CHINA POPULATION, RESOURCES AND ENVIRONMENT
Volume 17, Issue 2, March 2007
Online English edition of the Chinese language journal

Available online at www.sciencedirect.com
ScienceDirect

Cite this article as: Chn Popu Res Envi, 2007, 17(2): 1–7.

SHORT COMMUNICATION

Environmental Policies in China: Evolvement, Features and Evaluation

ZHANG Kunmin [1,*], WEN Zongguo[1], PENG Liying[2]

1. School of Environmental Science and Engineering, Tsinghua University, Beijing 100084, China;
2. School of Environment and Natural Resources, Renmin University, Beijing 100872, China

Abstract: This article reviews the development of current environmental policies in China: their initiation started following the United Nations Conference on Human Environment (1972 in Stockholm), and got great progress during 1979–2006. Learning lessons from industrialized countries and combining own situation, China realizes the main features of its environmental policies as follow: (1) explore command and control measures to its full extent; (2) strive to raise funding for environmental protection; (3) identify who should take the accountability for environmental protection, (4) encourage"combination of prevention and control" and "integrated utilization", (5) Open in field of environmental policy and international cooperation earlier. For the past 30 years, China's environmental policies have been evolved and deepened: status from national basic policy to sustainable development strategy; focus changed from pollution control to combination of pollution control and ecological protection; method changed from end control to source control; scope changed form point treatment to watershed and territory treatment; management style changed from using executive power to using legal and economic measures. At last, this article introduces the evaluation of policies by the international community and the prospects of them.

Key Words: environmental protection; sustainable development; policy; China; evaluation

China is the first developing country to announce implementation of sustainable development strategy (Zhang, 2004). China has a large population and limited resources per capita; air pollution, water pollution, soil degradation and ecological damage are all urgent issues. China faces more pressure than other country on economic development and resource shortage; and the extent and severity of China's environmental problems is more serious than people would normally imagine. A research group in China's Academy on Science issued four publications on "National Status Research" in the 1980's, pointing out that China faces four difficult situation in reform and opening, including population, resource, environment and food, and emphasizing that China should and can only implement a development strategy with the following characteristics, including (1) production system with low resource consumption; (2) societal system with reasonable consumption; (3) economic system that keeps stable and continuous economic growth and improve economic efficiency steadily; (4) social system that guarantees efficiency and social justice; (5) technology system that is innovative and keeps absorbing new technology, new process and new ways; (6) an open trade and non-trade international economic system that promotes close connection with world market; (7) rationally use resources, prevent pollution and protect ecological balance. The strategy is fully aligned with the sustainable development strategy proposed by World Commission on Environment and Development in *Our Common Future*.

As a developing country, China started its pollution control and ecological protection after United Nations Human Development Conference when its GDP per capita was lower than $300. During the past 30 years, the whole country made every effort for this goal. Even though we had certain achievement but we were not able to fully contain the trend of a deteriorating environment with an economy growing at such a high speed. Along with progress of the globalization and upgrade of industrial construction, some heavy pollution industries, such

Received date: 2006-11-18.
*** Corresponding author.** E-mail: zhangkunmin@hotmail.com

as iron and steal, chemical, cement, and so on, transferred continuously from abroad to China, and from eastern China to central and western China. Through practice, more and more people began to realize the only way to turn the deteriorating trend in China around is to transform economic growth pattern and to implement sustainable development strategy.

This article reviews the development and characteristics of China's environmental policy and evaluation of the policy by international community.

1 Evolvement of China's environmental policy

United Nations Conference on Human Environment (1972 in Stockholm) started the initiation of China's current environmental protection. After the conference, China started to establish environmental protection agencies, control of industrial wastes and environmental planning. "*The PRC's Law on Environmental Protection (Trial)*" was issued in 1979; some other major environmental legislation followed. In 1987, translation and publication of United Nations report "*Our Common Future*" was done right after its original version was published. In 1992, within less than two months after the United Nations Conference on Environment and Development (Rio) was over, China published the "*China's Ten Strategic Policies on Environment and Development*", announcing China was going to implement sustainable development strategy, and proposed policies in 10 areas. In 1994, China published "*China's Agenda 21*", which was the first "*Agenda 21*" at a national level. In 1995, China determined to implement "two fundamental transformations" (economic structure and economic growth pattern), and started treatment of Huai River watershed that was heavily polluted. In 1996, along with implementation of the Ninth Five-Year Plan and "Total Emission Control" and "Green Project" (SDPC, SETC, and NEPA. 1996), China strived to basically control the deteriorating trend of environmental issues. Since 1997, the central government calls for a seminar of basic national strategies in March every year; leaders from all levels and all regions gathered together to discuss population, resource and environmental issues and to propose countermeasures. This has become an established institution.

