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Environmental Industry Project Report

Environmental Industry Project

Institute for Global Environmental Strategies

(Revised Version: 25 February, 2004)

Environmental Industry Development in Selected Asian Developing Countries: China, India, Indonesia, and Republic of Korea

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Part One: Introduction and Summary of the Findings and Recommendations

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1. Introduction

The Report focuses on the Environmental Industry (EI) in four selected countries of the Asia-Pacific Region. The countries selected are: the People's Republic of China (China), India, the Republic of Indonesia (Indonesia) and the Republic of Korea (ROK), representing different stages of EI development. The Report outlines and assesses the current state of environmental deterioration in these four countries, the current stage of EI development, major government policies for EI development, major contributions to EI development by external bilateral and multilateral donors and by multinational corporations (MNCs).

EI in this Report refers to:1) Environmental technology and processes (software), 2) Environmental products, equipment and instruments (hardware), and 3) Environmental management systems at corporate level. And all these three categories are applied to three environmental market segments: air, water, and soil pollution, including waste treatment and disposal.

EI in the Asia-Pacific region, and especially in the four selected countries which represent a wide range of economic, social, political and ecological conditions, is critical to sustainable development not only in the region but also in the whole world because of their sheer size of land-mass and population and their rapid economic growth and environmental deterioration and to enabling those countries to attain the Millennium Development Goals (MDGs) and to realize the Johannesburg Plan of Implementation by 2015.

How the domestic and external factors such as bilateral donors, international organisations and MNCs, contribute to the development of EI in the four selected countries of the Asia-Pacific region is the focus of the Report. The role of the external factors is assessed in the context of domestic policies and institutions that facilitate or impede the effective contribution by bilateral and multilateral donors and MNCs to EI development.

Structurally, the Report consists of three parts. Part I presents an Introduction, Major Findings and Recommendations. Part II consists of country studies, i.e., a chapter each on China, India, Indonesia and ROK, and a chapter on the role of small and medium enterprises (SMEs) in EI development in the Asia-Pacific region. Part III deals with the role of external partners in the development of EI in Asia, and consists of a chapter on the role of Japanese Official Development Assistance (ODA) and Japanese MNCs in the development of EI in the four selected Asian countries, a chapter on the inter-city environmental cooperation by Kitakyushu City, and a chapter on the contribution of bilateral (except Japan) and multilateral donors and MNCs in the four selected Asian countries.

The information and data used in the Report are derived from hard cover publications, electronic/website reports and data available at the Institute for Global Environmental Stragtegies (IGES) and elsewhere at no cost, and personal communications. Proprietary reports and information have also been identified during the research but have not been accessed and/or obtained due to significant costs involved.

Methodological issues exist with respect to projected investment and/or market value of EI in the four selected Asian countries based on the data examined. Classification and definition of environmental market segments and of the environmental technologies and services differ from country to country and at times between different industries even within countries. Likewise, the base years for which data is available vary. However, these elements do not affect the thrust of the analysis and the major conclusions and recommendations.

Lastly, the Report has benefited from the rich discussion at IGES International Workshop first on 1-2 December 2002 and second on 14 and 15 June 2003, especially the specific suggestions made by all the participants on each of the chapters included in the Report. It is also to be noted that the papers submitted to the three sessions of the Tripartite Roundtable Meeting on Environmental Industry organized by the governments of China, Japan and ROK during the last three consecutive years 2001-2003 have enriched the discussion on environmental industry development in respective countries. As director of the Environment Industry Project at IGES and as editor of this Report, I am indebted to all the research collaborators and research secretaries on the EI project for their excellent cooperation.

2. Major Findings and Recommendations

A. Findings

1) The Asia Pacific Region is the leader in EI among developing countries. It is positioned to take off as an effective competitor with industrial countries in domestic and international EI markets. Moreover, EI could be a locomotive for economic growth and sustainable development.

2) The potential growth of EI is substantial, with estimates ranging from 10 percent to 20 percent (US$1.5 billion to US$3 billion) annually and, even higher in some segments, in the next five years. While environmental products have been the largest single market in all the selected countries of the region, the fastest growth is expected in environmental technology and service sectors. Exports of EI products, technology and services particularly from China, India and ROK, together with those from Japan, are also projected to grow fast.

3) R&D in sophisticated and high-tech environmental products and technologies sector, however, is not adequate to support the projected growth of EI. Moreover, the Global Environment Facility (GEF), Clean Development Mechanism (CDM), and the Multilateral Fund of the Montreal Protocol (MFMP) are not being used effectively to promote EI development in the region. Likewise the World Bank/International Finance Corporation (IFC), the Asian Development Bank (ADB) and the United Nations Development Programme (UNDP) have not in the past explicitly included development of EI as a specific objective of their programmes and lending activities.

4) Air and water pollution prevention and control equipment are the two EI segments with greater growth potential, including renewable energy, clean coal technologies and energy efficiency, water use efficiency and treatment of wastewater, together with advanced engineering consulting and environmental technology services. Another growth sector, especially in China and Korea, is recycling and reutilization of waste, including industrial solid waste, waste liquids and waste gas.

5) A wide diversity exists among the four selected Asian countries in the nature and extent of environmental deterioration, its major sources, government policies in dealing with it in terms of the nature and range of concrete measures, timing and implementation successes and failures, and the contribution of bilateral and multilateral donors and MNCs to the development of EI. While environmental deterioration in ROK, as in developed countries, has stemmed mainly from industry, offices, transportation and household activities in urban areas, that in China, India and Indonesia has been caused partly from depth of poverty in rural areas and partly from rapid rate of industrialization and urbanization.

6) Regardless of country, these governments in the Asia-Pacific region have resorted initially to legislative and administrative measures to cope with growing environmental deterioration. However, they have not been able to solve it due partly to their inadequate human and institutional capacities to implement those measures, and to the lack of environmental awareness among different segments of the population including public and private sectors and individual households. According to experiences of Japan, ROK and other developed countries and more advanced developing countries such as Singapore, their environmental policies tend to be strengthened and become more effective in fighting against environmental deterioration, when people, reaching a moderate level of income and consumption, become keenly aware of the critical importance of such policies to their health and future generations and pressure governments ceaselessly to adopt more effective measures to deal with it.

7) Having found difficulties in redressing environmental deterioration by legislative and administrative measures alone, most governments of the Asia-Pacific region have been adding in recent years to their anti-environmental arsenal those pricing policies, financial and fiscal incentives and disincentives to assist the stakeholders in the adoption of individual and collective measures to deal more effectively with environmental

deterioration. Command-and-Control (CAC) system is being steadily replaced by Community-Regulatory-Market (CMR) system.

8) Most prominent among these economic incentives are government direct subsidies and preferential credit and tax measures to install anti-environmental technology and equipment in private sector production and distribution activities and household consumption. Instead of end-of-pipe (EOP) environmental technologies, many private sector enterprises have installed cleaner production processes including the use of environmentally sustainable industrial raw materials, cleaner energy and environmentally friendly technologies, as well as more effective waste management system In turn, many private sector retail stores have also adopted some kind of deposit schemes to reuse, reduce and recycle household wastes. Many governments in the Asia-Pacific region have also been trying to reduce traffic congestion and resultant CO_2 emission by building mass rapid transit system such as subways and overhead monorails. City centre traffic control scheme as introduced by Singapore and the "stop the engine-idling" at the cross roads widely practiced in Japan are being replicated by other metropolitan authorities in the Asia-Pacific region.

9) In response to the installation of the CMR system in the Asia-Pacific region, the role of MNCs is steadily expanding, contributing to more rapid development of EI in technology, equipment and products, and environmental management systems in all the four selected Asian countries. While EI development is rather slow in Indonesia, increased private sector participation in environmental management has been observed and is further anticipated, especially in China, India and ROK, utilizing an integrated project management approach. This approach integrates engineering, procurement, construction and operation (financing in some instances) and results in Build-Own-Operate (BOO) and/or Build-Own-Operate and Transfer (BOT) projects.

10) Japan, U.S., and Germany are the three major bilateral donors, contributing to the development of EI in these four selected Asian countries through their bilateral ODA programs as well as through their respective MNCs. Canada, France and the UK are also making significant contribution.

11) Filling in gaps in the regulatory frameworks and performance-based standards and streamlining/consolidating the administrative/institutional arrangements, while being

steadily improved in China and ROK, will result in more effective monitoring and compliance in all these Asian countries, particularly in India and Indonesia, with regulatory requirements, norms and standards, especially in the rural areas and remote provinces where they are now lagging behind. It will also create more efficient conditions for MNCs and national companies to enter the growing EI market in these countries and elsewhere.

12) Small and medium size enterprises in the Asia-Pacific region require special attention since they are significant contributors to industrial pollution and the future growth of EI through their subcontracting activities in both software and hardware production as well. Three million SMEs in India, for example, generate about 40 percent of the national GDP and account for 60 percent of all industrial pollution, and so with SMEs in China, Indonesia and ROK.

13) China and ROK, having already adopted the Euro I standard, are likely together with India[1] to adopt the Euro II standard for emissions before the 2008 Olympics in Beijing and at the same time to expand substantially the fleet of buses and taxis fueled by compressed liquid gas and fuel cells, as the latter technologies should become more widely available and accessible at lesser cost in the near future. Here again, the introduction of more economic and fiscal incentives and wider use of them by national enterprises and MNCs is anticipated as the use of command and control systems declines.

14) Greater availability of environmental soft loans such as the ASEAN-Japan Development Fund (AJDF) operated through its Japan Bank for International Cooperation (formerly, Overseas Economic Cooperation Fund) for Pollution Abatement Equipment (JBIC–PAE) in Indonesia and of the Private-Public Partnership (PPP) of the German government to encourage private sector participation in EI in China are expected to expand throughout the Asia-Pacific region where suitable conditions already exist or will be created in the future. Recent European legislation that encourages Pension Funds to invest in EI and the growth of various ECO-funds in all developed countries targeting their loan and equity investment at environmentally sustainable projects and corporations are also expected to contribute to this effort.

[1] India may adopt in some major cities the EURO II standard by 2005

B. Recommendations[*]

— To National governments in the Asia-Pacific region, especially in China, India, Indonesia and the Republic of Korea

1) Streamline and perfect the regulatory framework and standards with improved environmental management instruments and target inspections and audits on potential trouble spots and worst offenders.

2) Reduce the multiplicity of agencies and bureaucratic levels involved in the approval/licensing of EI initiatives and in administering and monitoring compliance with standards and regulations – “One Stop Shop.”

3) Reduce dependence on command and control mechanisms and increase reliance on market-driven and “bottom line” business incentives and performance.

4) Improve compliance and monitoring in rural areas and increase automation and related telemetering systems for monitoring in urban and metropolitan areas as well as more widely.

5) Expand institutional capacity and the size of qualified personnel to monitor compliance, which will require increased budgetary allocations.

6) Strengthen pubic and private R&D about environmental technology and products, and motivate MNCs to participate in this endeavor. R&D in China, India, and ROK may also include developing a hydrogen energy economy and fuel cell production for the energy (stationary fuel-cells) and transportation sectors.

7) Simplify and expand economic and fiscal incentives and their transparency, and make them more user friendly to small and medium size enterprises.

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[*]The recommendations listed below require immediate action. However, some such as R&D, capacity development, and establishment of credible databases and information systems will require longer timeframes.

8) Develop capacity to access and use effectively the opportunities provided by the Clean Development Mechanism – “One Stop Shop.”

9) Expand availability of and access to information about EI through credible and user-friendly databases and information systems, which may also include sub regional and regional action.

— To Bilateral and Multilateral Donors and MNCs operating in and concerned with EI development in the Asia-Pacific region:

1) Substantially increase the participation by private sector in EI, including that which is financed by international organisations, especially IFC and GEF.

2) Expand availability and access to soft loan financing and grants for EI by Japan and other bilateral donors as well as the World Bank and the Asian Development Bank.

3) Promote international environmental standards for major industrial sectors and corporate environmental management systems for MNCs, which should be applicable to all private sector corporations operating not only in the Asia-Pacific region but also outside this region. IGES concerned with environmental sustainability particularly in the Asia-Pacific region could expand its research activities on environmental industry development and corporate environmental management to provide such services regionally in collaboration with national research centres in various countries of the Asia-Pacific region.

