results particularly in metropolitan areas, but not necessarily in vast rural areas of the country.

Environmental industry development in China originated, as in other developing countries, from a series of government policy changes in favour of environmental protection in the light of worsening environment particularly in urban and industrial areas. Laws and regulations to restrain air, water and soil pollution and other

environmental destruction have been enacted under the Chinese Communist Party leadership, beginning with a Constitutional amendment in 1978, but the government implementation of these environmental laws and regulations had been lukewarm until the Earth Summit in Rio de Janeiro in 1992 which led subsequently to the adoption of the National Environmental Action Programme and the amendment of the Air Pollution Prevention Law. The continued air and water deterioration particularly affecting the population in urban and industrial areas has finally forced the government to take severe actions against industrial polluters including penalties and factory closure.

Environmental industry has developed in China under its import substituting industrialization policy in the 1980s, with a sequence of light air, water and soil pollution measuring instruments assembled initially by state-owned enterprises (SOEs) and increasingly thereafter by town-and-village enterprises (TVEs), and subsequently their parts/components manufactured by those enterprises. With the rising demand at home for meeting the ever tighter environmental standards put into effect in the 1990s, imports from Japan and other industrial countries of both small-scale and large-scale air, water and soil pollution abatement machinery and equipment began to rise. Imports of these equipments were gradually replaced by their production by those SOEs and TVEs. Today, with the exception of large-scale pollution abatement equipment installed in electric power generating plants as well as in large-sale waste treatment plants under metropolitan authorities, most of these anti-pollution machinery, equipment and instruments in industrial and commercial enterprises polluting air, water and soil are manufactured at home, in some cases under foreign licensing arrangements. In addition, domestic demand for environmental technology and management services has been on a rapid rise, exceeding the rate of expansion in hardware production.

With a keen eye on the rapidly expanding environmental market at home and around the world estimated to reach US$800 billion a year or 2% of the world GDP of US$40,000 billion, and ever spreading across all industrial, commercial, service (public and private) and household sectors, Chinese environmental protection industry is now bent toward an accelerated rate of production and diversification not only in the traditional pollution abatement machinery, equipment and instrument manufacturing sector, but also in environmental technology and management services sector. Though belatedly, Chinese government has finally and effectively placed environmental protection industry under its top priority strategic industry development programme, and begun to provide both financial and technical assistance programmes to environmental industry firms.

In meeting the urgent need for modernization and expansion of environmental protection industry, however, China is currently being confronted with three basic constraints. First of all, Chinese environmental protection industry is made up of thousands of small- and medium-scale TVEs which are largely using old equipment in manufacturing environmental products and services. Even those SOEs producing larger-scale environmental protection machinery, equipment and instruments have not reached the level of environmental technology as attained in industrial countries, as most typically observed in energy- and resources-saving technology. It is urgently required that environmental protection industry as a whole has to be modernised in the installation of environmental technology and management services, which will inevitably require the wholesale reconstitution and restructuring of the environmental protection industry in China. Foreign direct investment associated with advanced environmental technology and management services, if properly and consciously protected under the WTO regime of intellectual property rights (IPRs), will hopefully accelerate this process of industrial restructuring urgently required in the country.

Secondly, the State Environmental Protection Administration (SEPA), while being enriched from year to year in terms of administration and research capacities, is not empowered adequately and sufficiently to mainstream environmental concerns into all national, provincial and local development programmes and projects of the government. Each sectoral ministry at all levels of government has not considered fully and effectively the environmental implications of their investment activities. This is true in all cases, whether in power generation and distribution, transport sector such as road, harbour, railroad or airport engineering, construction and maintenance, or light and heavy industry sectors such as food processing, paper and pulp manufacturing, cement and ceramics production or iron/steel, copper and chemical products manufacturing, or even in education and medical sectors such as school, clinics, hospital design, engineering, construction and maintenance. Furthermore, SEPA has not negotiated effectively with the Ministry of Finance and the Ministry of Science and Technology in providing both financial and technical support to the modernization and expansion of environmental protection industry and in particular to the development of high and emerging environmental technology in the country. Government’s slow process of enforcing both complete compliance with IPRs on their domestic firms and full compensation for the mis- and mal-appropriation of IPRs has been one of the major barriers to foreign multinational corporations in importing the most advanced

environmental technology into the country.

Thirdly, Chinese non-government organizations (NGOs), while intensifying since the Rio Summit in 1992 their environmental protection activities all over China, particularly in urban centres, are nonetheless relatively weak in terms of both expertise, financial resources and management capabilities available to them. Looking at the experiences of developed and some advanced developing countries, the contribution of NGOs has been vital to improving environmental awareness of the people, legislators and government administration staff. While unlike under the traditional political structure of China, the entry of China into the World Trade Organisation (WTO) and the spread of information and communications technology (ICT) among all segments of the population have seen a rapid rise of NGOs and civil society organizations (CSOs) in the country since the late 1990s, their interaction with their counterparts in the rest of the world has still been limited, even in the environmental sector. In this respect, it may be pointed that unlike in many other developing countries, both bilateral and multilateral donors have found it extremely difficult to channel their official development assistance (ODA) directly to Chinese and foreign NGOs and CSOs of their own choice including religious bodies operating for environmental protection in China.

2) Policy recommendations

It is therefore recommended that all environmental stakeholders in China including central, provincial and local governments, SOEs, TVEs, private sector enterprises and NGOs/CSOs will recognize the above-mentioned constraints facing the country's environmental industry. As a step toward this objective, following suggestions and recommendations are made to each and every stakeholder, in addition to those listed at the end of the chapter.

First of all, the Chinese environmental industry association (CAEPI) may undertake a national mobilization programme by which all SOEs, TVEs and private sector firms will be compelled to compete with each other in modernizing their environmental technology and management services by introducing a national industry exhibition and contest where competing firms will be rewarded by the association for their best environmental products, technologies and management services. At these national exhibitions foreign enterprises should be not only invited to participate and run for competition, but also provided with an opportunity to engage in commercial

transactions. This will certainly contribute to improving the technological and management capacity of Chinese environmental protection firms and thus to modernizing the China's environmental protection industry as a whole..