In the past more than 30 years, important policies and actions related to environmental protection in China reach 130 items. During the 25 years period between 1981 and 2005, the State Council issued five "Decisions" to enforce environmental protection, which rarely happened among departments of the State Council. Table 2 obviously shows that China's environmental policies have evolved from its early stage of focusing on enhancing administrative institution of environmental protection and improving environmental legislation to its recent stage of emphasizing coordination and "win-win" of economic development and environmental protection. Especially in December 2005, the State Council issued *Temporary Provision on Enhancing Adjustment of Industrial Structure* and *Decision on Enhancing Scientific Development and Environmental Protection*. The latter for the first time in history proposed that in certain region "Environmental Protection should be prioritized", "Development should be optimized, controlled or prohibited". All the decisions showed that China has the resolution to reverse the trend of "focusing on economic development and ignoring environmental protection" and to implement sustainable development through adjustment of industry structure and improvement of environmental protection and insisting on development with savings, with cleaner technology, with safety.

Environmental pollution and ecological damage had caused tremendous economic loss to China and other countries. Table 1 listed some researches about China. The World Bank pointed out (1997) that economic loss caused mainly by air pollution equaled to roughly 7.7% of China's GDP. The World Bank suggested that China increase its investment in pollution control significantly; ideally it should be 2% of GDP.

2 Features of China's environmental policy

At the early stage of environmental protection movement in China, there were more challenges to environmental management. Therefore, Chinese government always tries to combine lessons and experiences learned from developed countries and China's own situation in developing its environmental policies. The characteristics of China's environmental policies are as follows.

2.1 Explore command and control measures to its full extent

Typically, public pollution accident occurs because the enterprise or project where pollution was generated didn't assess the environmental impact comprehensively and take corresponding strategies and actions. To eliminate those accidents, China introduced "System on Environmental Impact Assessment", requiring all development projects to obtain environmental impact assessment report before implementation of the project. At the same time, China developed its own "System on Three Simultaneity" (meaning pollution control facility must be designed, implemented and operated at the same time with the corresponding development project with which the facility is associated). The "System on Three Simultaneity" was included in the Law on Environmental Protection (Trial) issued in 1979 to prevent new pollutions from happening. Experiences showed that the system was very effective to most enterprises; however it meant little to some big corporations well connected to government or to the rural enterprises to which nothing

really matters. Consequently, fore systems or actions had to be implemented, including "System on Declaring and Permission for Environmental Pollutants", "System on Pollution Control within Deadline" (meaning to the heavy pollution sources with detrimental impact, government will issue mandatory action to have pollution under control within a deadline), "System on Total Emission Control for Major Pollutants", and the so-called "Environmental Protection Storm" when government agencies go out to inspect and to impose sanction to those who break the law to be closed or to be penalized. Meanwhile, administrative level of environmental agencies in governmental organizations needs to be elevated to enhance environmental agencies' power in legal enforcement and to improve the effectiveness for environmental agencies to participate integrated decision-making. An administrative system similar to that of the USA with Environmental Protection Agency and its 10 subdivisions at Federal level and other Environmental Protection Agencies at state level running together may be useful to enhance China's environmental protection agency's capability to inspect and coordinate and to avoid impropriate intervention from other local authorities. This was pointed out in the "*Decision*" issued by the State Council in December 2005.

2.2 Strive to raise funding for environmental protection

Environmental protection has been a topic in China for over 30 years. However, for a long time there wasn't specific budget for environmental pollution control in either central governmental financial planning or local governmental financial planning. Environmental protection facility for new development project may get its funding from development project investment, yet where can we get financial support for old factories? In order to solve this problem, pollution levy system was introduced based on the polluter pays principle. Initially, of all the funds collected as pollution fee, 80% was returned to the factories that turned in the money as part of their pollution control investment. Later on, the funds became "Special Funds for Pollution Control", which factories can borrow and payback can be reduced based on the effectiveness of pollution control results. The fact was, at the time when funding was extremely short, the pollution fee system solved some urgent pollution issues. Yet under-charged pollution fee might have been misleading. For example, some polluting factories would rather pay pollution fee than control their pollution since the latter costs more. The other 20% of pollution fee gathered was meant to improve capacity-building for local environmental agencies, yet in reality part of it was used to pay salaries for the staff in environmental agencies since they were not paid by the local government. That caused the so-called dilemma where the local environmental protection bureau set up to control pollution might not have incentive to control pollution since their salary was based on the pollution level. After 1998, all staff of environmental protection bureaus have been paid by government and the dilemma no longer exists. After the Asian financial crisis, China has increased investment to environmental protection infrastructure. The payout subject on environmental protection has been brought into

Table 1 Comparison of major studies on economic losses of china caused by environmental problems