4) Establish a clearing-house either regionally or globally for environmental technology and services that is readily accessible and user friendly to public and private sectors in the Asia-Pacific region. IGES concerned with environmental sustainability particularly in the Asia-Pacific region could expand its current activities on information and capacity building to provide such services regionally in collaboration with national research centres in various countries of the Asia-Pacific region.

5) Expand ratings of MNCs and national companies about their sustainability performance (environmental and social responsibility) already provided by services such as Innovest and Dow Jones. IGES could expand its research activities on corporate environmental management to provide such services regionally in collaboration with national research centres in various countries of the Asia-Pacific region.

6) Standardize consistent and comparable internal reporting by MNCs and national corporations about their sustainability performance, as about fifty members of the World Business Council for Sustainable Development (WBCSD) is already doing it. IGES could expand its research activities on corporate environmental reporting to provide such services regionally in collaboration with national research centres in various countries of the Asia-Pacific region.

7) The current arrangement of the Tripartite Roundtable Meeting on Environmental Industry organized by China, Japan and ROK could be expanded, with a view to accelerating the development of environmental industry in the Asia-Pacific region, to include the participation of other interested countries of this region under the auspices of the ECO-ASIA or other similar arrangements already present. The agenda of such expanded Roundtable Meeting could include among others the specification of regional environmental industry standards including technical and management standards, further exploration into effective national and regional financial mechanisms to facilitate environmental industry development including R & D in environmental technology, and better utilization and, if necessary, expansion of the existing national and regional institutions for human resources development specialized in various disciplines for environmental sustainability.

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.

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Chapter II

Environmental Industry Development in Developing Asian Countries: Case of India

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Summary and Recommendations

Worldwide phenomenon of environmental degradation has affected India as well owing to the rapid increase in population and economic development. Encouraging achievements in social indicators on one hand have also been accompanied with inadequately provided basic services. Scoping of environmental issues for this study was done accordingly after a comprehensive literature review and covers key environmental issues: Air, Water, Solid waste, Green house gases and Climate change and Environmental Management. The study provides an overview to each issue and identifies critical issues facing the sector while highlighting Government policy measures & initiatives. Briefly discussing the experience of different projects and/or funding agencies, the study also brings up potential business opportunities in the sector.

Growth in road based passenger transport accompanied with an increase in number of personal vehicles is the major contributor to the problem of air pollution. Rapid strides in industrialisation and power generation capacities have further magnified the problem. Prevention-based approach, especially in the SSI, has worked to a limited extent. Mechanisms and subsidies to deliver better energy services are misdirected towards more affluent urban households and commercial sectors. Existing information base on emission loads, emission factors, traffic volumes, specific resource consumption in the industry and emissions per unit output needs to be strengthened so as to evaluate success of policy and technology. Reforms need to be initiated in the Power sector by fixing fuel prices at realistic levels, rehabilitation of existing less efficient infrastructure and putting the renewable energy sources to maximum use. Getting the price of electricity right shall also send correct signals to consumers so as to encourage them to invest in energy saving practices and technologies. Reducing vehicular emissions shall require improved vehicle technology and fuel quality,

better traffic flow, controlling the number of vehicles on the road and use of alternative fuels and vehicle technologies. Interventions to reduce indoor air pollution shall include improving ventilation in-house, using improved and eco friendly stoves and cleaner fuels and creating awareness amongst masses about health impacts of indoor air pollution. Potential business opportunities lie in design and provision of systems for reducing levels of NO_x, SO_2 and noise; clean coal technology; heat recovery systems and; better combustion and emission control technology in vehicles. R&D thrust areas have also been identified in the field of renewable energy.

Though India is rich in terms of annual rainfall and total water resources available, the uneven distribution of resource causes regional and temporal shortages. Per capita availability of renewable freshwater resources in India fell from 6000 cubic metres in 1947 to about 2300 cubic metres in 1997. Sewage generation in urban centres has increased six-fold between 1947 to 1997. Critical issues facing resource management include the widening gap between demand and supply, inequitable access to basic services, degradation in resource quality, inefficiencies in resource usage and poor pricing policies. There is a need to strengthen monitoring networks for water quality monitoring, generate information on availability of groundwater and on water consumption and effluent discharge patterns for industries. There is a need to increase resource availability through rainwater harvesting measures, preventing water run-offs and inter basin water transfer. Water management efforts should be at a river basin or sub-basin level. Appropriate tariff structure for water services will encourage wise usage of resource and generate additional support for the fund-starved service providers as well. Efforts for conservation of water need to be intensified to prevent overexploitation of scarcely available resource and reduce the quantity of wastewater generated. Sewage collection, interception and treatment efficiencies need to be enhanced further. Potential business opportunities lie in generating more resources by removal of dissolved organics in brackish water and saline water and bettering resource quality through removal systems for BOD and COD, high Ammonia wastewater, heavy metals and treatability studies for sewage and process wastewater.

Solid waste generation in the country has increased from 6 million tonnes in 1947 to 48 million tonnes in 1997 owing to urbanisation and changes in lifestyles.
India has witnessed a significant growth in industrial sectors that have a major potential for generation of hazardous waste. Production and consumption of plastic has itself increased

more than 70 times between 1960 and 1995. Inadequacies in solid waste management (SWM) system, poor waste segregation practices, absence of dedicated waste disposal facilities and inadequate infrastructure and culture for waste recycling pose problems in management of waste. Rules for waste management fail to provide any incentive for waste reduction/minimisation and do not clearly identify the role and responsibilities to be undertaken by the CPCB and SPCBs.

Studies on waste inventorisation and to explore the risks and health impacts of hazardous waste disposal need to be carried out. Technological interventions that need urgent consideration include waste collection, treatment and disposal. There is a need to set up decentralised waste treatment facilities throughout the country and demonstrate their viability through pilot-scale projects. Institutional and regulatory reforms need to be initiated in ULBs and additional support has to be mustered from the private sector. Business opportunities include design and execution of comprehensive solid waste handling, treatment technologies and disposal systems. This covers waste to energy technologies, resource recovery from wastes, waste stabilisation, soil remediation studies and technology evaluation of available options.

Given its dependence on climate-sensitive sectors as agriculture and forestry, India is also vulnerable to climate change. Main sources for the increase in atmospheric carbon dioxide being energy consumption. The Government of India's policy on climate change has been broadly based on the principle that developed countries should show a demonstrable sincerity in initiating actions to address climate change and the developed world should transfer resources and technologies at favourable terms to the developing world. Energy efficiency and increased use of renewable energy are the two main measures that can greatly reduce emissions of green house gases. The interim approval criteria drawn up by the MoEF states that CDM should be oriented towards improving the quality of life of the very poor from environmental standpoint. Data requirements for proper planning and initiation include development of GHG inventories; vulnerability assessment and; identification of strategies, options and technologies to reduce GHG emissions. It is also required to develop adaptive capacity to combat the negative impacts of climate change and build institutional capacity on operationalising CDM.

Environmental management is changing from resistant compliance to sustainable business decision-making with greater public awareness and support from judiciary. The number of companies going in for ISO 14001 certification has also increased from a mere 1 in 1995 to 605 by the end of 2002. There is a need to bring in a change in mindsets towards judicious use of available resources. Government policies also need to shift from that of a watchdog to facilitator accompanied. This shall be have to be supplemented with better information availability in public domain, better tracking of operations and resource consumption, environmental accounting of operations and through introduction of market-based instruments that have a potential to provide cost-effective solutions to environmental problems and stimulate environment-friendly technological progress.

Based on their experience in India, the funding agencies recommend changing the mind-set of key business and government leaders with respect to environmental management. There is also a need to build awareness among the employees when dealing with environmental and occupational health and safety issues. Introducing management measures such as monitoring and reporting to sharpen management's awareness of environmental costs and benefits is also called for.

1. Introduction

1) Overview

India has been no exception to the worldwide phenomenon of environmental degradation resulting from rapid increase in population and economic development. The trends rather have been substantial and more prominent as compared to other developing economies. The economics of environmental pollution, depletion and degradation of resources has in fact been neglected as compared to the issues of growth and expansion.

The country has recorded encouraging achievements in the age-specific mortality rates, expectation of life at birth and aspects related to livelihood conditions like education, nutritional security and health. With the country's population having grown three-fold and the urban population itself quadrupling in four decades (1951-1991), the current infrastructure in most of the cases is not only over stretched but also inadequate.

The rapid expansion of cities has brought to the fore acute problems of transport congestion, atmospheric pollution and unwise water and waste management resulting in the degradation of the quality of life. The deterioration of environmental quality in Indian cities is but one aspect of the threat to the quality of life, the other perhaps more pertinent issue being that of the sustainability of growth itself. The much-needed impetus to industrial development has also resulted in huge residuals, having undesirable effects on the environment.

The study titled *Environmental Industry Project* aims to promote development of environmental industry in the Asia-Pacific Region. Looking at the current state of environmental industry development, the objective of the study is to:

1. establish the current status of environmental industry development;
2. identify major factors responsible for industry development, including government policies and contributions of multinational corporations (MNCs) and bilateral and multilateral donors;
3. analyse major constraints and issues facing the industry and;
4. recommend domestic and external policy measures to promote the industry development on the basis of their dynamic comparative advantages

2) Scope of the study

To define the scope of environmental issues for this study, comprehensive literature review has been done. Salient features of the different studies have been discussed briefly:

1) The *US Commercial Services Report* lists the following as major areas of investment in India's environmental industry: Water treatment, Biomedical waste, Industrial and Vehicular air pollution control, Recycling and sanitation, Environmental Management, Pollution testing and monitoring equipment/services, Clean and renewable energy equipment, Environmental consulting/engineering services.
    a) Water treatment- Market $1 billion, to grow at 14-15% for wastewater utilities and in highly water polluting sectors such as chemicals, petrochemicals, metal processing, ferrous and non-ferrous metals processing and food processing sectors.
    b) Biomedical waste- This sub-sector with an estimated market potential of approximately US $200 million sector is expected to double over the next three years.
    c) Industrial and vehicular air pollution control- Monitoring and testing technologies, expected to grow 15 percent annually owing to planned capacity additions in the thermal/liquid fuel/gas-based power sector, and retrofitting opportunities in the existing polluting industries like steel and petroleum refinery.

The report estimates the market for environmental business to be at US $3.2billion and forecasts an annual growth of around 15 percent.

2) The *Study on the Indian Environmental Scenario and Market* [1] by the Indo German Chamber of Commerce in Feb 2001, identifies the following areas as the most promising business opportunities in the environmental goods and services sector:
    a) Air pollution control (removal of gaseous and particulate emissions from air using process and prevention technologies)
    b) Water and wastewater treatment (includes technologies to purify drinking water, clean sewage, and remove pollutants from industrial wastewater)
    c) Waste management (collection, disposal, recycling, and treatment of domestic wastes, industrial wastes and hazardous wastes)

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[1] Indo German Chamber of Commerce, February 2001

d) Contaminated land remediation (assessment and cleaning up of contaminated land)
e) Energy management (systems and technologies to make efficient use of both conventional and renewable energy)
f) Environmental monitoring (physical monitoring of environmental standards using instruments and analytical services)
g) Environmental services (consultancy and laboratory)
h) Noise and vibration control
i) Marine pollution control

3) MMCs report on *Opportunities for British Companies in the Indian Environmental sector*[2] prepared in 1998 quotes "the changing attitudes of India's large companies offer endless possibilities in practically all industries". It also estimates that market for clean up technologies shall be of the tune of US$7billion by 2010. These opportunities lie in the following sectors:
   a) Power sector
   b) Renewable Energy
   c) Water treatment
   d) Land degradation
   e) Solid waste disposal
   f) Medical waste disposal
   g) Cleaner paper production
   h) Environmental Management Systems
   i) Other areas including Aquaculture, Tourism and environmental damage, Health and Environment

4) The ADB in its study pointed that an estimated $1.1 billion of ongoing projects in India are being funded by various multilateral and bilateral donor agencies in sectors including forestry, river pollution control, institutional strengthening and capacity building, urban and rural infrastructure (sanitation and water supply), energy improvement, water resources/drainage.