Secondly, the Chinese government may be encouraged to streamline its legislative and administrative support to the environmental protection industry at all levels, if the industry is in fact considered to be a strategic industry in terms of both reducing the adverse environmental impact at home and even at the international level (e.g., acid rain and sandstorm) of all the development activities in the country and making China's environmental industry to be competitive on the world market. Such measures could include among others the empowerment of the SEPA in terms of inter-ministerial authority and implementation capacity. SEPA's activities at provincial and local government levels could also be strengthened in terms of authority, expertise and finance. Furthermore, while administrative measures including penalties and factory closure could continue to be effective in inducing firms to observe environmental laws and regulations, far more use could be made of tax and financial incentive schemes, including public and private sector eco-funds to be made available to those firms willing and ready to improve environmental protection as now observed in many industrial countries. This will inevitably contribute to the expansion of domestic demand for environmental products, technology and management services which should in turn lead to the further development of environmental protection industry in China. Furthermore, more rigorous enforcement of IPRs under the WTO regime will be hoped to be effected by Chinese government at all establishments, public or private, at the earliest possible time, if foreign multinational corporations were to contribute more effectively to the modernisation of the country's environmental protection industry and strengthening of their competitiveness on the global market..

Thirdly, in view of the overriding importance of civil society organizations to get involved in national, provincial and local environmental protection programmes and projects as one of the major stakeholders of environmental sustainability, Chinese governments at all levels could preferably not only make people to organize NGOs and CSOs easier to strengthen their environmental protection activities in their communities and at the national level, but also assist them in empowering their expertise, finance and management skills and know-how through effective interaction with their counterparts in the rest of the world. The enhanced strength and role of Chinese NGOs and CSOs will contribute enormously to further strengthening the environmental awareness of the

people and other stakeholders, thus accelerating the process of modernization and expansion of the country's environmental protection industry. More forward-looking policies of government to direct external assistance to Chinese and foreign NGOs will be welcome.

1. Introduction

With the average annual economic growth rate registering 9.1 percent during the 1980s and 9.8 percent during the 1990s, China has been successful in modernizing its economic and industrial structures and improving the level of personal income and consumption for a large number of people during the last quarter of a century ever since the open-door policy was announced in 1978 by Teng Xiao Ping, the then political leader of China. During the period 1980-2001 Chinese economy has thus expanded by 5 times from US$231 billion to US$1,159 billion and gained its position in the world economy from 1.3% to 3.8% of the world GDP, although China's per capita GDP, however, has still remained rather low during this period as compared with many developing countries, standing at US$167 in 1980 and US$869 in 2001.1/

Reflecting the fast tempo of economic growth and modernization both in production and consumption patterns, environmental deterioration has also proceeded at a rapid rate. Electricity consumption per capita increased from 253 kilowatt-hours to 827 KWH during the period 1980-2000, and the urban population as percent of the total increased from 17.4% to 36.7% during the years 1975-2001. 2/ The number of passenger cars and commercial vehicles in use jumped respectively from 1.6 million and 3.7 million to 5.8 million and 6.0 million during the short period 1990-1997. As a result, the emission of carbon dioxide per capita enormously increased, i.e., from 1.5 to 2.3 metric tons during the years 1980-1999, reaching as high as 11.9% of the world's total CO2 emission.3/

In addition to increased air pollution, there has also been a continued deterioration in the quality of water and soil all over China, particularly in urban communities where the population with sustainable access to improved water sources declined during the years 1990-2000 from 99% to 96% of the total urban population. In rural communities there was only a slight improvement in this respect, from 60% to 66% of the rural population, while some improvement was observed in the urban population with access to improved sanitation, i.e., from 56% to 69% during the 1990s.4/ Furthermore, the continued

deforestation over a century in poverty-stricken communities of mountainous Chinese hinterland finally caught the toll of keen shortage and irregularities of water supply downstream, resulting in an untold threat of widespread desertification of farmland and loss of agricultural productivity and output all over the country.

It was therefore natural under these exhausting circumstances that the Government of the People's Republic of China was compelled to embark on the national battle against environmental destruction by legislative and administrative measures including punitive ones ranging from pecuniary disincentives to forced plant closure. This paper deals first with the current state of environmental deterioration in China during the last two decades or so, secondly with government policies and measures to redress this alarming situation including those to accelerate the development of environmental industries ranging from corporate environmental management through the production of environmental hardware to the research and development of environmental technology, thirdly with the impact of external resources through multinational corporations and bilateral and multilateral official development assistance.5/

2. Environmental Deterioration in China during the Last Two Decades and Economic Loss Caused by Environmental Deterioration in China

Environmental deterioration was going from bad to worse in many former socialist, centrally planned economies during the entire postwar period, as observed in the Soviet Union, East Germany and China, as a result of the top priority placed by their governments to fulfilling the planned production quota at any cost including environmental, social and political cost. The communist goal of establishing a human-centered and environmentally sustainable society where people would be able, irrespective of their individual and collective abilities, to satisfy their human needs consistent with ecological sustainability remained in general illusionary in these centrally planned economies, and so with those goals under Chairman Mao who placed top priority on indigenous and grass-roots technology for socialist production. 6/

China has not been alone in rapid environmental deterioration. This has taken place in all rapidly industrialising economies in East Asia (Northeast and Souteast Asia).7/ China's environmental destruction had mainly been caused by its resources-based industrialization during the closed-door, self-reliant policy period prior to 1978 and has resulted from its post-1978 open-door, export-oriented industrialization policy period.

It has long been found in both industrial/manufacturing and primary industry sectors, both urban and rural communities, and both production and consumption processes. Mining and manufacturing enterprises in China had for long dumped their industrial wastes, solid and fluid, into nearby rivers, lakes and oceans as well as into the atmosphere, without regard to the possible adverse impact of such emission on plants, fish and birds as well as on soil erosion and people's health. The Table 1 below underestimates the level of environmental pollution, as the data for the town and village enterprises is excluded from the table. According to the survey taken between 1989 and 1992, only 15.7% of them numbering 571,200 met the standard of industrial waste disposal set by the SEPA.

Table 1 Environmental Deterioration in China*

Items	1985	1990	1995	2000
Industrial waste effluents (bl.tons)	25.74	24.87	22.19	n.a.
Industrial particulate (million tons)	13.05	7.81	6.39	n.a.
Industrial solid waste (million tons)	525.90	527.97	644.74	675.5

Note: * These figures exclude the town and village enterprises (TVEs), the worst performers of environmental pollution.