Institutions or Researchers	Baseline Year	Environmental Pollution Loss		Ecological Damage Loss		Total	
		Billion RMB	% of GNP	Billion RMB	% of GNP	Billion RMB	% of GNP
Guo X., Zhang H.	1983	38.16	6.75	49.75	8.9	88.31	15.6
Jin J., et al	1985			1039.5	12.47		
US East-West Research Center	1990	36.7	2.1	952.5	5.4	1325	7.5
Policy Research Center, SEPA	1992	109.65	4.50				
UN University & its Chinese Partner	1993	182	5.3				
Research & Development Center of China's Academy of Social Science	1993	108.50	3.16	236.1	6.87	344.60	10.03
The World Bank	1995	443	7.7				
CCICED	1999	97.144 US$	9.7				
SEPA and National Bureau of Statistics	2004	5118	3.05				

Source: compiled by author based on literatures (Xu, 1998; Fu and Yu, 1999; Jeremy et al. 2002; Wang et al. 2006)

the national budget since 2006. Collecting fee on household sewage and garbage had been a hot topic since early 1990's, and it finally got settled in the new century. In comparison, there is still no common understanding on environmental taxes. As far as under-charged pollution fee, and how to better utilize economic measures, they are still issues that remain to be improved.

2.3 Identify who should take accountability for environmental protection

Environmental Protection Agencies at all levels should be held accountable when they do not execute their legal rights to monitor and manage environment. However, who should ultimately be responsible for environmental quality at certain territory? In the *Law on Environmental Protection* approved in 1989, its Provision 16th defines "The local people's governments at various levels shall be responsible for the environmental quality of the areas under their jurisdiction and take measures to improve the environmental quality." Thus the responsibilities of environmental quality have been legally defined. It should be noted that rural government and town government also belong to people's governments. *China's Ten Countermeasures on Environment and Development* published in 1992 further pointed out that "practices in China showed that it is an effective measure to control environmental pollution and biological damage through better establishing management agencies and enhance management by law at a time when economy was underdeveloped and investment in environmental protection was stretched. China should also learn from developed countries' experiences of "leverage market for economic growth and leverage government for environmental protection". Environmental protection as one of the fundamental functions of government will become more significant during reform of governmental organizations and economic structures." "Governments at all levels must support environmental protection agencies to execute their legal rights in monitoring; all regulations must be followed rigorously; all violations must be investigated. All proven effective environmental protection measures should be actively promoted and environmental protection should be enhanced thoroughly." Environmental protection will only gain ground when legal responsibility of environmental protection at all levels' governments is identified. "System on Environmental Protection Goal Responsibility" and "System on Quantitative Assessment of Integrated Urban Environmental Management" under the "New Five Measures" and the study and pilot of "Green GDP" are all based on this provision in *Law on Environmental Protection* and experiences from international community to identify and to encourage governments at all levels to take responsibility.

2.4 Encourage "combination of prevention and control" and "integrated utilization"

China's environmental policies inherited principles from ancient China on ecology and sustained resource utilization. The first National Environmental Protection Conference convened in 1973 identified strategies of environmental protection, including comprehensive planning, reasonable structure, integrated utilization, transform hazard to benefit, rely on public, everyone's responsibility, protect environment, and benefit the public. The strategy emphasized concepts of planning, integrated use and public awareness. In fact, planning, environmental assessment, "Three Simultaneity" system and "Pollution Permit" systems are all important "control at source" rather than "control at end of pipe". The so-called "integrated use" in the 1970's applied the same principle as the concept of "circular economy" that is very popular in China today. All the principles are effective in developed countries and are also necessary in developing countries. However it is more challenging to implement in developing countries like China when educational level, environmental awareness and legal awareness of the general public remains comparatively low. China's environmental policy has been very active in ecological agriculture, renewable energy, cleaner production and recycling economy. It was fully reflected in the publication of *China's Ten Countermeasures on Environment and Development*, *Law on Energy Conservation*, *Law on Cleaner Production Promotion* and *Law on Renewable Energy* and pilots of ecological agriculture, ecological industrial park, green GDP, circular economy and so on.

2.5 Open in field of environmental policy and international cooperation earlier

China's delegation to the United Nation's Human Environment Conference in 1972 took abundant information on global wave on environmental issues. Ten books including *Only One Earth* were translated and widely published. Public environmental accidents and environmental policies abroad drew a lot of attention to the State Council. Though China's opening and reform policy didn't start until 1979, to certain extent China had been open in environmental protection area ever since 1972. Afterwards, China has been sending delegations abroad and to international organizations such as UNEP have come to China to exchange experiences. Lessons learned and environmental policies in developed countries drew great interests from China and important policies such as Polluter Pays Principle, Environmental Assessment and Pollution Fee were introduced then. After 1979, communication in environmental area became more active. Almost any good experiences or new trend abroad will lead to interest and pilot in China. China became an active member of the World Council of Environment and Development, promoting preparation of the United Nations Convention on Environment and Development. Based on that, China soon published China's Ten Countermeasures of Environment and Development and China's Agenda 21. In 1992, China Council for International Cooperation on Environment and Development

(CCICED) was established. It is a high level international advisory organization to the State Council, whose purpose is to give recommendations to Chinese government on integrated policies on environment and development. Typically CCICED has task forces and special groups consisting of 50 or so international or domestic council members, who are renowned experts or high level officials. Under CCICED there are 10 task forces or special groups consisting of same amount of domestic and international experts to investigate very important issues and to give policy recommendations through policy pilot and project pilot. The recommendations have greatly influenced China's integrated decision-making on environment and development (such as resource pricing, conservation, energy strategy and related legislations). Vice Premier Peiyan Zeng is the President of current CCICED, the 3rd phase. Prior to that, State Councilor Jian Song and Vice Premier Jiabao Wen have been the Presidents of the 1st and 2nd phase of CCICED. China has also cooperated with many other governments, international organizations and Non-Governmental Organizations on environmental issues.