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[2] Prepared by MMC, India for The Department of Trade and Industry, Overseas Trade Services, England

5) An analysis of the sector-wise distribution of external assistance in India since 1989 has also been done by CII[3] (Table 1). This also reflects a major funding focus on urban management problems including urban infrastructure, industrial pollution and resource management.

Table 1 Sector-wise distribution of external assistance in India

Sector	**Amount in million USD**
Agriculture and Natural Resources	4529.42(45%)
Industry and Energy	1660.99(16%)
Urban Infrastructure	2747.43(27%)
General	765.36(8%)
Global issues	454.29(4%)

6) The key potential business opportunities in environmental consulting services in India as identified by *US Department of Commerce* are as Table 2[4].

Table 2 Key business opportunities in India

Opportunity	**Details**	**Growth prospects**
Pollution Prevention Studies	Covering environmental audit, waste minimisation and pollution prevention, especially in small and medium enterprises	Estimated market as in 1997 at US$ 15million and anticipated growth rate of 15% over next three years
Environmental Impact Assessment, Emergency plans , Safety audits	Prior environmental clearance mandatory for 29 project categories both for existing as well as new projects	Estimated market size of US$ 30million as in 1998 and projected to grow at 16-20% over next three years
Environmental	Increase in number of companies	Estimated market for EMS

[3] Compendium of Donor-assisted Projects in the Environmental Sector in India, May 2002, compiled by CII for the WB

[4] Unofficial estimates and extrapolations from the 1994 figures published in the Environmental Business Opportunities in India, Jan 1996, CII

Management Systems	going in for ISO 14001 certification. However, small and medium enterprises have not viewed EMS as a priority area.	consultancy in 1997 was approx. US$ 5million with an annual growth rate of 10-15%
Environmental Policy, Regulatory studies and Training	Translating the Environmental Action Plan into actual work through policy research, new regulations and enforcement strategies	Estimated market as in 1997 at US$ 5million and anticipated growth rate of 15% over next three years
Consultancy services for Biomedical and Hazardous waste management	Limited technical expertise available for treatment of hazardous wastes	Estimated market at about US$ 50million

Besides this the Indian market for process control, instrumentation, monitoring, testing and analytical equipment for pollution control amounted to US$ 72 million in 1996 and is expected to grow at an average annual growth rate of about 15-20%. The major constituents of the market and their respective shares are:

a) Process control equipment and instrumentation for
   i. Air/Gaseous pollution: 25%
   ii. Water pollution: 20%
b) Environmental measurement/monitoring systems:12%
c) Testing and Analysis equipment: 15%
d) Process control and Instrumentation systems: 28%

3) Contents of the study

Based on review of these studies, the current study proposes to cover the following environmental concerns that have emerged in the country:

1) Air
2) Water
3) Solid waste
4) GHG and Climate change
5) Environmental Management

The study also presents in Chapter 6 two interesting case studies on experience of funding agencies in the country.

4) Structure of the study

The subsequent chapters on the listed environmental concerns provide:

1) An *overview*[5] to the issue
2) Highlight *Government policy measures & initiatives*[3]
3) Highlight the *critical issues* facing the sector, also covering *Policy gaps* and *Knowledge/Information/Data gaps*
4) *Experiences* from/of different projects and/or funding agencies
5) *Potential business opportunities* in the sector and
6) *Recommendations*

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[5] Various studies at TERI: DISHA (Directions, Innovations and Strategies for Harnessing Action for Sustainable Development , TERI 2001) and State of Environment: India, UNEP 2001

2. Air

1) Overview

The rise in number of vehicles together with greater industrial expansion and inadequate enforcement has combined to produce unacceptably high levels of pollution. High SPM levels have been observed in most of the Indian cities, while some of them also recorded high levels of SO_2 and NO_x. The following summarise air pollution scenario in the country:

1) The number of motor vehicles in the country has increased from 0.3 million in 1951 to 37.2 million in 1997 with the two wheeler population increasing from 9% in 1951 to 69% in 1997 and share of buses declining from 11% to 1.3% during the same period. Of these vehicles, 32% were estimated to be concentrated in 23 metropolitan cities, with Delhi accounting for 8% of the total vehicles.
2) Road based passenger transport has recorded high growth from an estimated 44.8 billion passenger kilometres in 1951 to 2515 billion passenger kilometres in 1996. Consumption of gasoline and HSD (high speed diesel) has also increased by about 14-15% between 1980-81 to 1996-97.
3) Rapid strides in industrialisation have got India a place in the list of ten most industrialised nations in the world. Power generation in the country has also multiplied 55times over last 50 years to 93.3 thousand MW in 2000. Of this, the thermal power constitutes to about 74% of power generated.
4) Domestic pollution resulting from the use of different types of fuels like coal, fuelwood and other biomass fuels is estimated to contribute 7-8% of the total pollution load in the country's capital, Delhi.

2) Government policy measures and initiatives

The Government of India has formulated legislations, policies and programmes for control of air pollution. Brief details of these efforts are as discussed:

1) The Air (Prevention and Control of Pollution) Act, 1981
2) The Environment (Protection) Act, 1986
3) AAQ standards for SPM, RSPM, SO_2, NO_x, CO and Lead have been laid down for industrial, residential and sensitive areas. Emission standards have been prescribed for various pollutants from different industries. Stringent vehicular emission norms along

with fuel quality specifications have been laid down in 1996 and 2000. Euro I norms are applicable since 1 April 2000 and Euro II will be applicable wef 1 April 2005.

4) Environmental Impact Assessment (EIA) has been made mandatory for 29 kinds of project activities. Industries are required to submit an annual environmental statement to the respective state pollution control boards providing information on the activities undertaken, pollution caused and resources consumed.
5) Guidelines exist on siting of industries so as to benefit from the natural self-cleansing capacities of receptor media. District wise zoning atlas has also been prepared in order to guide industrial siting.
6) Status of pollution control as on 30June 2000 shows that of the 1551 industries, 1324 have provided necessary pollution control facilities, 165 have been closed and other 62 are on defaulter list. However, the small-scale sector which accounts for more than 40% of the country's total industrial output generally lacks adequate pollution control measures.
7) The Ministry of Environment and Forests (MoEF) has also undertaken carrying capacity studies for some areas in the country.
8) Various clean production and pollution prevention technologies are being developed to reduce waste generation and emission of pollutants. Beneficiated/blended coal use with ash content less than 34% has been made mandatory in ecologically sensitive areas.
9) Action plans for pollution control are being prepared and implemented in the identified problem areas and involve the concerned agencies/industries. Epidemiological studies have also been initiated in seven critically polluted areas[6].

3) Critical issues

1) Vehicular Pollution

Increase in population, urbanisation and per capita income has led to a rapid growth of about 10% in the number of vehicles as listed in Table 1.1. The trends clearly indicate a considerable decline in the share of public transport in India. Among the major reasons is the inability of public transport system to keep pace with the increasing demand and the deteriorating quality of service. Other reasons include age of the vehicle fleet, technology they run on, fuel quality, poor access to alternative fuels, inadequate traffic planning lead to

[6] Vapi(Gujarat), Angul-Talcher(Orissa), Chembur(Mumbai), Cochin(Kerala), Kanpur(Uttar Pradesh), Mandi-Gobindgarh(Punjab) and Najafgarh Drain basin(Delhi)

emissions of carcinogenic benzene, oxides of sulphur and nitrogen and fine particulate matter. Emission levels from vehicles are estimated to grow at an annual rate of 5%.

Table1.1[7]: Growth in number of vehicles over years

Category	*1975*	*1980*	*1985*	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*
Two-wheelers	946	2,117	5,179	12,611	14,200	15,661	17,183	18,899	20,831	23,252	25,729	28,642	31,328	33,913
Cars, jeeps, and taxis	766	1,059	1,607	2,694	2,954	3,205	3,361	3,569	3,841	4,204	4,672	5,138	5,556	6,042
Buses	114	140	223	298	331	358	364	392	423	449	484	538	540	559
Goods vehicles	335	473	822	1,238	1,356	1,514	1,603	1,691	1,794	2,031	2,343	2,536	2,554	2,681
Others[b]	311	732	1,339	2,311	2,533	2,769	2,994	3,109	3,406	3,850	4,104	4,514	4,897	5,198
All vehicles	2,472	4,521	9,170	19,152	21,374	23,507	25,505	27,660	30,295	33,786	37,332	41,368	44,875	48,393

[a] includes omnibuses
[b] include tractors, trailers, three-wheelers (passenger and goods vehicles and other miscellaneous vehicles which are not separately classified)

2) Pollution from domestic and commercial sectors

Burning of unprocessed biomass for cooking in traditional inefficient devices contributes majorly to indoor air pollution. Such emissions are particularly toxic because of the poor availability of dilution air indoors resulting serious health problems from prolonged exposure to pollutants. Emissions from traditional fuels in the residential sector are estimated to decline though the levels shall remain a cause of concern.

3) Industrial Pollution

Despite that the number of air polluting industries in the country have reduced drastically, high potential still exists in bettering the energy use efficiencies. As the demand for energy increases, pollution from power generation shall remain a concern.

Studies estimate the energy saving potential to be in the tune of about 25% to 50% in the small-scale industries. Comparison of the specific energy use in select Indian industries as

[7] Motor Transport Statistics of India, Ministry of Surface Transport, 2000, New Delhi

against other developed countries, as Table 1.2, highlights this potential. Small-scale industries are another area of concern because of the poor penetration of clean technologies and end of pipe treatment in different clusters of the country.

Table 1.2[8] Comparison of specific energy use (million kcal/tonne) in selected industries

Country	Steel	Cement	Pulp and paper
India	9.50	2.00	11.13
UK	6.07	1.30	7.62
USA		0.95	9.70
Japan	4.18	1.20	-
Sweden	5.02	1.40	7.56

4) Policy gaps

1) Over reliance on command and control type of environmental management has worked to a limited extent, particularly in the small-scale industries (SSIs). This prevention-based approach needs to be strengthened by policy initiatives that promote clean technology approaches and better land use planning.
2) Lack of tools to assess effectiveness and impact of various policy measures.
3) Separate transport policies do not exist at state and national levels.
4) Lack of well-defined policy to promote private sector participation in public transport.
5) Lack of co-ordination between various agencies to improve transport services.
6) The Indoor Air Pollution issues have not been integrated into the health, energy, infrastructure and rural development programmes.
7) Mechanisms and incentives (like subsidies) to deliver better energy services are misdirected towards more affluent urban households and commercial sectors.

[8] Ministry of Science and Technology 1993

5) Knowledge/Information/Data gaps

1) Monitoring at hotspots like traffic intersections and other sensitive areas needs to be strengthened by increasing the number of stations, frequency and scope of monitoring. The results of analysis need to be linked with policy and infrastructural changes. There is not much of Private/Community participation in monitoring activities.
2) The existing information base on emission loads, emission factors, vehicles on road, traffic flow volumes, specific resource consumption in the industry and emissions per unit output calls for further strengthening so as to evaluate success of policy and technology.
3) Information base is also poor on source apportionment; epidemiological aspects of different pollutants; success of programmes and subsidies for improved and efficient stoves, better kitchen design and; effectiveness of different fuels.

Box 1: Case study on Small-scale cast iron foundries in India

The case study describes a technological upgrading initiative undertaken by TERI to improve the energy efficiency and environmental performance of small-scale foundries have very low energy efficiency and poor environmental performance. Upgrading the technology used in the melting plant lowers energy consumption, which in turn lowers the operating cost and also the emissions of pollutants at source. The reduction of pollution at source reduces the size of the pollution control system necessary to meet the statutory emission standards. Until recently, most of the foundries had conventional cupolas. The divided blast cupola offers an attractive option to reduce coke consumption at a modest investment. When the regulatory authorities enforced the emission standards, most small-scale foundry units found it extremely difficult to comply with the law primarily due to lack of availability of any ready-made gas cleaning system. Hence, a suitable flue gas cleaning system along with a divided blast cupola was designed to provide a viable solution to the small-scale foundries.