Source: China Annual Reports on Environment, 1985, 1990, 1995 and 2000.

An ever increasing number of personal and commercial automotive vehicles associated with rapid expansion of economic activities and higher income in urban areas had contributed not only to a huge increase in the emission of CO2, NOx and Sox, but also to intensifying the level of noise and vibration, all hazardous to residents along and beyond those streets. A heavy dose of chemical fertilizers and pesticides to increase agricultural productivity per hectare have not only contributed to soil erosion in the long run, but also increased health hazards among farmers and household consumers alike all over China. Furthermore, an increased use of chemicals for cleaning electronic chips, cleaning, coloring and preserving foodstuff and for housing and construction materials in industrial production processes have threatened the health of factory and office workers and household consumers as well. Finally, with an increased use of non-biodegradable packaging materials for foodstuffs and other consumer products such as pre-cooked and canned food and with the habit of fast-food eat-out being popularised, household and commercial garbages and other wastes have risen enormously particularly in urban areas.

It is also scaring to note that in spite of the Montreal Protocol on Ozone Depleting Materials, China's annual consumption of ozone-depleting chlorofluorocarbons has remained highest in the world, although it declined from 41,829 to 33,923 ODP metric tons during the period 1990-2001 and that GDP per unit of energy use has remained among the lowest of all developing countries, in spite of some improvement, as shown from US$1.7 to $4.1 on purchasing power parity basis per kg of oil equivalent during the 1990s. It is equally sad to note that the ratio of protected area to the surface area in China remains among the lowest at 0.07, though not as bad as Democratic People's Republic of Korea and Vietnam at 0.03. 8/

According to Drs. Guo Xiaomin and Zhang Huiqin, the total economic loss caused by environmental destruction in 1983 was 883.08 billion RMB Y or 15.6% of China's GDP, consisting of that caused by air pollution amounting to 381.55 billion RMB Y and that by ecological degradation amounting to 497.52 billion RMB Y, each constituting 5.75% and 8.9% of GDP. It was reported ten years later by Research Centre for Environment and Development, Chinese Academy of Social Sciences that the total economic loss caused by environmental degradation acutely rose to 3,445.6 billion RMB Y, consisting of that caused by air pollution climbing up 1,085.1 billion RMB Y and that by ecological degradation even more sharply rising up to 2,360.5 billion RMB Y, though declining in terms of % of GDP respectively to 10.03%, 3.16% and 6.87% of GDP. East-West Research Center, U.S.A., however, reported in 1990 much smaller economic loss caused by environmental degradation, i.e., 1,320 billion RMB Y, or 7.5% of China's GDP, consisting of 367 billion RMB Y or 2.1% of GDP and 953 billion RMB Y or 5.4% of GDP.9/

Table 2 below shows the significance of environmental deterioration in Shanghai, one of the major and most prosperous cities of

Table 2 Environmental Deterioration in Major Cities in Asia and the Pacific, Relevant Years during 1990s

Indicators	Bangkok	Calcutta	Dhaka	Jakarta	Manila	Seoul	Shanghai
Days air pollution	97	268	n.a.	173	n.a.	n.a.	133
Days suspd particulates	75	64	65	40	75	100	100
Days sulfur dioxide	24	10	6	19	16	24	24
Water service (%)	30	34	50	52	58	40	n.a.
Water losses (%)	n.a.	n.a.	120	157	n.a.	180	239

Sewerage covered(%)	10	3.2	28	n.a.	16	90	n.a.
Solid wastes coll.(%)	95	60	50	70	82	90	65

Source: Douglas V. Smith and Kazi F. Jalal, Sustainable Development in Asia, ADB, 2000, Table 1-1.

Table 3. Burden of Disease from Major Environmental Risks (Life Years Lost due to Premature Death), Relevant Years in 1990s

Environmental Risks	China	India	EAP/SA
Water supply and sanitation	4.5	11	10
Malaria	0	0.5	1.5
Indoor air pollution	9.5	6	4
Urban air pollution	5	2	2
Agro-industrial wastes	1.5	1	1.5
Under 5 mortality rates(%)	4.1	9.8	44/97*
All causes	20.5	20.5	19

Sources: Douglas V. Smith & Kazi F. Jalal, Sustainable Development in Asia, Table 4-5, ADB, 2000.

Note: (*) - Data for East Asia and the Pacific/South Asia are shown separately.

China, to people's day-to-day living, relative to other major cities in Asia. People in Shanghai seem to be suffering most from all types of environmental deterioration, as compared with residents of other major cities in Asia. And Table 3 above shows the human cost of environmental degradation in China being generally higher relative to India and the whole region of East and South Asia, except for water supply, malaria, etc.

3. Environmental Protection Policies and Environmental Industry Development Policies in China

1) Environmental Protection Policies

Realising the enormous economic and human losses caused by advancing environmental degradation as shown above, the Chinese Government has made a number of important policy decisions which have been translated into legislative and administrative actions, particularly since 1992. Initially precipitated by the United Nations Conference on Human Environment in Stockholm in 1972, China convened the First National Congress for Environmental Protection in 1973, and revised its

Constitution in 1978 to include environmental protection as basic human rights. In 1979 China enacted its first Environmental Protection Law on a provisional basis, setting down the polluter-pay principle as the basic guideline for preventing environmental degradation by state-owned and other enterprises which had been going on rampantly. The Ocean Environment Protection Law was enacted in 1982, subsequently followed by the enactment of the Water Pollution Prevention Law in 1984, the Air Pollution Prevention Law in 1987 and the Environment Protection Law in 1989.

Once again, precipitated by the U.N. Conference on Environment and Development in Rio de Janeiro in 1992, China adopted in the same year the National Action Programme for Environmental Protection, or the so-called Ten Strategic Policies for China's Environment and Development and became in 1994 one of the first countries to draft the Agenda 21 at the national level. In 1995 Chinese government revised the Air Pollution Prevention Law and tightened regulations to reduce SOx and prevent acid rainfall, even resorting to the plant closure of more than 60,000 TVEs that had been the worst polluters of air, water and soil. Also, on the administration side, China established the Ministry of Environmental Protection at the central government level in 1984 and its counterpart in all provincial and municipal governments all over China.