3 Evolvement of China's environmental policy

Over years, China has witnessed five major changes in environmental policy (Ou G P, 2002).

3.1 Status from national basic policy to sustainable development strategy

In 1983, the State Council announced that environmental protection was one of China's two national basic policies; emphasizing environmental issue was just as urgent to China as population issues. Nine years later, *China's Ten Countermeasures on Environment and Development* announced that China is implementing sustainable development strategy. After *China's Agenda 21* was published in 1994, many departments and local governments formulated their own "*Agenda 21*" and promoted implementation in different areas such as planning, legislation, policy, communication and public participation. In 1996, the Ninth Five-Year Plan listed sustainable development as two essential strategies together with "revitalizing the nation with science and education". From national departments to local governments, they all set goals of sustainable development to formulate their planning and used sustainable development concept to guide their work.

3.2 Focus changed from pollution control to combination of pollution control and ecological protection

In early 1970's, China's environmental protection started from treatment of industrial waste, including wastewater, emission and solid waste. During 1980's and early 1990's, the focus of environmental protection was still around pollution control. In recent years, investment in pollution control kept growing steadily, reaching 346 billion RMB for the Ninth Five-Year Planning Period (1991–1995), equaling to 0.93% of total GDP. During 1996-2004, the total investment in pollution control reaching 952.27 billion RMB, was 1.0% of GDP. In 2004, the investment was 190.86 billion RMB, up 17.3% from previous year and equal to 1.4% of GDP, a historical record.

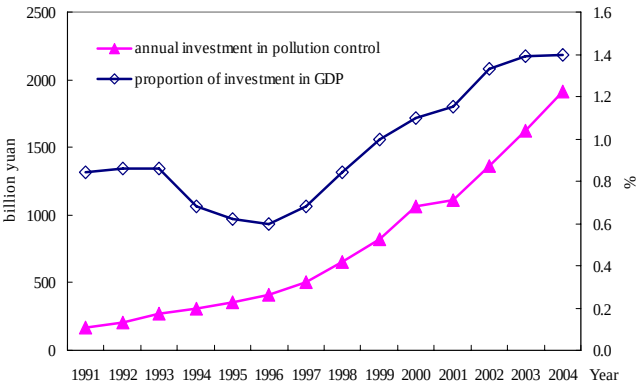

Fig. 1 Change in investment to environmental pollution treatment in China

Source: China Environmental Statistics, 1992 – 2005

In 1998, severe flood occurred in Yangtze River basin; it brought the country to realize the urgency of protecting natural environment and implemented a series of measures. For example, fully stop deforestation of natural forest in upper and middle stream of Yangtze River and Yellow River, make ecological recovery and construction as the top priority in developing great west; and formulate corresponding policies, etc. All the measures signaled historical turning point of China's environmental policy. In 2005, the forest area of the whole country reaches 175 million hectares; the forest coverage rate for 18.21%; the stock volume of forest for 12.46 billion cu. m. By the end of 2005, there are 2349 natural protection zones of different types and different levels, occupying 15% of nation's area; there are 528 established ecological pilot region and/or unit, including 233 recognized national ecological pilot regions.

3.3 Method changed from end control to source control

In the early 1990's, industrial pollution control in China implemented "Three Changes", including change from end control to whole process control, change from solely concentration control to combined control over concentration and total amount, and change from decentralized treatment to centralized treatment. At the same time, China started to limit development of industries with heavier pollution, higher resource consumption and outdated technology and began pilot of cleaner production with loans from the World Bank. During the Ninth Five-Year Planning Period (1996–2000), over 80 000 factories with 15 types of heavier pollutants were closed. By the end of 2000, over 90% of all 238 000 polluting factories were in compliance with stan-

dard. This reduced damages to resource and environmental pollution from the sources. Meanwhile, the government actively promoted development of high tech industry and the third industry. Since 1995, China's industrial wastewater discharge and COD discharge has been decreasing while industrial product kept growing rapidly (Table 2).