A full-scale demonstration plant consisting of the energy-efficient divided blast cupola and a high-efficiency venturi-scrubber for improving the energy and environment performance was set up by TERI at a small-scale foundry unit in Howrah. The plant, which is operating continuously since September 1998, has drastically reduced its coke consumption and emissions of suspended particulate matter and sulphur dioxide. Adoption of the demonstrated technology by foundries planning to modernise or expand their operations is a win–win option–a reduction of pollution load and also energy saving in melting operation.

Conventional cupolas consume more coke and release large amounts of suspended particulate matter and sulphur dioxide in the absence of any pollution control device. The new technology aims at reducing pollution at source through optimisation of the design and operational parameters of the melting furnace and reduction of stack emission by an appropriately designed pollution control system. To maintain a tighter control on the raw material and fuel input, the feed materials are charged into the cupola by a mechanical charging system. The exhaust gases are cleaned using a properly designed venturi- scrubber to meet the more stringent emission standards before discharge to the atmosphere. The critical components of the pollution control system are made of stainless steel to avoid corrosive wear and ensure several years of trouble-free operation.

The new design reduced coke consumption by 35% and emissions of both particulate matter and sulphur dioxide by as much as 90%, bringing the emissions well below the permissible limits. More specifically, the emissions of particulate matter came down from 1500-2500 milligrams per normal cubic metre to only 55-70 and of sulphur dioxide from 600 to 30 whereas the upper limits (for cupolas more than or equal to 3 tonnes per hour) are 150 and 300 milligrams per normal cubic metre respectively.

6) Experiences

The constraints in renewable energy sector is good case study to be looked at. Although the cost of generation of small hydro at about Rs 1.43 per kilowatt-hour is highly competitive with conventional technologies, some renewable energy technologies, such as solar photo voltaic (SPV), are far less economically attractive than conventional technologies. Even if the cost declines by 50% the SPV cost would remain incompetitive compared with that of other renewables and conventional technologies, notwithstanding the low variable costs associated with SPV technology. Other factors that constrain the use of renewable energy technologies are as follows:

1) Technological

a) Most renewable energy technologies have not achieved maturity within the country, and a large portion is imported.
b) Renewable energy sources are site-specific, and the supply may not be continuous.
c) Technical information is not easily available either for the entrepreneur or the consumer.

2) Institutional

a) A top-down centralised approach is generally adopted for this potentially highly decentralised option.
b) Little encouragement has been received from the state electricity boards.
c) There is a lack of awareness about the potential environmental benefits.
d) There is a lack of serious education and training for operation and upkeep.
e) Incentives are misused; they are related to investment rather than to performance of plants.

3) Financial and economic

a) Diesel and electricity are subsidised for use by agriculture and residential consumers.
b) Funds allocated to renewable energy sector are minimal when compared with fossil fuel and nuclear energy options.
c) In some cases, large initial investments are required.

4) Infrastructural

a) The land requirement for renewable energies could be very high.
b) Poor grid availability proves to be a major deterrent.
c) There is a lack of proper maintenance and servicing facilities at the local level.

A number of options to address the constraints exist, some of which are already at various stages of implementation:

1) collection of information; dissemination and training campaigns;
2) reorienting of the investment portfolios of power utilities to develop decentralised power options and encouragement for the utilities to ensure grid connection to private developers;
3) formulation of a policy for power purchase;
4) promotion of the financing of economically viable renewable energy technologies by developing and introducing innovative financing schemes, such as lines of credit, revolving funds, and hire-purchase plans, to the conventional loan schemes and;
5) formulation of government policy and legal and regulatory frameworks that encourage private sector participation.

7) Potential business opportunities

1) Systems for reducing levels of NO_x, SO_2 like burners, catalytic converter and technology for control of NO_x /HC/SO_2 from large stationery diesel engine
2) Noise pollution controls for equipment like compressor, pressure reducing valves etc.
3) Technology for coal washing, clean coal, fugitive emission control
4) Technologies for air pollution control and heat recovery systems in small-scale industry like foundries etc. Package scrubbing systems for small and medium scale units
5) Better combustion technology and emission control technology in vehicles like smoke traps for Diesel vehicles. Electric vehicles and alternate fuels for surface transportation. R&D thrust areas identified by the Ministry for support in the field of renewable energy are detailed below:
6) Use of Biomass for briquetting, co-generation and power generation
7) Production of gaseous fuels like producer gas, methane etc and their application in rural applications

8) Solar Energy applications like Development of Photovoltaics and other materials and improvement in solar cell/system efficiencies for Solar ponds, solar energy assessment studies.
9) Electricity generation using wind electric generators
10) Tools for building energy conservation
11) Techno-economic feasibility studies and market surveys in the areas of hydrogen and geo-thermal energy
12) Monitoring Hydrocarbon-analyser instruments both portable and continuous, on-line stack monitoring, continuous ambient air monitoring, continuous gaseous emission monitors
13) Special pollutant removal systems like fluoride removal in phosphatic fertiliser, particulate emission in control in urea prilling tower, bagasse fired boilers and small scale flue gas desulfurisation system

8) Recommendations

1) Power sector

a) Reforming and restructuring the power sector by fixing fuel prices at realistic levels: While most coal prices have been deregulated, power station grades of domestic coal are still priced below the cost of production and the true value of better grades is underestimated. Cleaner imported fuels are priced too high in comparison with domestic coal.
b) Rehabilitating power generation plants and T & D Networks
Investment needs to be made to rehabilitate transmission and distribution (T&D) networks, better the power factor, check pilferage and thefts so as to bring down the energy losses which are in the tune of 21%.
c) Energy use is currently less efficient and less cost-effective than the best available technology would allow. There is a need to manage and model energy demand by implementing policies that reduce energy consumption. Demand-side management programs could reduce total system costs and hence pollutant emissions.
d) The Ministry of Non-Conventional Energy Sources has estimated that 126 GWs of power generation capacity is available from renewable energy sources in long term. Although there is a high technical potential, the prospects for expansion in short term are limited owing to different restraints.

e) Significant benefits in pollution control shall result from improved implementation of existing standards and working through market mechanisms. It is necessary to have a suitable legislative and regulatory framework for administering the MBIs and checking the different barriers to effective implementation.

f) Clean coal technologies[9] do improve combustion efficiency and reduce SPM and SO_2 emissions to the environment. Similarly, coal washing prior to its burning needs to be practised at a larger scale.

g) The National Thermal Power Corporation's experience suggests that the use of fly ash can be encouraged by changes in plant policy. Most plants, however, do not appear motivated to pursue these policies. The current problems of ash disposal and management could in part be corrected through stronger enforcement of present environmental standards.

h) Construction of new coal-fired plants will be needed to meet future demands, it is therefore important to consider the environmental impacts attributable to plant location. Relative disadvantages and advantages of two-types of power plant sites need to be considered: locate the plant at a load center (that is, in an area where a high population of power users is concentrated) or at the pit-head (in a sparsely populated area).

i) Other reforms include:

   i. Getting the price of electricity right so as to send the correct signals to consumers to encourage them to invest in energy saving practices and technologies.

   ii. Getting the price of fuels right to "create a more level playing field" for natural gas and renewable energy sources

   iii. Increasing the commercial motivation of utilities to give them the incentives to make choices that benefit the environment, such as improving ash management and rehabilitating transmission and distribution systems

   iv. Increasing the funds available to utilities so as to make improvements by raising tariffs.

2) Reducing emissions from vehicles

a) Improved vehicle technology and fuel quality

Reducing vehicular emissions calls for interventions to improve both vehicle technology and fuel quality. This should be done gradually in phases by introducing

[9] Though there is only a marginal reduction in ash and CO.

cleaner technologies to allow the automobile and oil industries to make the required investments. Policy initiatives are required for in-use vehicles as well because the turnover rate of vehicles in India is low. The strategies for making in-use vehicles less polluting would revolve around mandating stricter emission standards coupled with better enforcement so that all vehicles go for periodic certifications.

b) Improved traffic flow

One major reason that improvements in vehicle technology and fuel quality have not resulted in reduction in emissions is the poor traffic flow resulting from a relatively high share of non-motorised modes on a common right of way. Improvements in traffic flow can be achieved through better traffic engineering and improved traffic management.

c) Controlling the number of vehicles on the road

The number of vehicles on the road can be achieved by measures such as an increased use of mass transit through extending its coverage, reducing waiting time and travel time, making the services more reliable, co-ordinating transfers and making available park-and-ride facilities. There is a need to introduce disincentives for use of private vehicles like increasing parking charges, surcharge on motor vehicles and fuels and fuel rationing.

d) Alternative fuels and vehicle technologies

A number of automobile technologies and alternative fuels like CNG, LPG are now available in the market. In addition, a number of such zero-emission vehicles as solar-powered vehicles and those powered by fuel cells are in the development stage. However, information on these alternative technologies is limited and needs to be explored and disseminated.

3) Interventions to reduce indoor air pollution

a) Improved ventilation

Modifying existing kitchens and designing the new rural housing units in a better way to ensure better ventilation can mitigate indoor air pollution. In this context, it is important to promote awareness of the dangers related to indoor air pollution so that people may try to adopt ways of minimising exposure through better kitchen management and infant protection.

b) Improved stoves

Improved stoves are comparatively eco-friendly as they burn less fuel and produce less smoke. Their design with provision of chimneys helps in better ventilation. User participation and improved design for higher efficiency and longer life will make these not-so-expensive stoves more popular.

c) Cleaner fuels

Use of cleaner fuels and processed biomass fuels comprise effective long-term interventions for reducing indoor air pollution. A faster transition from solid fuels to cleaner liquid or gaseous fuels requires appropriate policy interventions like checking misdirected subsidies on kerosene. Steps should therefore be taken to increase the availability of LPG and kerosene to meet the demand for cooking.

d) Dissemination and Replication of success case stories

There is a need to replicate success stories wherein IAP issues have been integrated with other projects and programmes on agriculture, forestry, nutrition, family planning and promotion of women's welfare. Government intervention shall be required in designing finance schemes that combine housing finance with improved kitchen/stove design

4) Other directions and strategies

a) Urban planning with focus on the environment

The only way to relieve highly polluted cities of the huge additional burden and pressures is to 'de-concentrate' the cities by relocating the population, industries, and economic activities in different 'priority' towns in the hinterland. Regional development plans need to be developed and implemented that incorporate policies relating to population distribution, settlement system, transport and communications, physical and social infrastructure, regional land-use, environment and eco-development, management structure for plan implementation, and counter-magnet areas for development.

b) Planing tools for air quality management

Efforts to formulate an urban air quality management strategy require information on ambient air quality and data on the emissions of pollutants, models to predict the dispersion of these pollutants, and epidemiological studies that ascertain the health effects of different ambient pollutant concentrations. Emissions inventories are also useful for planning to identify the sources and estimating the quantities of pollutants. The inventories must be kept updated to evaluate the impacts of changes in the characteristics of emission sources and of the strategies to control air pollution on ambient air quality.

c) Air quality monitoring

The capability to monitor pollutants should be strengthened and data on air quality needs to be used to check compliance with standards; to inform the public; to trigger measures that reduce both emissions and; the public's exposure to them and to help policy-makers in formulating measures to control air pollution or to evaluate the measures that have already been implemented.

d) Epidemiological studies

Many air pollutants adversely affect people's respiratory and cardiovascular systems and, in some cases, cause premature death. An integrated study of air quality monitoring, exposure assessments, and epidemiological studies should be conducted to set more reliable air quality standards and suitable emission norms. Information on effects of certain pollutants is not available and needs to be generated and adequate mitigation strategies formulated. Air quality standards should be reviewed from time to time based on location specific carrying capacity.

e) Greater transparency

Greater transparency is needed in matters related to pollution control and sharing information with the public.

f) Increased public awareness

The most important element of strategies to mitigate air pollution shall be to bring a behavioural change by raising awareness amongst masses about health impacts of air pollutants and providing specific information on the range and effectiveness of mitigation options. This shall require facilitating involvement of all stakeholders, specifically women as part of the household energy programmes.