In spite of these progresses made in recent years in the Chinese government policies for environmental protection through its legislative and administrative measures, to what extent these measures have been enforced effectively can be judged only by the results shown in terms of the level of environmental degradation and risks impacting on the people in the 1990s and 2000s. Generally, speaking, as the Chinese authorities frequently admit, the monitoring of preventive measures against environmental deterioration, whether air, water or soil, has been one of the major challenges to both local, provincial and central governments of China, partly due to the vast geographical spread of the country but mainly due to the inadequate human and institutional capacity to cope with the task.

Major difficulties in enforcing these legislative and administrative measures seem to lie in the following areas.

a) Inadequate information on the type and extent of pollution received by governments, central and local, from both SOEs and TVEs on which governments would have to depend in taking preventive and punitive actions;
b) Inadequate environmental awareness among these enterprise managers,

workers and households resulting in increased pollution and underestimating the level of pollution reported;

c) Inadequate reporting capacity of polluting enterprises and other organizations due partly to low technical competence and partly to financial constraints;

d) Irregularities in observing reporting requirements through corruption and collusion; and

e) Inadequate monitoring by both public-sector organizations and NGOs of anti-pollution measures and actions taken by these enterprises and households;

f) Difficulty of governments in collecting anti-pollution fees from all polluting enterprises; and

g) Inadequate rules on 80% of the anti-pollution fees collected by governments from polluting enterprises for drawbacks for environmental protection, while simultaneously allowing them to deduct from corporate profits and reduce their corporate income taxes;

2) Environmental Protection Industry Development Policies

On the basis of the State Council announcement in 1989 of the decision regarding Key Points of Industrial Development Policy, the Chinese government released the State Council Environmental Protection Committee's Notice entitled "A Few Suggestions Regarding the Active Development of the Environmental Industry." "The Notice incorporated the environmental industry in the priority list of on-going industrial restructuring and defined the scope of the environmental industry. Environmental industry was for the first time defined to cover such economic activities as technology development, goods production, commercial distribution, resource utilization, information services, engineering and contracting," whose aim was "to prevent and control environmental pollution, rehabilitate the natural environment, and conserve natural resources. The Notice also decided to form a coordination group on the development of environmental industry under the leadership of the state council environmental protection committee. The coordination group was mandated to make the policies and programs for developing the environmental industry. The Notice also entrusted the State Planning Commission (SPC) to promulgate and update a Directory of Priority Environmental Protection Products on a regular basis. "10/

Since 1997 the Chinese Communist Party has convened in March every year an annual symposium to discuss population, resources and environment among the heads of CCP

Central Committee, local provinces, municipalities and various departments/agencies, laying the foundation for new government policies and guidelines for accelerating the development of environmental industry in China. The State Economic and Trade Commission (SETC) and the State Tax Administration (STA), together with the SEPA, promulgated the Inventories of Key Environmental Facilities (or Products) Currently Encouraged by the Country in March 1997, listing in the Catalogue Guide for Foreign Business and Industrial Development those technologies for developing energy conservation, renewable resources and multipurpose resource utilization, environmental pollution treatment engineering, detecting and monitoring technology as new and rising industries to be encouraged for foreign business participation. Since then the National Proposals on Accelerating the Development of Environmental Protection Industry was also issued jointly by eight ministries of the Chinese Government (SETC, State Development Planning Commission – SDPC, Ministries of Science and Technology – MOST–, Finance and Construction, the People's bank of China, STA and the State Administration of Quality, Technology Supervision and Quarantine). Finally, the 10th Five-Year Plan and Long-Term Objectives for 2010 for Environmental Protection Industry was published in 2001.

Under the above National Proposals the Chinese government identified the three priority areas for environmental protection industry. Under the first priority areas came environmental technology and equipment and environmental products such as environmentally compatible materials and environmental chemicals, mainly including flue gas desulphurization, automobile emission control, recycling, treatment and disposal of municipal solid wastes, disposal of industrial solid wasted effluents, water conservation, cleaner production, ecosystem conservation, and online environmental monitoring, etc. Under the second priority area came multipurpose resource utilization mainly including recycling of industrial wastes and used goods. And included under the third priority area were environmental services consisting mainly of environmental consultancy, information and technical services, environmental engineering and the operation of environmental pollution abatement facilities.

The National Proposals also stressed the importance of "developing technological and quality standards, installing independent third-party certification, removing direct government intervention in enterprise's decisions on concrete environmental technology and equipment, and dismantling local and sector's protectionism towards environmental industry." It also attached "unprecedented importance to building the market demand for

environmental technologies and products," and encouraging "the private sector to actively participate in the development of environmental industry." It stipulated "a mix of potential sources of financing for environmental industry development, including (1) increasing allocation from government fiscal expenditures, (2) larger pollution levies by means of more stringent implementation of the 'polluters pay principle' (rather than the popular 'polluter controls principle', (3) more investments from the private companies and capital market, and (4) more utilization of international founds (sic. funds)."11/

While the Chinese government has become since the mid-1990s increasingly conscious of the need for rigorous enforcement of the existing environmental protection laws and regulations, they have become equally cognizant of the need for the acceleration of environmental protection industry development as part of pursuing the twin objectives of accelerating the import substitution of all industrial production in the country generally and strengthening the international competitiveness of the Chinese manufacturing industry in particular. Under the recent two five-year development plans they have become far more aggressive in fostering the environmental protection industry as part of its rapid industrial modernization programmes. It is important to note, however, that the government priority to enhancing the international competitiveness of the Chinese environmental protection industry has prejudiced in favour of locating production facilities in several major industrial cities and coastal provinces, thus further widening the disparities already existing in employment and income opportunities between these favoured regions and the hinterland of the West. Here again shows the government strategy of promoting rapid industrialization on a global competitive basis instead of pursing equitable growth of all regions in the country. In other words, greater efficiency more than greater equity, an inevitable objective of all transition economies in their earlier stage of development of which China is one.