3.4 Scope changed form point treatment to watershed and territory treatment

Past "Polluter Treats" policy in China focuses on "control of pollution in point source" and "control by concentration of pollutant". In 1996, China's State Planning Commission, State Economic and Trade Commission, National Environmental Protection Agency jointly issued *Plan on Total Emission Control of Major Pollutants during the Ninth Five-Year Period*, starting to control total emission of 12 types of major pollutants. Prior to that, in order to compensate data loss in rural and township enterprise pollution, National Environmental Protection Agency and Ministry of Agriculture conducted a joint survey on rural and township enterprises pollutions and made a major adjustment to total emissions of major pollutants in all provinces since 1995. During the Ninth Five-Year Planning Period, pollution treatment was enhanced throughout the country and large-scaled environmental infrastructure projects were implemented.

Between 1996 and 2005, China implemented *Plan on Trans-Century Green Project*, the key regions were three rivers (Huai, Hai, and Liao), three lakes (Taihu, Chaohu, and Dianchi) and two zones (SO2 Pollution Control Zone and Acid Rain Control Zone), one city (Beijing), one sea (Bohai), the Three Gorge Reservoir & upper reaches of the Yangtze River, and Area of Project on Water Pumped from South to North. The Yellow River and Songhua River are also listed in the key regions in 2006. In these key watersheds and territories, funds were raised through multiple channels, including World Bank, Asian Development Bank, Japan International Cooperation Bank, government funding from some Europe countries, BOT and some domestic funds). In addition, integrated measures were adopted to enhance pollution treatment, including implementation of Total Emission Control Policy, Polluter Levy Policy and Energy Policy of "Substituting Coal with Gas and Electricity". All the policies were deployed to promote enterprise to be compliant with emission standard and to develop environmental infrastructure, to improve deteriorating environmental status.

3.5 Management style changed from primarily using executive power to using legal and economic measures

Since the 1990's, environmental legislation in China has been enhanced year over year. To date nine environmental laws, including *Law on Environmental Protection* and *Law on Prevention and Control of Water Pollution*, and 15 laws concerning natural resources, including *Law on Forestry* and *Law on Water*, has been enacted. Revised *Criminal Law* included a provision of "Crime of damaging environment and resource protection". The State Council published over 50 administrative regulations, including *Regulation on Administration for Safety of Hazardous Chemicals*. The State Environmental Protection Administration issued nearly 200 regulations and over 500 national environmental standards, and approved about 51 multilateral or international environmental conventions. Provincial governments of whole country passed over 1600 regional or local environmental regulations. As a result, an environmental legislation system has come into place, but it still needs to be improved. In 2005, the number of projects put into production of the year was 99 thousands; 96.2% of

Table 2 Wastewater discharge and COD discharge in decent years

Item	Wastewater discharge (100 million tons)			COD discharge (10 thousand tons)		
Year	Household	Industrial	Total	Household	Industrial	Total
1995	133.7	281.6	415.3	610.3	1622.9	2233.2
1996	—	205.9	—	—	—	—
1997	189.0	227.0	416.0	684.0	1073.0	1757.0
1998	194.8	200.5	395.3	695.0	801.0	1496.0
1999	203.8	197.3	401.1	697.2	691.7	1388.9
2000	220.9	194.2	415.2	740.5	704.5	1445.0
2001	230.2	202.6	432.9	797.3	607.5	1404.8
2002	232.3	207.2	439.5	782.9	584.0	1366.9
2003	247.0	212.3	459.0	821.1	511.8	1333.9
2004	261.3	221.1	482.4	829.5	509.7	1339.2
2005	281.4	243.1	524.5	859.4	554.7	1414.2

Sources: China's Environmental Statistics and China's Statistics Yearbook, multiple years

projects met "Three Simultaneity" requirement. The number of enterprises that paid pollution fees was 746 thousand; fee collected was 12.32 billion RMB (National Bureau of Statistics and State Environmental Protection Administration, 2006).

To increase incentives of economic measures, related departments of the State Council have been formulating and improving economic measures that were beneficial to environment on development, integrated use, financial taxation and foreign investment based on the principles of "Polluter Pays, User Compensates, Developer Protects, and Destroyer Recover". To environmental recovery at regional level, central government gave policy support and financial support, for example, to urban wastewater treatment plants and garbage disposal plants under construction in eastern region, central government would subsidize 1/6 of funding, but the ratio went up to 30% in central region and 70% in western region (such as Three Gorge region). Pollution fee would be increased gradually and environmental tax was under study. Table 3 listed common environmental measures used by China.

4 Comments to China's environmental policy from international community

4.1 From the World Bank

The World Bank spoke highly of China's "Total Emission Control" and "Green Project" in its report *Clear Water Blue Sky – China's Environment in the New Century* published in 1997,"Many governments commit themselves to only vague environmental objectives; China, by contrast, has defined a clear set of measurable targets."

The World Bank pointed out in its report *China: An Evaluation of World Bank Assistance, 2005*: "China faces serious environmental problems, and because of its size, some of the effects, such as greenhouse gas emissions, are also worldwide. During the 1990s, government gave increased attention to the environment. Awareness was heightened by widely publicized international reports and by events in China. Widespread illness among users of the Huai River in China's industrial Northern Plain in 1994 was a turning point for government, resulting in the eventual closure of 75,000 small, high-polluting TVEs nationwide. Floods in 1997 and 1998 prompted the introduction of a logging ban in sensitive areas. The government has also used less drastic measures, including more open environmental reporting, price incentives, and new laws and regulations. Leaders regularly address environmental issues in major speeches, and China has adopted "sustainable development" as a guiding principle for the tenth five-year plan (2001-05)."