3. Water

1) Overview

India is considered rich in terms of annual rainfall and total water resources available at the national level, however the uneven distribution of the resource causes regional and temporal shortages. India's average annual rainfall equivalent of about 4000 billion cubic metres (BCM) is unevenly distributed both spatially as well as temporally. Annual per capita utilisable resource availability in the country also varies from 18,417 cubic metres in the Brahmaputra valley to as low as 180 cum in the Sabarmati basin (Chitale, 1992). Levels of precipitation vary from 100 mm annually in western Rajasthan to over 9 000 mm in the north-eastern state of Meghalaya (Engleman and Roy, 1993). With 75% of the rainfall occurring over the four monsoon months and the other 1000 BCM spread over the remaining eight months. The following provide an overview on the water scenario in India:

1) The per capita availability of renewable freshwater resources in India fell from 6000 cubic metres in 1947 to about 2300 cubic metres in 1997.
2) Groundwater is being increasingly overexploited; surface water is being used either inadequately or inefficiently and; the traditional water-harvesting mechanisms have also declined.
3) Sewage generation in urban centres has increased six-fold to 30 billion-litres/day between 1947-1997. Of this, only 10% is treated.
4) The average value of the total coliform count in Indian rivers rose steeply between 1979 and 1991. Groundwater aquifers in isolated pockets have also been contaminated with pollutants.

2) Government Policy measures and initiatives

Water has been included in India's Constitution as Entry 17 of the state list. The current institutional arrangement for managing the water resources in India involves various government agencies[10]. Major policies and legislations guiding the management of water resources and its quality and initiatives taken have been discussed.

[10] Central Pollution Control Board, Central Water Commission; State Pollution Control Boards; Central Ground Water Board, Ministry of Agriculture, Ministry of Power, Ministry of Urban Development, Ministry of Rural Development, Ministry of Environment and Forests, Municipal Authorities

1) The Government of India formulated the National Water Policy in 1987 and 2002. This accords top priority to drinking water supply in the allocation of water resources for various beneficial uses. The policy also addresses issues like need for well-developed information system for better resource planning, maximising water availability, planning of water resource development projects, financial and physical sustainability of projects, participatory approach, private sector participation, water quality, water zoning, water conservation, flood and drought management, performance improvement.
2) The government explicitly enacted the *Water (Prevention and Control of Pollution) Act, 1974* under which it formed the Central Pollution Control Board (CPCB) and the State Pollution Control Boards (SPCBs) for implementation. The Water Act empowers the state pollution control boards to lay down and maintain location and source specific standards for discharge of wastewater.
3) *The Environment Protection Act, 1986* is an umbrella act providing for the protection and improvement of environment and for matters connected therewith. It authorises the central government to intervene directly in order to protect the environment and also allows public interest litigation for the same purpose.
4) The government has also introduced, as a supplementary measure, major economic incentives for pollution abatement, besides the 'command and control' regulatory mechanism. The *Water Cess Act,* introduced in 1977, empowers the SPCBs to levy a cess on local authorities supplying water to consumers and on consumption of water for certain specified activities. The Act also provides for a rebate on the cess payable if the local authority or industry concerned installs a plant to treat sewage or trade effluent. To encourage conservation and reduced discharge of wastewater, the cess rates were increased three fold in February 1992. A rebate of 25% on the cess payable has been provided to those industries whose wastewater discharge does not exceed the quantity declared by them and the quality of discharge complies with the prescribed effluent standards.
5) Under the 1994 EIA notification, an *Environmental Impact Assessment* (EIA) has been made mandatory for 30 categories of development activities involving investments of more than Rs 500 million and above and environmental clearance for activities is given by the MoEF.
6) Under the *National River Action Plan (NRAP),* stretches of major rivers with high or intermediate levels of pollution were identified by the CPCB. Sewage collection and treatment works have/are being created to reduce the pollution load to these rivers

through schemes for better sewage interception and diversion, construction of STPs, provisions for low cost sanitation and other schemes. In the first phase, as the GAP (Ganga action plan), 29 towns were selected along the river and 261 schemes of pollution abatement sanctioned. At present 156 towns are being considered under the NRAP, out of which about 74 towns are located on river Ganga, 21 on river Yamuna, 12 on Damodar, 6 on Godavari, 9 on Cauvery, 4 each on Tungbhadra and Satlej, 3 each on Subarnrekha, Betwa, Wainganga, Brahmini, Chambal, Gomti, 2 on Krishna and one each on Sabarmati, Khan, Kshipra, Narmada, and Mahanadi (MoEF 1999).

7) To focus on the urban lakes subjected to anthropogenic pressures, the *National Lake Conservation Plan (NLCP), 1993* was prepared. Bhoj Lake of Madhya Pradesh is already getting assistance under funds provided by OECF, Japan.
8) Under the World Bank aided Industrial Pollution Control project there is a provision of loan and grant assistance to proposals for construction of Common Effluent Treatment Plants (CETP) in clusters of small-scale industries.
9) The Central Ground Water Board (CGWB) constituted the Central Ground Water Authority (CGWA) for regulating the development and management of groundwater resources. To this end it has notified and banned fresh bores in areas affected by groundwater depletion. The Authority is also promoting rainwater harvesting and artificial recharge and has circulated guidelines for implementing artificial recharge projects
10) The CPCB is monitoring water quality of national aquatic resources in collaboration with the concerned state pollution control boards (SPCBs) at 507 locations. The Central Water Commission (CWC) also has a network to measure flow and monitor water quality at about 369 field stations. The CGWB monitors groundwater quality at 15355 locations. In an effort to assess the health of a water body, the CPCB has also initiated a bio-monitoring project under the Indo-Dutch Collaboration Programme on Environment and selected 215 locations for the introduction of bio-monitoring based on the interpretation of physico-chemical data at different locations.

3) Critical issues

1) Resource demand and Sectoral pressures

The rapid increase in the country’s population, from about 343 million at the time of Independence to over 1 000 million in 2000, accompanied by growth of agriculture, rapid urbanisation, economic growth and improved access to basic services has resulted in an increase in the demand for water.

a) The agricultural sector accounts for over 95% of the total water consumption. The sector enjoys subsidised or free supply of power and water resulting in over-exploitation and inefficient use of water in the sector. Degradation of land, soil and water has resulted from unbalanced and excessive use of chemical fertilisers and pesticides.
b) The domestic sector accounts for approximately 4% of the total water consumption. With only 70%of the population in Class-I cities[11] having access to basic sanitation services and wastewater treatment efficiency at about 30%, huge proportion of untreated sewage finds its way into water bodies, making the water unfit for all useful purposes.
c) The manufacturing sector accounts for a mere 0.3% of the total water demand but industrial wastewater generation has increased from about 70 million litres a day in 1947 to 3000 million litres a day in 1997. About 45% of the total pollutant load generated in the industry is derived from the processing of industrial chemicals.
d) Water in the power sector is required for both steam generation and disposal of fly ash. High ash content (of the tune of about 40%) in Indian coal requires a high percentage of water is required for wet collection besides leading to contamination of groundwater on account of percolation of hazardous elements from the ash ponds.

Current requirement levels of 629 BCM (approximately agriculture: 95%; domestic: 4%; industry and power: 1%) against the availability of 1122 BCM indicate an overall surplus at the national level. However spatial and temporal variations in availability give rise to shortages in some regions like the Western plains. Under the BAU scenario, the country's total water requirement is projected to grow to 1060 BCM by the year 2047. Such widening gap between demand and supply shall lead to over exploitation of surface and groundwater resources and also threaten the quality of available water sources because of inadequate provisions for the treatment of wastewater.

2) Inequitable access to basic services

Huge disparities exist in the provision of basic services with only:

a) 77 of the 299 Class-I cities have 100% piped water supply coverage
b) 203 of the 345 Class-II towns have low per capita supply of less than 100 lpcd

[11] Those with a population of 100 000 or more

c) Per capita water supply ranges from as low as 9 lpcd in Tuticorin to as high as 584 lpcd in Triuvannamalai
d) Underprivileged have poor access to basic services

Besides the inequitable distribution of basic services, the quality of services is not upto the acceptable levels.

3) Ground water depletion

Shortages in water supply for domestic and industrial consumption, is resulting in over-exploitation of groundwater beyond its recharge capacity. The share of groundwater in net irrigated areas has also increased considerably from a third in 1965/66 to over half at present. Groundwater overdraft beyond recharge capacity is posing serious threats, in the form of a long term decline in water levels, with associated adverse consequences such as land subsidence, deterioration of water quality in aquifers, and ingress of saline water in coastal aquifers.

4) Resource quality

Indian rivers have witnessed a considerable degradation in their water quality, not only because domestic wastewater is collected inadequately and treated inefficiently in Class-I cities but also because highly complex waste from industries is discharged into water bodies. Indicators of this deterioration include depletion of oxygen, excessive presence of pathogens, settling of suspended material when the flow is lean, and bad odour. Groundwater sources too, are undergoing severe degradation due to chemical contamination, mainly from fertilisers, industrial waste, and municipal solid waste as well as biological contamination, particularly in the form of human waste in dug wells. The current degraded state of major Indian rivers is beyond its self-cleansing capacity.

5) Inefficiency in resource use/management

Government policies have provided little incentive to encourage efficient use of water. High percentage of evapotranspiration losses , excessive distribution losses of treated water in municipal water supply systems, high seepage losses in irrigation and water losses in agriculture due to water over application and low levels of Industrial output per unit of water withdrawal highlight poor resource usage practices. Inefficiencies also persist at the service providers end–in the form of overstaffing, high administrative costs, and time and cost overruns in the execution of projects.

6) Pricing policies

Water tariff structure varies from state to state, it being a state subject. Typically, water rates for agriculture and domestic use do not cover even the O&M expenses, let alone capital costs. In the irrigation and urban sectors, the percentage recovery of working expenses through gross receipts in recent years is only about 10% and 30%, respectively. The subsidy regime has on the one hand encouraged inefficient use of the resource and on the other, led to poor financial health of the sector, resulting in poor services and user dissatisfaction.

7) Institutional set-up and legal framework

In the current institutional set-up involving various government agencies, there is a separation of responsibilities on the basis of water quality and quantity. As many as eight agencies are involved in collecting the water related data as quality of surface water, ground water quality, monitoring of drinking water quality, sanitation and drinking water supply. With a number of organisations involved in water management, there is a duplication and ambiguity of functions. Implementation of environmental laws in general remains weak, mainly on account of inadequate financial resources and capacity of the pollution control boards.

4) Policy gaps

1) The current fragmentary approach, both at the central and state levels, results in duplication and ambiguity of functions and discourages unitary analysis of this scarce resource. Water being a state subject, the states are empowered to enact laws or frame policies related to water. Even then, only some of the states have set up organisations for planning and allocating water for various purposes. The existing monitoring network of different agencies also needs to be used optimally.
2) A proper legal framework for regulating withdrawals of groundwater is not in place. Though efforts have been made to check the overexploitation of groundwater through licensing, credit or electricity restrictions, these restrictions are directed only at the creation of wells. Even the licenses do not monitor or regulate the quantum of water extracted.
3) Water cess in industries, though is potentially an effective instrument for inducing abatement, the rates of raw water are so low that the rebate has not served as much of an incentive so far. Market based instruments to encourage resource conservation mainly in the agriculture and domestic sector have not been tried much.
4) It was realised during the later stages of implementation of the Ganga Action Plan, that the local authorities are not able to operate and maintain these assets due to inadequate resources and skills with them. The level of commitment required from the state agencies was also missing. The pollution was also from a number of diffused sources either urban or rural.

5) Knowledge/Information/Data gaps

1) Water quality monitoring by CPCB is presently being done at 507 locations, as against 77 stations in 1977. Reporting is done in terms of maximum, minimum and mean value of the parameter and the percentage violations for select parameters. However, specific information is not available for water quality in these water bodies for seasons with lean flow. The frequency of monitoring and number of monitoring stations also is not representative of the quality of water body specifically in the non-monsoon period.
2) Information on availability of groundwater and its quality is limited. Though groundwater availability maps have been prepared for certain locations, extraction rates have not been defined.

3) Much of information- quantitative as well as qualitative on water supplied, coverage of population, quality of service and sanitation both in the urban and rural areas is not available. Besides information gaps on water consumption and effluent discharge patterns for industries also exist.