4. Environmental Protection Industry Development in China

There has been a rapid development of environmental protection industry in China particularly since the early 1990s, as follows.12/

Table 4 China's Environmental Industry, 1988-2000

Items	1988	1993	1997	2000
Number of enterprises and institutions	2,529	8,651	9,090	10,000
Number of persons working (1,000)	321	1,882	1,699	1,800
Annual value of output (billion RMB Y)	3.79	31.15	52.17	108.00
Environmental equipment and products				30.00
Utilisation of environmental resources				68.00
Environmental services				10.00
Annual value of profit (million RMB Y)	830	4,090	5,810	n.a.
Environmental Industry Output as % of GDP	0.25	0.9	0.7	0.77

Source: Zhang Kunmin and Wen Zongguo, "Sustainable Development and Environmental Industry in China," in Zhang Kunmin, 2001, Policies and Actions on Sustainable Development in China, Beijing: China Environmental Science Press, Table 2.

According to Mr. Han Wei, Secretary-General of China Association of Environmental Protection Industry, Chinese environmental industry has gone through two stages to reach the current state of development.13/ The first stage, mid-1960s to the early 1980s, was the rudimentary stage when the industry focused mainly on the treatment of three wastes, i.e., waste water, waste gas and waste residue, from those industries such as machinery, metallurgy, building materials and chemical manufacturing. The second stage, the so-called developmental stage, the mid-1980s to the late 1990s, focused mainly on the production of environmental protection devices related to pollution treatment and integrated waste utilization and then expanded onto the research, design and manufacturing of environmental hardware, cleaner products, environmental services and ecological construction. The current stage, the late 1990s to the 2000s, is the rapidly developing stage where the industry is making a rapid progress, all geared to the more efficient research, development and production of all types of environmental protection technology, products, services that would meet the rapidly growing demand for high-technology environmental protection in all manufacturing and other industrial sectors, as shown in Table 5 below.

Table 5 Supply and Demand of the Environmental Products in China, 2000

	A	B	C	D	E	F	G	H
No. of Firms	2,394	2,066	261	343	7	240	540	3,786
Kind of products	176	102	33	41	n.a.	124	45	521
Sales (B.yuan)	9.5	9.1	1.4	0.8	0.02	1.3	2.4	23.7
Shares of total	38.5	37.2	5.8	3.3	0.1	5.3	9.8	100.0

Notes: A is for water and waste water treatment devices, B for air pollution treatment devices, C for solid waste disposal devices, D for noise and vibration controlling equipment, E for radioactivity and electromagnetic wave prevention equipment, F for monitoring instruments, G for professional drugs and materials and H for the total.
Source: Han Wei, "Environmental Industry Now and the Future: The Way Forward," Ministry of Environment, Japan (ed.), 2002, The Second Roundtable on Environmental Industries (China, Korea and Japan), MOE, Table 3, p. 52.

Historically, China's environmental protection industry had its beginning in the development of ***the primary environmental market consisting of agricultural and natural ecological conservation, resources protection and utilization and organic/green food production and distribution.*** For generations after generations original and secondary forests had been exploited to accommodate rapid increases in population and extend farmland under cultivation. The need for agricultural and natural ecological conservation was initially articulated by farmers who had long suffered from soil erosion and enundation resulting from a rising tide of floods year after year and later shared by the general public who had suffered from the loss of their lives and personal properties due to frequent incidence of floods. The critical importance of efficient resources protection and utilisation has increasingly been recognized by all stakeholders, consumers, industry and governments, when confronted by a steady depletion and higher cost of resources, especially energy resources. Finally the demand for organic food has finally been rising in China as a result of an increasing concern among consumers with their own health security, resulting from their increasing disposable income and their rising exposure to chemically processed foodstuff with diverse health risk.

With a rapid pace of industrialisation and urbanisation taking place during the last few decades, China has been no exception to increasing air, water, soil and noise pollution

as well as to the critical problem of industrial and household waste disposal, all harmful, if left unprepared, to the health of people now and in the future and to the sustainable development of the nation. To deal with these pollution problems in China, the government and research institutions as well as the public, cooperative and private sector enterprises particularly in and around metropolitan areas have joined forces together and, as seen earlier in Table 4, there have been ***rapidly growing secondary environmental markets for pollution prevention and control equipment and facilities, equipment and facilities for comprehensive utilization of resource wastes, environmental monitoring equipment and facilities and low-hazard and environmentally friendly products.***

Along with the increased production of these anti-pollution equipment and facilities and environmentally friendlier products, the ecologically better utilization of resources including manpower and finance and an increased awareness among the general public of the critical importance of environmental protection itself have increasingly required both governments, state-owned enterprises and other corporations including foreign multinational enterprises to invest in ***the research and development of a wide range of environmental technologies, the designing and construction of environmental engineering projects, the application and extension of environmental technology services to all production sector including factory and office administration, wholesale and retail distribution sectors and consumption activities, as well as operation and management of environmental facilities, i.e., the tertiary environmental markets.*** In response to the government's policy for achieving environmentally sustainable development, the tertiary market has seen the most spectacular growth in recent years, although its absolute size has still remained relatively smaller as compared with the secondary market. In particular, the growth of this sector has been phenomenal in China for environmental consultation services including environmental impact assessment, engineering consultation, supervision, technology assessment, product life period assessment, authentification of both environmental management system such as ISO 14001, environmental symbol products and the organic foods and audit and training of cleaner production as well as environmental information services. For instance, the number of firms and other organizations which were awarded with ISO14001 certification jumped from 135 (85 for mainland China and 50 for Hong Kong) to 1,600 between December 1999 and June 2002. 14/ Table 6 confirms that this trend will most probably continue into the second decade of the 21st century.