"As a result of these policy shifts, China has had some successes in reversing or containing some forms of environmental degradation, though serious problems remain and future trends are uncertain:

Although China remains one of the most inefficient major economies in terms of primary energy use per unit of GDP (3.3 times higher than the United States in 2001 and 40 percent higher than India), unit energy use improved by 30 percent between 1995 and 2001. In a period of in-

Table 3 Common environmental protection measures used by China

Command–control	Market–economic	Voluntary	Public participation
Emission concentration control	Pollution fee	Environmental Signage	Publishing environmental status report
Total emission control	Penalty for exceeding pollution standard	ISO14000 environmental management system	Publishing environmental statistics report
Environmental impact assessment system	SO_2 emission fee	Cleaner protection	Publishing river water quality
"Three simultaneity system"	SO_2 emission permit trading system pilot	Ecological agriculture	Publishing air quality index
Pollution treatment within deadline	CO_2 emission permit trading system	Ecological demo zone	Publishing enterprise env. performance
Pollution permit system	Subsidy to energy saving products	Ecological industrial zone	Public hearing of env. impact assessment
Centralized control of pollutants	Ecological compensation fee pilots	NGO organizations on environmental protection	Enhancing the school's Env. Education in all level
Urban environmental integrated assessment system		Environmentally sound model enterprise, products	"*China Environmental Protection Campaign*" (Public media)
Environmental administrative inspection		Pilot of Green GDP accounting	

creasing industrial production, industrial pollution loads have fallen drastically since the late 1990s.

China increased forest area during the 1990s, albeit with some loss of species diversity.

Erosion on the extended Loess Plateau area has been contained, with benefits not only to the people living there but also in the quality of the Yellow River and the amelioration of dust storms as far away as Beijing.

China made a major contribution to the global environment through a sharp reduction in ozone-depleting substances (ODS) in recent years."

4.2 From the United Nations Development Program (UNDP)

UNDP in its *China Human Development Report 2002* (SEI/UNDP, 2002) across-the-board analyzed China's environment: setting the scene; current state; the society–environment nexus; challenges; and the path ahead, and it shrilly indicated that the "get-rich-fast — clean-up-later" strategy is inappropriate and even dangerous for China. Important parts of the ongoing environmental degradation may be irreversible. Once biodiversity is lost, river ecosystems destroyed, arable land desertified, and groundwater contaminated, there is no going back, at least not at a feasible cost. At best, the "get-rich-fast — clean-up-later" strategy is the least cost-effective approach. At worst, it becomes a "get-rich-and-dirty — stay-dirty-get-poor" approach.

UNDP pointed out in *Common Country Assessment 2004* (UN Country Team China, 2004), "China has achieved remarkable economic growth over the past 25 years, lifting more than 300 million people out of poverty. Although levels of development vary sharply, all 33 provinces and special regions have achieved Human Development Index (HDI) values in the medium or high range. Life expectancy now exceeds 70 years. But the same economic progress that has led to these impressive achievements has also brought new challenges and concerns." The report indicated further that like in society, "Challenges are also equally large in the environment as a result of unprecedented economic growth and development. Traditional approaches are not enough to overcome the challenges: innovative ideas and holistic approaches are needed to ensure the sustainability of environment and energy. The areas which require special attention include: (1) systematic approach to land degradation, (2) mainstreaming biodiversity conservation into overall development, (3) increasing water-use efficiency and ensuring safe drinking water, (4) increasing energy efficiency and the use of renewable sources, (5) enhancing environmental governance, (6) upgrading waste disposal and sanitation, and (7) strengthening of disaster prevention and preparedness."

UNDP indicated in its *Country Program for PRC (2006–2010),*"Balancing economic growth and the environment is a pressing challenge for China. Strengthening environmental governance and promoting "green growth" are enormous challenges that requires enhanced cross- sector coordination, comprehensive planning, and effective monitoring"

4.3 From Japan

Japan Environmental Council – a non-governmental organization in Japan published *White Paper on Asia's Environment* which reviewed China's environmental issues and environmental policies thoroughly with three volumes. The first volume categorizes the characteristics of China's environmental issues as the following 5 points (Japan Environment Conference, 2005): "(1) Environmental problems in China is current crisis instead of future crisis; (2) China's natural environmental is particularly disadvantageous; (3) Civilization, invasion by other countries, civil war and policy mistakes in the past thousands years have had tremendous impact on China; (4) Economic structure evolved around heavy industry along the history, which relies on coal consumption and imposes huge burden to environment and can not be fundamentally transformed even after reform and open policy; (5) From the end of 20th century to the first half of 21st century, both urban areas and rural areas will become a society with heavy consumption and heavy waste. "Does China have to develop its economy at the cost of continuous destruction of environment?" The author thinks criticism like this is not overly harsh.