6) Experiences

1) World Bank

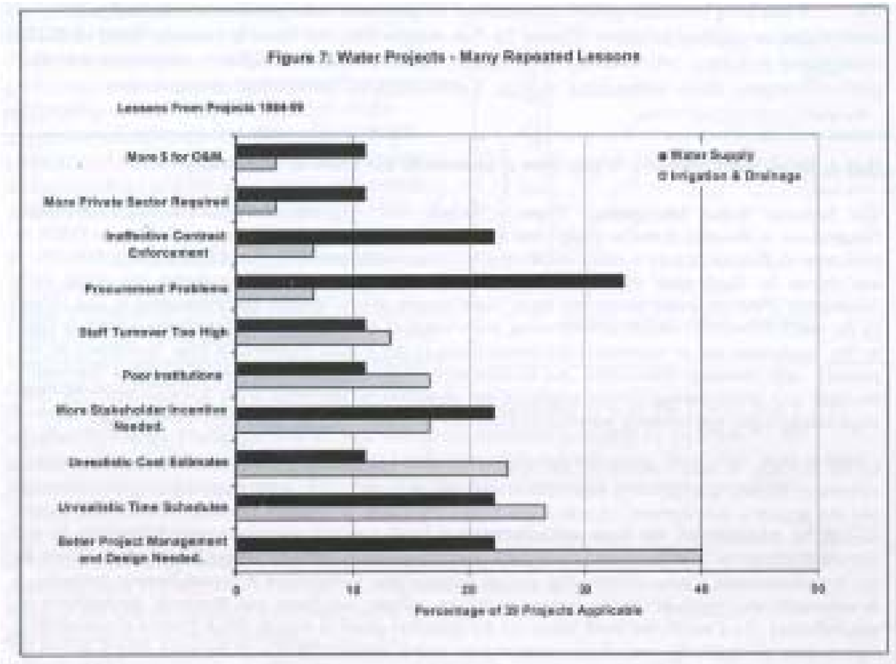
Of the World Bank's total lending in 1995-98 for the water sector, 16.9% of the lending was focussed in India. Foreign investment in irrigation by WB in India is 72%. The World Bank evaluated its water strategy in India with objectives like:

a) Whether the Bank implemented its strategy in India
b) How it implemented the strategy
c) Whether that implementation was relevant to the country context and the Banks assistance strategy
d) The degree to which the implementation was effective in meeting the country's needs and policy goals and
e) Whether the policy remains relevant

The study highlighted that water as a resource was under stress with institutional and organisational problems, too many actors and little of the policy dialogue reaching the multiplicity of water management institutions. From the national perspective, there is little transparency and community participation is negligible. Looking at how the Bank performed in India:

a) Satisfactory project outcomes have been declining, projects have become less sustainable, their institutional impact has diminished and the Bank's own performance at appraisal and supervision has deteriorated.
b) A closer look at the performance subsectors in India shows that Hydro and Rural Water Supply Schemes had the poorest performance on outcomes with none of the projects performing satisfactorily.
c) Bank projects have not met the test of efficacy- the power to produce effect i.e. sustainable institutions, water management and reforms.

The figure below summarises the project-related problems based on lessons from projects funded between 1984-99.



The findings conclude:

a) Focus has to be on the underlying organisational and institutional issues rather than fiscal reforms
b) Focus should change from supply to demand management
c) Current water sector operations have moved away from new construction and are focussing on making existing infrastructure work efficiently
d) Pay more attention to political will and commitment as political economy is at the root of many problems
e) Serious monitoring and evaluation of projects implemented required

2) JBIC

JBIC’s ODA program in India was launched in 1958, India being the first country to receive ODA loans. Japan .is the largest bilateral donor country to India since 1986 and JBIC funded projects in over 13 states and across all sectors. The most prominent include – Delhi Metro, Afforestation in five states, Ajanta Ellora Conservation, Lake Bhopal conservation, Bangalore Water & Sewerage.

The Yamuna Action Plan (YAP) comprised following components in 15 towns spread over Delhi, Haryana & UP:

a) Sewerage component: Interception & Drainage works, pumping stations, treatment plants, etc.
b) Non-sewerage component : community toilets, crematoria, bathing ghats, afforestation, etc
c) Public Participation & Awareness component : rallies, street play, radio spots, hoardings, film shows, painting competition / eco-club for school children etc

The shortcomings & challenges as identified for future programs include:

a) Systematic analysis of inventory of pollution load to identify source-wise & town-wise contributors to pollution; prioritise & phase-out investments
b) YAP has mainly addressed pollution from domestic sewage. Future programs may need to look at other components like solid waste, industrial waste, slum improvement, etc.
c) Consultation & involvement of Urban Local Bodies right from planning stage is required for Sewerage component
d) Participatory approach is required for planning & construction of community assets (non-sewerage component)
e) A multi-pronged municipal reform needs to be initiated in YAP towns to build municipal capacity for ensuring sustainable O & M

3) UNICEF

India's water and sanitation program, strongly supported by UNICEF for nearly three decades has provided not only services but also long term training and technical support. The program has encouraged technological innovation and international experience while at the same time strengthening input from the community and local private sector. The Water and Environmental Sanitation (WES) program in India yields following lessons that could be useful:

a) External agencies have greater freedom than the government to test new approaches
b) It is crucial to develop technologies suited to local conditions, especially where water is scarce. Local realities must be taken into consideration in implementing policies made by the central government.
c) A balance must be maintained between technology and the social and behavioural aspects of water and environmental sanitation services

d) Gender and poverty need attention when the program is planned, implemented and monitored
e) Cost data are needed for comprehensive and effective analyses
f) Health, Education, Nutrition, Water and Environmental Sanitation have to be linked
g) Going to scale too quick has adverse repercussions
h) Long term commitment and partnerships produce results
i) Partnerships can maximise results, but they must be closely co-ordinated and mutually advantageous for each participant

Box 2 highlights technical operational problems in running of CETPs and STPs based on performance evaluation studies.

Box 2: Operational problems of CETPs & STPs

Performance evaluation exercises have been carried out for CETPs and STPs and suggest the following:

Plants usually require concerted efforts for optimising the performance as characteristics of treated effluent in general exceed prescribed norms, at times leading to high content of BOD, COD and heavy metals.

- The CETP management should stress on good maintenance of primary treatment provision at member units and also optimise the effluent conveyance to CETP. A rational distribution of member units is also required.
- Infrastructural facilities to analyse and keep a strict watch on various critical parameters like MLSS, VSS, DO besides conventional parameters like BOD, COD in treatment system are required at CETP itself.
- Excessive use of cow dung should be discouraged, as this material being rich in cellulose has a deleterious effect on population of aerobic bacteria.
- The conveyance system from member units to the plants should have adequate counter measures to check the possible inflow of surface run-off, especially during monsoons.
- Adequate arrangements should be made for at the site storage of hazardous sludge waste from treatment and for its final disposal.
- Performance of pre treatment units at the individual discharging units need serious efforts to ensure better and uniform quality of influent waste.
- Down time repairs of the equipment s should be observed regularly to avoid shut down. Besides possibilities should be explored to run the plant partially so as to improve the quality of effluent discharged in cases of plant shut down.

7) Potential business opportunities

1) Reverse Osmosis for removal of dissolved organics in brackish water and saline water for conversion of drinking water in coastal areas where fresh water is scarce and TDS removal systems like Membrane technology

2) BOD and COD removal systems: Low energy anaerobic biological systems, physico-chemical systems e.g. adsorption, advanced biological reactors, chemical oxidation, ozonation and ultrafiltration
3) Special Pollutant removal like Nitrification/Denitrification removal systems for high Ammonia wastewater, removal and recovery of heavy metals
4) Treatability studies
5) Ground water analysis
6) Process industries like paints, dyes, paper, tannery, in-house small scale electroplating industry
7) Combined industrial effluent treatment plant

8) Recommendations

1) River basin approach

Instead of the present approach wherein water-related matters are restricted to political boundaries only, water management efforts should be at a river basin or sub-basin level. This would ensure that aspects such as water allocation, pollution control, protection of water resources, and mobilisation of financial resources are not dealt in an isolation and decisions for the overall development process and land-use planning flow from this.

2) Increasing resource availability

The need is to develop surface irrigation sources and take measures for rainwater harvesting and preventing water run-offs. With the rivers of the country carrying about 80% of the flow during the monsoon months of June-September and generally in excess of 90% during the period of June-November, the run-off can be tapped by building appropriate water harvesting structures in the lower reaches to trap the water. Inter basin water transfer is another option to be considered and evaluated.

3) Plug weaknesses in the current policy and legal framework

State-specific water policies need to be prepared for all issues concerning a state. Various individual development projects and proposals, water allocation priorities and guidelines for resource management need to be area-specific and formulated by the states within the framework of such an overall plan. It is important to assess the effectiveness of the various legislative acts and work out measures that improve their applicability and outcomes.

Incentives under the Water Cess Act, for instance, have to be made more attractive to make the industries undertake pollution control measures.

4) Pricing of the resource

Poorly targeted subsidies send wrong signals to the users causing wasteful use of resources and suboptimal choices by consumers. Appropriate tariff structure for water services will encourage wise usage of the resource and generate additional support for the fund-starved service providers as well.

5) Resource conservation

Along with the measures towards pollution abatement it is imperative to further intensify efforts for conservation of water to prevent overexploitation of scarcely available resource and reduce the quantity of wastewater generated. There is a need to develop and implement cost-effective water appliances such as low-flow cisterns and faucets and formulate citizen forum groups to encourage and raise awareness on water conservation. Efforts have to be made to introduce and implement the Zero discharge concepts, which would enhance recycle and reuse of effluent discharge.

6) Resource degradation

In order to enhance effective treatment of wastewater, there is a need for better collection and interception of sewage. Application of many low-cost and effective technologies for wastewater treatment, e.g. UASB, duckweed ponds, and horizontal filters have been to a limited extent. There is a need to explore the advantages associated with these in terms of the negligible amount of energy required, beneficial uses of by-products (sludge as manure and biogas), lower operation and maintenance costs, etc. Adoption of cleaner technologies by the industry would go a long way in safeguarding the quality scarce resources.

7) Plugging information gaps

Baseline information on quantity as well as quality needs to be collected for water supply and sanitation both in the urban and rural areas and then used for formulating strategies and prioritising the action plan. Exercises like performance measurement of the service provider, specifically in the urban areas need to be undertaken to benchmark operational efficiencies related to water treatment and distribution. Water Zoning Atlas needs to be developed to guide decisions related to siting of industries and other economic activities.

8) Community management

Community management is the key to successful overall performance of the water sector and pollution control. It has been amply demonstrated that projects with community inputs are more successful in terms of reaching the greatest number of affected people with long lasting services. Other benefits include lower costs, greater acceptance of the technology, and better maintenance of the facilities by the users.

4. Solid Waste

1) Overview

Increasing urbanisation and changes in lifestyles have led to quantum increase in the solid waste generated in the country from 6 million tonnes in 1947 to 48 million tonnes in 1997. Collection of waste, its transportation and disposal are posing tremendous environmental challenge to planners, engineers and policy managers as shall be evident from the following:

1) More than one-fourth of the municipal solid waste is not collected at all, and the landfills to dispose of the waste are either poorly equipped or managed inefficiently
2) The production and consumption of plastic has itself increased more than 70 times between 1960 and 1995
3) During the last 30 years, there has been a significant growth in industrial sectors such as pesticides, drugs and pharmaceuticals, textiles, dyes, fertilisers, tanneries, paint, chloralkali etc which have a major potential for generation of hazardous waste.
4) Directorate General of Health Services has estimated total infectious biomedical waste generated from different states of India at 54 404 tonnes per annum as on 1 January 1993 [12]. Of this, about 85% of the waste is non-infectious, 10% infectious but non-hazardous and 5% hazardous as per a WHO study. Owing to a lack of awareness on bio medical waste management, most of the waste is getting disposed at MSW dumpsites.

Different studies have been done in Indian cities to assess per capita MSW generation and its typical characteristics. Per capita waste generation is estimated to be around 450gms/day and 250 gms/day in Class I and Class II cities respectively. Table 3.1 highlights the physico-chemical characteristics of MSW in Indian conditions.