Reflecting these developments on both demand and supply sides, there has been a rapid expansion of China's environmental market, as shown in Tables 4 and 5, particularly since 1997 when the primary environmental market in China totaled only 1.98 billion RMB Y, with even the secondary market totaling 43.91 billion RMB Y (environmental products, equipments and facilities totaling 23.45 billion RMB Y and comprehensive utilization of wastes 20.46 billion RMB Y), and the tertiary market totaling 6.28 billion RMB Y. There was also an enormous change in the structural breakdown of the China's secondary environmental markets between 1997 and 2000. The 9.45 billion RMB Y market in 1997 for the equipment and facilities for water pollution treatment rose to 94.5 billion RMB Y in 2000 and the 8.74 billion RMB Y market for those for air pollution treatment rose to 91.1 billion RMB Y during those years, while during the same three-year period the 1.12 billion RMB Y market for those for solid waste disposal and treatment increased to 14.2 billion, and the 1.38 billion RMB Y market for those for noise and vibration control and the 0.48 billion RMB Y market for those for environmental monitoring expanded respectively to 8.1 billion and 13.0 billion. 15/

It is noteworthy that in spite of such phenomenal growth of the environmental market in China, and while Chinese environmental protection industry was fast becoming one of the new growth engines of China's industrial development and national economy, there was a sober consensus among the Chinese participants in the Beijing Workshop on Environmental Protection Industry in March 2003 that it lagged behind developed country level particularly in technology development and that expanded efforts are called both in the public and private sector for research and development of new environmental technology and services, if at all China's environmental protection industry should become competitive on the world market which is now approaching US$800 billion, to use the average size of the environmental market as % of GDP in 1995.16/

In this connection, it is noteworthy that several externally assisted projects and programmes for environmental protection have been found quite useful to China for further acceleration of its environmental protection industry. Among the multilateral cooperation programmes are a World Bank project in 1998-2000 whose objective was to develop environmental information disclosure systems in Chinese enterprises in Zhenjiang City in Jiangsu province and Huhehor City in Inner Mongolia chosen to be pilot and demonstration sites. The World Bank has also assisted in building as large as 15 waste water treatment plants totaling US$2.0 billion all over China. The United

Nations Industrial Organisation (UNIDO) is planning to mobilize US$30 billion in the construction of large-scale waste water treatment plants in metropolitan areas in the first decade of this century. European Union (EU) has been supporting a project to assist MOST and SEPA on improving environmental management at the enterprise and national levels initiated in 2001. The Asian Development Bank (ADB) has been assisting China's People's Congress and the State Environmental Protection Committee on cleaner production legislation. All these aid projects are expected to result in stimulating the domestic demand for environmental technology market and thus China's environmental industry development.

Among the most outstanding bilateral cooperation programmes directed at the promotion of environmental equipment, technology and management services are a series of Japanese-initiated projects for cleaner production and environmental management in three demonstration cities such as Dalian, Chongqing and Gunyang as well as Japan-China Friendship Centre for Environmental Conservation in Beijing, focused on environmental science and technology research, human resources and institutional capacity building for environmental protection. To meet the China's rapidly rising demand for expanding municipal waste water treatment plants, Germany has joined several metropolitan authorities in Tentsian, Xian, Chongqing, Shanghai and Nansi. Both bilateral and multilateral donors have been making substantive contributions to human and institutional capacity building through training programmes in such areas as environmental management and environmental accounting and auditing as well as the provision of environmental guidelines for specific industry sectors and processes. Some multinational corporations have installed training programmes for improving environmental awareness and management skills of their own employees and provided seminars and workshops in cooperation with universities and municipal and provincial government bodies.

5. Major Policy Issues Confronting China's Environmental Protection Industry

Participants in the Beijing Workshop in March 2003 and the Third Tripartite Roundtable Meeting on Environmental Industry held in Beijing in December 2003, all agreed that Chinese environmental enterprises:

1) were of small scale: 94% in the number of enterprises according to Dr. Han Wei of CAEPI and scattered without any technological tie-ups

with big state enterprises and their total output value accounts only 1.9% of China's GDP and less than 1 percent of the world's total environmental industry output;

2) specialized only in a narrow range of environmental products, were less than optimal in production structure, orienting itself mostly to environmental products and recycling of wastes, but not in environmental technology development and services and imbalanced region-wise (Zhejiang, Jiangsu, Shandong, Guangdong, Hunan and Liaoning producing 191.96 billion RMB Y and constituting 60% of the total output of the industry);

3) had less advanced technology, generally lagging 10-20 years behind developed countries, as shown in desulfurisation and on-line automatic monitoring as well as in the lack of standardization and systematisation;

4) were operating under underdeveloped pricing mechanisms (direct sales and lack of professional suppliers and violation of intellectual property rights), with all kind of restrictive practices ("some regions and departments setting exorbitant anti-foreign gate to market permission and)" resorting in some cases to "impertinent non-market methods to intervene the trading activities." 17/

In other words, ***major policy issues confronting China's environmental protection industry include among others 1) compartmentalisation, 2) local protectionism and 3) unfair competition. What China's environmental protection industry must do is to improve its technology through technological licensing agreements with foreign multinationals, promotion of foreign direct investment in the country, and heavier doses of investment in research and development of both new environmental technology in terms of both industrial materials, production processes and final products and advanced application and diverse extension of technology services to all sizes of state, cooperative and private sector enterprises, to all sectors of the national economy and to all regions of the country.*** Behind their recognition of these major policy issues facing China's environmental protection industry lies their concern with a possible acquisition and control of some competitively weak Chinese enterprises by foreign multinational corporations which by all means must be prevented in the eyes of a majority of Chinese policy makers and researchers.

6. Major Tasks Ahead facing China's Environmental Protection Industry in the Coming Decade

1) Future of China's Environmental Protection Industry

According to Dr. Wang Xinfang, State Environmental Protection Administration, China's environmental protection industry will grow at the annual average rate of 16% between 1997 and 2005 and at 10% between 2005 and 2010, after which it will hopefully become one of the important exporting sectors of the national economy. The 10th 5 Year Plan envisages the government to invest 700 billion RMB Y in China's environmental protection industry, or about 1.3% of GDP and about 3.6% of the nation's total sum of social fixed assets. The breakdown of such government investment is as follows: 270 billion RMB Y for water pollution treatment, 280 billion RMB Y for air pollution treatment, 90 billion RMB Y for solid waste treatment, 50 billion RMB Y for ecological protection, and finally 10 billion RMB for construction of environmental infrastructures.18/ As a result, China's major air, water and soil contaminations in 2005, including sulfur dioxide, dust, chemical oxygen consumption, ammonia and nitrogen, industrial solid waste, and so forth will be reduced by 10% as compared with the 2000 level. It is also envisaged that the contaminations in the industrial waste water, including heavy metals, cynamides and oil will also be effectively controlled, with dangerous wastes safely disposed. Also, the discharging capacity of sulfur dioxide in designated acid rain controlling areas and sulfur dioxide controlling areas will be reduced by 20% as compared with the 2000 level.