Professor Taketoshi Kazuki (2005) of Japan Momoyama College University researched China's Environmental Kuznets Curve (EKC). He used data from *China Statistics Yearbook* and *China Environmental Statistics Yearbook* between 1993 and 2002 to simulate EKC model for China's 29 mainland provinces (Tibet and Chongqing excluded), and concluded inflexions of COD, SO_2 and dust per capita corresponding GDP. The result and the comparison with other literatures see Table 4. From existing results, maybe China's inflexions below then other developed countries, but China has to enhance environmental protection continuously.

4.4 From the United States

Elizabeth C. Economy, the Director of Asia Research Division under Foreign Affair committee of USA, published a book in 2004, titled *The River Runs Black: The Environmental Challenge to China's Future* (Elizabeth C, 2004). The book started with the dying of Huai River, reviewed China's civilization and history of environmental destruction, explosive economic growth and environmental cost associated to the growth, responses of China's environmental protection, neo-environmental politics (impact of NGOs), international community and China's environmental issues, international experiences and prevention of environmental crisis. In the end, the book discusses three potential scenarios of China's future environment – China with a beautiful environment? Continuing on its track to degradation? Or devastation? What role would the United State play? The author studies literatures on China's environment issues, interviewed some important peo-

ple, and rings alarm to China's environmental issues and their impact to China's future.

According to *Pilot 2006 Environmental Performance Index* (EPI, http://www.yale.edu/epi/) published recently by Yale University and Columbia University, China's score is 56.2, the 94th among all 133 countries or regions. EPI is calculated with 16 indicators in 6 policy categories (environmental health, air quality, water resources, bio-diversity and habitats, productive natural resources, and sustainable energy policy). China is in the middle among its Asian neighbors. EPI reflected progresses China made in certain areas in environmental protection, for example, protection of bio-diversity and productive natural resources; however, it also shows that China need to invest more in air quality, water resources and sustainable energy policy.

4.5 From OECD

OECD finished *the Environmental Performance Review of China* in November 2006, and put forward fifty-one recommendations (2006). OECD point out that China is experiencing the average rate of economic growth 10.1% over almost 15 years, and become the fourth largest economy in the world. However, poverty remains a serious challenge in rural China. Using concepts such as "harmonious society" and "scientific development", China is planning for national economic & social development, modern environmental legislation, strengthened environmental institutions, and higher priority to environmental and natural resources management. China will need to (1) strengthen the effectiveness and efficiency of the implementation of its environmental policies; and (2) enhance the integration of environmental concerns into economic decisions.

To reduce the gap in implementing environmental policies, OECD suggests: (1) Continue efforts to make local leaders, at different levels, more accountable for their environmental performance; (2) Upgrade SEPA from an Agency to a Ministry; (3) Extend the use of market mechanisms for achieving environmental objectives; (4) Increase and diversify sources of environmental finance.

To better integrate environmental concerns in economic & social decisions, OECD's recommendations are: (1) Review the price levels for natural resources and consider a green tax reform; (2) Better integrate environmental institutionally into economic policies; (3) Strengthen environmental democracy; (4) Provide access to sound environmental services to the poorer and rural populations; (5) Focus more on the health impacts of environmental degradation.

To strengthen environmental intl co-operation, OECD suggests: (1) Establish a coherent national plan on climate change; (2) Continue the phase out of ozone depleting substances; (3) Improve governmental oversight of overseas operations of Chinese companies; (4) Intensify efforts to address regional environmental problems, particularly acid rain; (5) Increase targeted financial assistance.

5 Future of China's environmental policy

Based on reports or publications by the World Bank, UNDP, OECD, Japan and USA, they are clearly concerned about China's environmental issues. Pollution accidents occurred in Songhuajiang River, Beijiang River and Mudanjiang River increased concerns from the public and outside world. However, there is an old China proverb, saying once something reaches peak at one extreme will inevitably change its direction to the opposite, and there are some truth to the old saying. In this case, we are not going to let go of pollution to an irreversible level. Based on evolvement of China's environmental and development policy in recent years, we see continuous improvements. *Decisions on Enhancing Science Development and Environmental Protection* (referred to as "*Decisions*" in the following paragraph) published by the State Council in Dec. 2005 provided a very promising blueprint.