[12] Manual on Hospital Waste Management, Central Pollution Control Board, Delhi

Table 3.1[13] Physico-chemical characteristics of MSW

Component	% of wet weight 1971-73 [a] (40 cities)	1995 [b] (23 cities)
Paper	4.14	5.78
Plastics	0.69	3.90
Metals	0.50	1.90
Glass	0.40	2.10
Rags	3.83	3.50
Ash and fine earth	49.20	40.30
Total compostable matter	41.24	41.80
Calorific value (kcal/kg)	800-1100	<1500
Carbon-nitrogen ratio	20-30	25-40

[a] Bhide and Sundaresan 1983; [b] EPTRI 1995

Hazardous waste generation in the country is around 7.2 million tonnes of which it is estimated that 1.4 million tonnes is recyclable, 0.1 million tonnes is incinerable and 5.2 million tonnes is destined for disposal on land[14] (MoEF 2000). Of the 323 hazardous waste recycling units in India, 303 units use indigenous raw material and 20 depend on imported recyclable wastes which mainly includes battery scrap, lead and zinc dross, ash, skimmings and residues and galvanised zinc. Table 3.1 highlights the sources and quantum of waste generated from major industrial sources.

Table 3.2 Sources and quantum of waste generated from major industrial sources

Waste	Quantities MTPA 1990	Quantities MTPA 1999	Source/origin
Steel and blast furnace slag	35.0	7.5	Conversion of pig iron to steel and manufacture of iron

[13] Solid Waste Management in Developing Countries, Bhide A D and Sundaresan B B. 1983, Indian National Scientific Documentation Centre, New Delhi

[14] Draft on Status of Implementation of the Hazardous Waste Rules, Ministry of Environment and Forests, 2000

Brine mud	0.02	-	Caustic soda industry
Copper slag	0.02	-	By-product from smelting of copper
Fly ash	30.0	58.0	Coal based thermal power plants
Kiln dust	1.6	-	Cement plants
Lime sludge	3.0	4.8	Sugar, paper, fertiliser, tanneries, soda ash, calcium carbide
Phosphogypsum	4.5	11.0	Phosphoric acid plant, ammonium phosphate
Red mud/bauxite	3.0	4.0-4.5	Mining and extraction of alumina from bauxite
Lime stone	-	50.0	-
Iron tailings	-	11.25	-
Total	77.14	147.05	

Source. National Waste Management Council - Ministry of Environment and Forests

2) Government policy measures & initiatives

1) Municipal solid wastes

The responsibility of dealing with MSW at the Central Government level lies with the Ministry of Urban Development and Poverty Alleviation. The other ministries involved are MoEF and MNES (Ministry of Non-conventional Energy Sources). The responsibilities of waste management at local level however lie with the urban local bodies (ULBs) which ensure collection, transportation and disposal of waste.

a) The MoEF, GoI has issued the Municipal Solid Wastes (Management and Handling) Rules 2000. These rules identify CPCB as agency that will monitor the implementation of these rules and municipalities will be required to submit annual reports regarding municipal waste management in their areas to the CPCB.
b) MoEF has also notified Bio-Medical Waste (Management and Handling) Rules in 1998 for management of biomedical waste.
c) National Waste Management Council has also been constituted in 1990 and is presently engaged in survey of 22 municipalities to estimate the quantity of recyclable waste and its fate during waste collection, transportation and disposal.
d) A national plastic waste management task force has also been set up to suggest measures to minimise the adverse environmental and health impacts arising out of plastic recycling.
e) The MNES offers various fiscal and financial incentives for energy recovery from wastes.

2) Industrial and hazardous waste

The MoEF, Government of India is the nodal agency at the central level for planning, promoting and co-ordinating environmental programmes, apart from policy formulation. However, executive responsibilities for industrial pollution prevention, and control, are primarily executed by the CPCB at the central level. At the state level, execution is mainly handled by the SPCBs. The Hazardous Waste Management (HWM) Rules, 1989 provide for control of generation, collection, treatment, transport, import, storage and disposal of wastes. Besides these rules, the MoEF has also issued Guidelines for Management and Handling of Hazardous Wastes in 1991 that also includes mechanisms for the development of a reporting system for the movement of hazardous waste etc.

As part of other initiatives, state governments are in the process of identifying hazardous waste disposal sites based on EIA of the potential sites. It has been decided to impose ban on import of hazardous wastes containing beryllium, selenium, chromium (hexavalent), thallium, pesticides, herbicides and their intermediates/residues based on recommendations by an Expert Committee. Similarly cyanide wastes and mercury- and arsenic-bearing wastes have been prohibited for export and import from December 1996 in order to control movement of Basel Wastes.

The Honourable Supreme Court has ordered the closure/shifting of non-conforming industrial units using hazardous processes and hazardous chemicals from Delhi region. In addition, SC has ordered closure of 200 tanneries in Tamil Nadu, and 35 foundries in Bengal.

3) Critical issues

1) Inadequacies in solid waste management (SWM) system

Inefficient collection efficiencies of 50-90% in major metros and about 50% in smaller cities; inadequate transportation facilities in more than 70% of the cities and; inadequate disposal highlight the need to make service delivery more efficient and accountable. SWM in fact constitutes 30-50 percent of the total municipal staff and the expenditure on these services is between 20-50%[15]. Lack of adequate financial resources is cited as the most common reason

[15] Upgrading municipal services: norms and financial implications, 1989, National Institute of Urban Affairs, New Delhi

for a municipal body's non-performance, there being no tax recovery to provide/ run the related services. Private sector participation (PSP) in SWM has not been very far reaching because of weak government policies.

The country has 116 hazardous waste incinerators and 11 engineered landfills in operation but all of them are located in Gujarat. Though 74 sites have been identified in other states to set up disposal facilities, only 14 of these have been notified. In absence of adequate number of treatment and disposal facilities, the industries continue to store the hazardous waste in their premises in improperly designed storages or dispose the waste illegally at abandoned sites.

In absence of proper segregation of waste at source, waste treatment alternatives like recycling, waste-to-energy projects and/or composting become uneconomical to operate. Most of infectious biomedical waste, though segregated at the generation point, gets disposed at municipal waste dumpsites. This is because of the absence of dedicated waste disposal facilities for biomedical waste generators.

2) Emerging trends in waste generation and its impacts
Studies at TERI point that the total waste generated in 2047 will exceed 260 million tonnes more than five times the present level. With technical difficulties in treating and disposing this waste scientifically, cumulative land requirement for waste disposal will increase to about 1385 square kilometres by 2047 as against the current requirement of nearly 10 square kilometres. The landfill gas, which is 50% to 60% methane, contributes significantly to global warming and is estimated to increase from the current 7 million tonnes to 39 million tonnes by 2047 under a BAU scenario.

4) Policy gaps

1) The HWM rules promulgated by the MoEF in the year 2000 fail to provide any incentive for waste reduction/minimisation efforts. Industries are therefore reluctant to adopt such measures.
2) In absence of standards for clean up of the sites contaminated earlier and limits for disposal of waste on land, the errant industries are not legally bound to clean the site unless ordered by judicial intervention.

3) Rules for the management of municipal waste and biomedical waste management do not clearly identify the role and responsibilities to be undertaken by the CPCB and SPCBs.
4) Enforcement on part of the regulatory agencies has been feeble partly due to inadequate infrastructure including staff in different SPCBs assigned for hazardous waste management in the state.

5) Knowledge/Information/Data gaps

1) Hazardous waste inventory carried out by various States is usually a one-time exercise. But with the industrial growth being very dynamic, there is a need to constantly update the waste inventories and design appropriate waste management strategies.
2) There has been less work to explore the risks and health impacts of hazardous waste disposal on surrounding ecosystem and communities.
3) Although some attempts have been made at the city level to identify and quantify municipal waste and biomedical waste, there are no state/nation-wide waste inventories available in both the cases.

6) Experiences

A lot of debate has been going on the potential of waste to energy projects in India. The proposed options include generating power from waste or converting it to fuel pellets. There has been some support from government agencies like MNES, MoEF and different ULBs for such projects but without much of success. Some of the experts quote their opinion as *solving a problem by burning it and hiding the ash under the carpet*. The associated reasons include:

1) Calorific value of the Indian waste ranges between 800-1050 kilocalories per kilogram as against a desired level of about 1500 kilocalories per kilogram for energy generation. To make the waste more fit for processing and producing power, it is usually recommended to add fuel to the waste that implies an additional incurring cost.
2) Cost of power generation through incineration is estimated to be between Rs 8-12 crore per MW to process 100-150 tons of waste per day which is 4-5 times as compared to the traditional thermal power plants. Similarly fuel pellet plants cost about Rs 2.33 crore to handle same amount of waste as against a compost plant that requires about Rs 1-1.5 crores. These economics raise the basic question of investing taxpayer money in such unproven technologies without undertaking any pilot scale studies.

3) Health effects of these burn technologies also ask for a mindful approach to address the problem of waste disposal. The Indian culture of disposing unsegregated waste poses health hazards resulting from carcinogenic dioxins, furans and heavy metals like arsenic, lead, cadmium and mercury.

Some of the notable cases that need to be looked at include:

1) Timarpur Incinerator

Timarpur in Delhi was the first MSW power plant project with incineration technology. Jointly funded by the Danish government and MNES in 1989/90, the plant was designed to use 300 tons of waste per day and produce 3.5 MW power. Put into trial operation in March 1987, and operated for 8–10 hours per day during this shake-out phase, the plant was reported to be running without commercial viability, probably due to some design problem and was therefore finally closed. The most serious cause was that the waste that was available for the plant was very different in composition: being inert and with moisture and energy content different than test results. This resulted in a waste stream with a density of 500–1,000 kg/m3, which is far above the design parameters. The energy content of the old Delhi waste was only 2,559 kJ/kg (1,100 BTU/lb), much less than originally planned.

2) Other waste to energy projects

A ray of hope came from the private investors/promoters who offered to take up the waste-to-energy projects with their own investment on BOO basis during 1993/94. As per proposals agreed to, the municipal corporation was expected to provide land and garbage free of cost while the promoter would run the plant commercially. Only a few agreements appear to have been converted into real projects. The status of projects in India is as follows:

a) An MSW project with 500 TPD capacity has been installed at Hyderabad Municipal Corporation by Selco International Ltd wherein the waste is converted into energy-rich fuel pellets. The energy plant installed with the help of the MNES and the APTDC (Andhra Pradesh Technology Development & Promotion Centre) is expected to expand further to treat 1500 TPD of waste to produce 20 MW power.
b) Nagpur Municipal Corporation signed an agreement with ENBEE Infrastructure Limited, Bhopal, for installation of a 500 TPD, 4 MW waste-to-power project using biogas technology with foreign collaboration. The construction work started at the site after the project received the sanction of subsidy from the MNES and loan from IREDA (Indian

Renew-able Energy Development Agency Ltd) and HUDCO (Housing and Urban Development Corporation Ltd).

The other municipal corporations who are in the process of signing agreements with private promoters are in cities of Mumbai – 1000 TPD (10 MW); Pune – 450 TPD (4 MW); Solapur 300 TPD(3 MW); and Kalyan – 600 TPD (6 MW).

3) Anaerobic digestion projects

In India, the focus has been mainly on the creation of large, centralized community-scale digesters, which provide gas for lighting and cooking for a number of households and community centers, power for machines such as flour mills, and electricity to community buildings and for individual households. Most of the Indian community-scale anaerobic digesters operate on a mix of human night soil and cattle manure, are quite labor-intensive, and deliver the resulting biogas via pipeline to nearby households, small businesses, and community centers. Recurring problems that confront community-scale systems include the labour intensive work of ensuring a steady supply of manure to the plant and the issue of long-term operation and maintenance of the system.

4) Emerging PSP arrangements in solidwaste management (FIRE (D))[16]

Different kinds of PSP arrangements experimented by the ULBs in India include:

- Contracting for Vehicular fleet maintenance and repair, leasing vehicles
- Service contracts for waste collection and transportation
- Long term concessions on resource recovery projects
- Community contracting to complement service provision by the ULB

a) The Chennai Municipal Corporation privatised waste collection and transportation in three of its zones that represents about 35% of the total area and manages 1000 tons of waste per day. The private operator selected for the assignment is responsible for sweeping, collection, storage and transportation of the waste and for creating public awareness. The rate fixed for the first year was Rs 648 per ton, which is much lower than the Corporations own estimated cost of Rs 1050 per ton.

b) The Kolhapur Municipal Corporation(KMC) conceptualised a BOOT solid waste composting project under which the Corporation provides 4 hectares of land on a long

[16] www.dec.org

term lease to the private operator for a facility that handles 160 tons of waste per day. The responsibility of supply of waste lies with KMC.