Under the 11th Five-Year Plan the Chinese government will be expected to invest a total sum of 938.8 billion RMB Y for environmental protection, with the breakdown of 358.7 billion RMB Y for water pollution treatment, 328.9 billion RMB Y for air pollution treatment, 161.2 billion RMB Y for solid waste treatment, 70.0 billion RMB Y for ecological protection and 20.0 RMB Y for construction of environmental infrastructure.19/ China's environmental protection industry by sub-sector market in the future will thus look like as follows.

Table 6 Future of China's Environmental Protection Industry

Sub-sector	1997	2005		2010	
	Output*	Output*	Growth(%)	Output*	Growth(%)
Natural ecological Conservation	1.98	23.0	36	43.0	14
Green food products	2.28	22.0	33	31.0	6
Environmental products	21.17	58.0	13	85.0	8
Comprehensive utilization of waste	20.46	35.0	7	50.0	7
Environmental technology services	6.28	37.0	13	71.0	14

Source: Wang Xinfang, SEPA 2001.

Note: * In billion RMB Y.

Forecasts by SEPA shows the highest growth rate for agricultural and natural ecological conservation, followed by green food products and environmental technology services between now and 2005 and for green food products and environmental technology services, followed by comprehensive utilization of wastes between 2005 and 2010. Thus, the future of China's environmental protection industry lies with possible improvements in its two sub-sectors producing environmental products, equipments and facilities, according to Mr. Li Xingwen 20/ and environmental technology and technology services, according to Messrs. He Shengtao 21/ and Wang Yangzu,22/ although there will be a rapid growth of its primary environmental markets for agricultural and natural ecological conservation, as predicted by Mrs. Wang Liqiang 23/ and organic food production, as has already been seen in many industrial countries.

2) Major Tasks Ahead

a) To promote the development of environmental industry in China, particularly in the secondary and tertiary environmental markets, Chinese governments, central and local, must see to it that environmental protection regulations and standards be improved, that environmental law enforcement be strengthened and that environmental investment be expanded.

b) In view of the excessive dependence of environmental protection industry upon

government policy guidance as a hangover from the days of centrally planned economy, there should be further rationalization of responsibilities and functions between governments and environmental protection industry in protecting and improving the environment in China. The government could be charged with environmental policy formulation, implementation, supervision, monitoring and evaluation, and laying down environmental infrastructures including human resources, institutions, standards and physical constructions, while steadily getting out of the production and distribution of environmental products and handing it over to private investors and producers who under effective competition would otherwise be more efficient in running such enterprises.

c) Both the central, provincial and local governments should be far more willing and ready to dismantle their restrictions and discriminations on private sector enterprises. The governments must correct the existing abnormalities of the state and provincial enterprises unfairly depending on government subsidies and protection in comparison with other forms of enterprises and unfair competition between them and state-owned enterprises.

d) The environmental protection industry in turn could be charged through the market with investment expansion in environmental technology development and adaptation as well as with the improved management of environmental protection enterprises. In accordance with the beneficiaries-pay-principle as well as with the polluter-pay-principle, all stakeholders in China consuming environmental products, technology and services, whether individuals or organizations, and whether public or private, could be charged with the responsibility for bearing the cost of environmental protection through the interplay of demand-supply markets and user charges. Any imbalances of user charges and polluter charges between different regions and different individuals/organizations should be rectified to the benefit of all stakeholders in China.

e) The government should deepen the on-going reforms of scientific research system including the one affecting R & D of environmental technology and products. The technical quality of environmental products and technology should be vastly improved through the installation of a combined system of manufacturing, human resources development and scientific and technological research of high-tech nature.

f) Environmental industry regulations should be re-oriented toward the

enhancement of equitable access to environmental product, technology and service markets and the reduction/elimination of local protectionist barriers installed by the collusion of provincial and local governments and private sector so that "an open, impartial and orderly market could be created."24/

g) Efforts must be made by central, provincial and local governments to improve public awareness of environmental protection and encourage both state-owned and private enterprises and the public "to protect ecological environment, purchase clean products, save resources and energy so as to powerfully support sustainable development and recycle economy."25/ All producers and consumers must become far more "green conscious" to promote the sustainable patterns of production and consumption.

h) As a step toward the rationalisation of the current structure of China's environmental industry, mergers and acquisitions of small-scale enterprises by larger ones should be promoted and modern management system must be introduced at all levels and across all sections of state-owned and private sector enterprises which alone could ensure constant improvement in the quality of environmental products and services. In this connection, all enterprises are encouraged to install cleaner production technologies, make environmental impact assessment in carrying out large-scale investment and get certified by the ISO 14001 and environmental labeling.

On investment financing, as pointed out by Mr. Han Wei, both government and public and private enterprises must come up with innovative financing mechanisms such as "social fund-raising mechanisms …. to mobilize the whole society to invest in environmental protection, to utilise capital market means." 26/ Following actions need to be taken immediately, in view of the long gestation period and high risks involved in social capital financing of environmental protection industry.

i) government environmental finance should be made available to all enterprises;
ii) reduction or elimination of sales tax, income tax, adjustment tax on fixed assets depending on investment orientation, now imposed on environmental protection enterprises;
iii) establishment of environmental protection industry investment funds to encourage innovation in environmental technology and commercialization of new technology;

iv) installation of flexible environmental financing policies, deregulation of financing institutions, broadening of financing methods such as corporate bond issuance, project financing such as BOT, listing on the stock market, entrusting of investment and financing guarantee;

v) enhancing foreign direct and indirect investment to meet the rapidly growing financing needs of China's environmental protection industry through improved access to domestic capital market: and

vi) strengthening of coordination between government and environmental investment parties so as to allow the latter to be able to direct their investment into their own chosen fields.

Footnotes:

* The author is indebted to Dr. Lin Yan, Chinese Research Center for Environment and Development for her contribution in the first year of the Project to writing a useful paper on the current state of environmental industry, changing government policies for its development and some of the major issues facing the industry in China. Regrettably she was unable to participate in our first Workshop held at IGES Headquarters in Hayama in December, 2002 and continue her participation into the second year due to the high pressure on her research at Harvard University, Cambridge, U.S.A.