The "*Decision*" is different from 4 previous Decisions from the State Council on environmental protection or China's Ten Countermeasures on Environment and Development issued in 1992. The "*Decision*" is long and comprehensive, including 32 provisions with concrete contents and rigorous requirements. The "Decision" specifies that the State Environmental

Table 4 Comparison on inflexions of environmental kuznets curve (EKC)

	Taketoshi Kazuki, 2005 China case			Shafik, 1994	Grossman & Krueger, 1995	Selden & Song, 1994	Matsuoka,Matsumoto, & Kawanai 1998 Japan case
	RMB, GDP per capita, 1990 price	US$, GDP per capita, 2000 price	US$,PPP per capita	US$, PPP per capita	US$, GDP per capita	US$, GDP per capita	US$, GDP per capita
COD per capita	2766	622	2960		7583		
SO_2 per capita	7130	1603	7630	~4000	4053	8916	8747
Dust per capita	5075	1141	5431		6151		

Protection Administration should inspect status of compliance with the "*Decision*" together with Inspective Administration and report to the State Council annually. That is to say, implementation of the "*Decision*" will be enforced by administrative power.

Some most noticeable points in the "*Decision*" include: (1) emphasizing that the urgent challenges faced in environmental protection area remains the same, population will continue to grow in the next 15 years, economic output will quadruple, consumption of resources and energy will continue to grow, pressure faced in environmental protection will become greater and greater. We have to place environmental protection at a more important strategic position, to lead environmental protection with a viewpoint of scientific development, to solve environmental issues with determination; (2) emphasizing "solving environmental issues in development", to actively promoting economic structural change and transformation of economic growth pattern, to essentially change the status of "pollute first and then treat the pollution, treat and pollute at the same time"; (3) solving 7 most significant environmental problems, especially drinking water safety and key watershed treatment; (4) improving environmental legislation and increase penalty to illegal behaviors through assessing environmental legislation and law enforcement. The key is to solve the issue of "it costs less to break the law than abide by the law"; (5) using marketing mechanism to promote pollution control to establish environmental-friendly pricing, taxation, financial, trade, real estate and governmental procurement policies; (6) improving ecological compensation policy and establish ecological compensation mechanism. Central government and local government's financial transfer should take into consideration of ecological compensation. The central government and local government can both take pilots on the mechanism; (7) promoting coordinated development of local economy and environment, promoting recycling economy; (8) enhancing construction of environmental science and technology platform, prioritizing key environmental technology development project, making environment and health the new directions for breakthroughs.

Outline of the 11th Five-Year Planning Period (2006–2010) proposed the main goals of economic development and social development. The first is 7.5% average annual growth rate of GDP in the next 5 years. This goal is set on the basis of optimizing structure, improving efficiency and reducing resource consumption. The second is to reduce energy consumption per unit GDP by 20% and to reduce major pollutant emission by 10%. Goals were proposed in facing urgent pressure from environment and resources and they have clear policy incentive. This shows the environment and development policy of the Chinese government is on its way to sustainable development.

References

[1] Elizabeth C. Economy, the river runs black: the environmental challenge to China's future. Cornell, USA: Cornell University Press, 2004

[2] Fu C L , Yu Q X. China's sustainable development. Tokyo: The United Nations University, the Institute of Advanced Studies, 1999, 20

[3] Japan Environment Conference. The state of the environment in Asia 1997-1998. Tokyo: Toyo Economy News Co., 1998. Chinese version, Beijing, China: China Environmental Science Press, 2005

[4] Jeremy J, Warford, Li Y N. Economics of the environment in China, a Publication of the CCICED. Maryland, USA: Aileen International Press, 2002, 60

[5] Kiyo Akasaka. Speech at the SEPA press point on environmental performance Review of China, 2006, (9). www.oecd.org/dataoecd/38/60/37659805.pdf

[6] National Bureau of Statistics and State Environmental Protection Administration. China statistical yearbook on environment 2006. Beijing, China: China Statistics Press, 2006

[7] OECD. Environmental Performance Review of China: Conclusions and Recommendations, 9 Nov. 2006. www.oecd.org/dataoecd/58/23/37657409.pdf

[8] Qu G P. Witnessing great changes on environment and development in China, in: Proc. of 5th Meeting of 2nd CCICED. Beijing, China: Huawen Press, 2002

[9] SEI/UNDP. China human development report 2002: Making green development a choice. Beijing, China: China Finance and Economy Publishing, 2002

[10] SDPC, SETC, and NEPA. Ninth National Five-year Plan on environmental protection and the goal of 2010. Beijing, China: China Environmental Science Press, 1996

[11] Taketoshi Kazuki. China's environmental policy: system and countermeasures. Tokyo, Japan: Huangyo Press, 2005, 142-156

[12] The World Bank. Clear water, blue sky: China's environment in new century. Washington, DC: World Bank, 1997. Chinese version, Beijing: China Finance and Economy Press, 1997

[13] UN Country Team China. Common country assessment 2004: balancing development to achieve an all round Xiaokang and Harmonious Society in China, 2004

[14] Wang J N, Yu F, Cao D. Study report 2004 for green national economic accounting. China Population, Resources and Environment, 2006, 16(6): 11–17

[15] Xu S L. Estimating economic cost due to environmental damage: case study and theoretical research. Beijing, China: China Environmental Science Press, 1998

[16] Zhang K M. Policies and actions on sustainable development in China. Beijing, China: China Environmental Science Press, 2001.