1. United Nations, World Economic and Social Survey 2002, Table A.1, p.285.
2. Urbanisation in China is expected to further rise in this century, reaching in 2015 as high as 40.7% of the population living in urban areas.
3. Human Development Report 2003, Appendix Table 5, p. 252 and Appendix Table 19, p. 302.
4. UNDP, ibid., Table 6, p. 223.
5. This paper is based on my own personal observations of environmental industry development in China for the last two decades or so, as well as many papers presented by Chinese and foreign experts on China's environmental industry and technology policies at Beijing Workshop on China's Environmental Industry held on 18-19 March, 2003, organized by Chinese Association of Environmental Protection Industry, Beijing and at two annual sessions of Tripartite (China-Korea-Japan) Roundtable Meeting on Environmental Industry held in Awajishima, Japan in July, 2002 and in Beijing in December, 2003.
6. Hirono, Ryokichi, 1974, Report on Consultation with PRC (mimeograph), Bangkok: UNECAFE.
7. For detailed discussion of the environmental deterioration and environmental policies in Asia, please see Hauff, Michael von and Martin Z. Wilderer, 1997, The Emerging Markets for Environmental Technology in Asia: India, Indonesia, Malaysia, Philippines, Singapore, Taiwan, Thailand, Kaiserslautern: University of Kaiserslautern; Angel, David and Michael Rock, 2000, Asia's Green Revolution, Industry Growth and Environment, Greenleaf; the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), 2000, State of Environment in Asia and the Pacific, 2000, New York, United Nations;

and the Institute for Global Environmental Strategies (IGES), 2004, IGES Environmental White Paper, Hayama: IGES (forthcoming).

8. Human Development Report 2003, Table 5, p.218.
9. Han Wei, 2002, “Environmental Industry Now and the Future: The Way Forward,” MOE, Japan (ed.), 2002, The Second Roundtable on Environmental Industries (China, Korea and Japan), Tokyo: MOE.
10. Lin Yan, 2002, “China Policies for Environmental Industry: Review,” p. 1, submitted to the IGES Environmental Industry Development Project.
11. Lin Yan, 2002, ibid., p. 3.
12. It is to be noted, however, that the figures for 2000 for environmental protection industry quoted by Professors Zhang and Wen in Table 4 in the text and those quoted by Mr. Han Wei, China Association of Environmental Protection Industry (CAEPI), Beijing in his paper entitled “Environmental Industry Now and the Future: The Way Forward,” are so different in many ways. For instance, according to Mr. Han, the total number of enterprises in 2000 numbered 18,144, with employment totaling 3.176 million persons, total value of output reaching 95.5 billion RMB Y and total amount of profits 16.7 billion RMB Y. There is no way the author can determine which numbers are correct between those two quoted.
13. Han Wei, 2003, “Development and Countermeasures of Chinese Envrionmental Protection Industry,” presented at the Workshop on China’s Environmental Protection Industry in Beijing in March, 2003.
14. The figures for December 1999 are from ISO World, while that for June 2002 are from Zhou Liu, 2003, “ISO 14000 Practice in China,” presented at the Second Tripartite Roundtable in Awajishima on 23 July, 2002.
15. Zhang Kunmin, 2001, Policies and Actions on Sustainable Development in China, Beijing: China Environmental Science Press,
16. According to the Environmental Business International, Inc.(EBI), 1995, the environmental market as % of GDP averaged high among industrial countries and low in transition economies and developing countries. It ranged from a high of 2.97% in Denmark through 2.95% in Sweden, 2.82% of Switzerland, 2.78% in the United States, 2.76% in Norway, 2.65% in Japan, 2.60% in Germany and 2.58% in the Netherlands down to a low of 2.36% in Belgium, 2.26% in Austria, 2.01% in Canada, 1.91% in the U.K., 1.89% in Finland, 1.87% in France, 1.81% in Australia and New Zealand, 1.48% in Italy, 1.20% in Spain and 0.75% in Portugal. Among developing countries, the same ratio

ranged from a high of 1.75% in Puerto Rico, 1.74% in Singapore, 1.48% in Taiwan, 1.28% in Malaysia, 1.18% in the Republic of Korea, 1.16% in Hong Kong and 1.09% in Greece down to a low of 0.97% in Thailand, 0.87% in Israel, 0.86% in Chile, 0.84% in former USSR, 0.80% in Peru, 0.74% in the Philippines, 0.73% in Egypt, 0.68% in Indonesia and Brazil, 0.63% in Argentina, 0.61% in Mexico and South Africa, and 0.60% in Poland. China's environmental market as % of GDP stood at 0.32%, one of the lowest among the 50 countries listed in the EBI's report, far less than the world average of around 2.00%. Even the ratio in 2000, while far higher than in 1995, was estimated to be 0.77% for China, as shown in Table 4 in the text above. For detailed discussion of the environmental market in Asia, please see EBI, 1995, The Global Environmental Market and United States Environmental Industry Competitiveness, San Diego: EBI and Regional Institute of Environmental Technology (RIET), 1996, The Asian Environmental Market – An Overview of Business Opportunities, Singapore: RIET.

17. Han Wei, 2003, op. cit.
18. Zhang Kunmin, 2001, op. cit.
19. Fang Zhi, 2003, "Environmental Investment and Financing in China: Current Issues and Future Development," presented at the Third Tripartite China-Japan-Korea Seminar held in Beijing on 15 December, 2003.
20. Li Xingwen, 2003, "Development and Countermeasures of Environmental Product Manufacturing in China," presented at the Beijing Workshop in March, 2003.
21. He Shengtao, 2002, "Development of Environmental Services in China," presented at the Beijing Workshop in March 2003.
22. Wang Yangzu, 2002, "Development of the Clean Product Manufacturing of China," presented at the Beijing Workshop in March 2003.
23. Wang Liqiang, "Study on the Development of the Natural Ecology Industry of China," presented at the Beijing Workshop on Environmental Protection Industry in March, 2003.
24. China Association of Environmental Protection Industry (CAEPI), ed., 2003, "Recommendations to Promote the Development of Chinese Environmental Protection Industry," Beijing: CAEPI
25. CAEPI, ed., 2003, ibid.
26. Drs. Zhang Kunmin and Wen Zongguo, "Sustainable Development and Environmental Industry in China," in Zhang Kunmin, 2001, Policies and

Actions on Sustainable Development in China, Beijing: China Environmental Science Press