5) Landfill projects

A German Technical Co-operation Project (GTZ) for assisting Karnataka State in development of Hazardous Waste Management Infrastructure has been initiated in 1995 at an estimated cost of DM 3 million for creation of hazardous waste disposal facility and DM 3 million for technical co-operation. In this project, the work completed include hazardous waste inventory, status of existing disposal system, and evaluation of waste disposal alternatives with focus on incineration and landfilling. The study has recommended setting up one single centralised landfill and development of one cement kiln in the state to incinerator status.

Box 3: Naroda Industries Association

Established in the year 1967 is the first of the industrial estates in the country. Located in the north-eastern part of Ahmedabad, the estate has an area of 357 Hectare and 689 plots. The estate has 554 industries representing thirty-one different industrial sectors (primarily chemical, plastic and ceramic and pottery units). The industries are predominantly small and medium scale in nature, in terms of initial investments. Several multinational corporations are also represented in the estate. A few large industrial houses of India are also present. The total turnover of goods manufactured amounts to nearly US$ 300 Million per annum. The goods are by and large sold overseas.

The first comprehensive exercise at the estate level of organization was carried out during the years 1998-2000. The principles of eco-industrial networking (EIN) were employed in interpreting the diversity of production systems, related waste streams and opportunities for value addition. The exercise was carried out under the guidance of the University of Kaiserslautern, Department of Economics & Economic policy (Dr. Martin Z. Wilderer & Prof. Dr. Michael Von Hauft) and with significant leadership inputs from Shri Rayjibhai Patel (Former President of NIA). Nineteen waste streams, from more than 450 firms, were identified and classified based on their commercial. Waste exchange and resource optimisation in production were proposed mainly for the biologically degradable waste component. Other significant waste streams included spent acid, gypsum, iron sludge, boiler ash and ceramic wastes. Further work is in progress on defining the quantitative and qualitative correlates between production systems and waste generation in order to identify at-source reduction and value addition options. This project has laid the foundation for sectoral analyses and reinforced the process of examining gaps in infrastructure and ambient monitoring programmes.

The waste to energy initiative is the first important output based on the EIN project. One ton of biologically degradable waste every day will serve as the energy source at the biogas plant located in the premises of the NEPL. This is the first of its kind in India wherein biologically degradable wastes of industrial origin are used for generation of biogas. The source of the wastes includes industries engaged in food and agro processing. 85 cu-m of gas per day is expected to be generated from the anaerobic digestion process and will be used to generate 13KW of power everyday to illuminate the NEPL premises at night. Additionally the slurry generated will be useful as manure. Two important cleaner production demonstration projects at NIE provided substantial impetus for dissemination of the concepts of waste minimization, cleaner production & significant process enhancement.

The vision of this effort is to work for Integrated industrial production and environmental protection at the individual firm level and the collective estate level. The endeavor recognises the need for Capacity building, development of an enabling action framework and implementation schedule integrating cleaner production and other preventive environmental management approaches towards synergising industrial production and environmental protection initiatives.

7) Potential business opportunities in solid waste management

Design and execution of comprehensive solid waste handling, treatment technologies and disposal systems:

1) Waste to energy technologies like exploring potential of waste incineration for power generation
2) Technologies for resource recovery from wastes
3) Aerobic/Anaerobic, Bio-filtration/oxidation technologies or other treatment technologies for municipal solid wastes; Biomethanation of semi-solid organic residues.
4) Technologies / pollution control equipment for sludge treatment
5) Waste pre-treatment, incineration or other appropriate technologies for waste disposal in a scientific manner
6) Appropriate technologies to improve industrial waste management practice particularly for fly ash, blast furnace slag, lime slag, phosphogypsum and red mud in the country
7) Incineration / pyrolysis technologies for pesticides petroleum, paints and chemical industry
8) Stabilisation of hazardous waste Hazardous waste treatment technologies for cyanide waste, zinc wastes, lead, copper wastes, phenolic waste and tarry wastes and land fill management
9) Hospital waste assessment and management including Design, operation and maintenance of hazardous / hospital care waste disposal systems
10) Production of solid, liquid or gaseous fuels (producer gases, methane etc.) from municipal, urban and industrial biomass wastes and organic effluents as replacements for petroleum fuels (LPG) etc

Other promising areas of environmental consultancy include soil remediation studies, technology evaluation of different available technologies and developing models for private public partnerships.

8) Recommendations

Satisfactory, efficient and sustainable solid waste management system shall require proper planning, implementation and management systems to be incorporated in the national policy for solid waste management. The present and future ways to manage solid waste need consideration of the following aspects:

1) Setting targets for waste reduction by introducing collection and disposal fees and tax incentives, better implementation of the mandatory standards and regulation and creating awareness on voluntary compliance with policies by business and consumers.
2) Technological interventions that need urgent consideration include waste collection and waste treatment and disposal. Waste collection can be improvised through provision of community waste bins at convenient followed by the separation of waste at source into biodegradable and non-biodegradable components. Infectious waste from health care facilities and industrial waste should be transported strictly in separate covered vehicles. Treatment and disposal should follow suggested segregation practices to generate better options for scientific disposal of waste.
3) Setting up decentralised waste treatment facilities (composting, vermi-composting, and anaerobic digestion) throughout the country and demonstration of their viability through pilot-scale projects and their replication on a mass scale.
4) Institutional and regulatory reforms in ULBs: To upgrade the existing infrastructure and improve efficiency of the ULBs, the government has to generate and provide additional resources. Staffing plans need to be worked out for better utilisation of available manpower.

   Additional support has to be mustered from the private sector. To attract PSP, ULBs need to generate more financial resources by introducing user charges. Private sector involvement in door-to-door waste collection can improve better collection as well as financial performance.

   ULBs also need to build their own capacity so as to better monitor private sector operations and own functions, since the overall responsibility of ensuring proper service delivery and standard compliance has to remain with the ULB. Solid waste management should be assigned to a separate cell, preferably headed by an engineer and proper staffing pattern for planning, design, specification of technical systems; performance monitoring and; rationalisation of operations. Developing policy guidance for user charges, cost recovery mechanisms and ULB institutional changes
5) Developing solid waste management plans on a regular basis, both at macro and micro levels: Non-governmental organisations and community resident welfare associations (RWAs) need to be proactive in organising programmes to build awareness and environmental consciousness. Such programmes will need technical know-how and

regular information on best waste management practices and techniques from research and academic institutions in addition to financial support from the local or state governments. Bilateral and multilateral agencies should support such capacity-building initiatives if funds are inadequate.

6) Private sector can play an important role along with NGOs in waste management at the micro level. With the technical and managerial capabilities and the much-required capital support of the private sector for decentralised collection and treatment, the targets for waste minimisation and scientific management can be effectively achieved and enforced. The government needs to provide fiscal incentives to promote private sector participation.

5. Green House Gases and Climate Change
1) Overview

India, given its dependence on climate-sensitive sectors as agriculture and forestry and low technical and financial adaptive capacity, is vulnerable to climate change. Climate models indicate that India's climate could become warmer (Lonergan 1998) and heavy rainfall events are likely to be more frequent in South and South-East Asia (IPCC 1998).

Main sources for the increase in atmospheric carbon dioxide is energy consumption from the combustion of fossil fuels, some industrial processes (e.g. cement manufacture), and the changing land-use patterns. Methane emissions come from livestock, animal waste, coal-bed releases, production and transport of oil and gas, wet cultivation of rice, burning biomass, and landfills and other human waste. Sources of oxides of nitrogen are fertilizer, combustion of fossil fuel, and manufacture of nylon.

Emissions from different countries vary considerably in terms of absolute and per capita amounts (Table 4.1). Although India figures among the top ten contributors to GHG emissions, its per capita emissions is only one-thirteenth of the OECD average, estimated to be 0.86 tonne of carbon dioxide per annum in 1995. Impacts of climate change on different sectors is as discussed:

1) Agriculture

Kumar and Parikh (1998) estimate a loss of 9% to 25% in farm revenue for a temperature rise of 2–3.5 °C. Agriculture in the coastal regions of Gujarat, Maharashtra, and Karnataka is likely to be affected the most, whereas West Bengal, Orissa, and Andhra Pradesh stand to benefit to a small extent (Sanghi et al. 1998).

2) Forests

Increased temperature and rainfall will increase the productivity of tropical forests in India but for teak plantations in moist deciduous forests, higher temperatures will reduce soil moisture, resulting in a decline in productivity (Achanta and Kanetkar 1996).

3) Coastal areas

India with a low-lying, densely populated, and fertile coastline, is among the 27 countries identified as vulnerable to a rise in sea level (UNEP 1998). Coastal infrastructure, tourism, and other economic activities such as oil exploration are also at risk.

4) Health

Higher temperatures will increase the extent, incidence and distribution of diseases like malaria, dengue, bilharzia, leishmaniasis, and schistosomiasis—as it is, 70% of the epidemics in India relate to water-borne or water-related diseases. The additional impacts of climate change on the existing conditions could seriously exacerbate health problems (IPCC 1998).

5) Other impacts

Other direct impacts of higher temperatures include an increase in energy demand for space cooling and increased water demand for irrigation. Higher temperatures and increased seasonal variability of precipitation will affect snow-fed rivers accompanied by increases in peak flow, sediment yields, and run-off, which will have major impacts on hydropower generation, urban water supply, agriculture, and human settlements (IPCC 1998).

Table 4.1 Total and per capita emissions of CO2 from fossil fuel combustion and CO2 intensity (1995)

Region/ Country	**Total emissions (million tonnes)**	**Per capita emissions (tonnes)**	**Co_2 intensity (Kg Co_2/1990 US $ purchasing power parity)**
World	22150	3.92	0.75
Total OECD	11091	11.08	0.65
European Union	3180	8.55	0.51
US	5229	19.88	0.85
Japan	1151	9.17	0.46
Germany	884	10.83	0.63
China	3007	2.51	0.92
India	803	0.86	0.73
Brazil	288	1.81	0.33

2) Government Policy measures and initiatives

The Government of India's policy on climate change has been based on following three broad principles:

1) The primary responsibility of reducing GHG (greenhouse gas) emissions is that of developed countries and they should show a demonstrable sincerity in initiating actions to address climate change.
2) The development needs of developing countries are of prime importance.
3) The developed world should transfer resources and technologies at favourable terms to the developing world, thereby facilitating developing countries to move towards a sustainable development path.

In August 2002, the Government of India acceded to the Kyoto Protocol. The MoEF also made public interim criteria for the approval of CDM project activities. It endorsed eleven projects under CERUPT (the Certified Emission Reduction Unit Procurement Tender) of the Government of Netherlands, of which six were shortlisted.

1) 7.5 MW biomass power project in Maharashtra
2) Three 7.5 MW biomass power projects in Rajasthan
3) 15 MW wind-biomass project in Tamil Nadu
4) 14.45 MW wind power project in Tamil Nadu
5) 15 MW wind power project in Tamil Nadu
6) 15 MW wind power project in Karnataka

The Ministry of Non-conventional Energy Sources and the Ministry of Power are also encouraging the identification and development of CDM options. These have given positive signals to potential project developers.

Corporate and NGO initiatives

Research organisations and industry associations in the country are active in creating awareness about CDM opportunities. The last year has been marked by a discernible shift towards project development activities, particularly following the CERUPT call.

1) TERI has been involved with the CDM concept since its inception, and has been undertaking research related to the economic, political, and quantitative aspects of the mechanism, along with information dissemination and project development activities. It has analysed a range of CDM projects in the Indian power sector for the Ministry of

Power, and formulated baselines for key renewable energy projects in India for the MNES.

2) The thrust of Development Alternatives is social objectivity and utilisation of the traditional knowledge base with focus on renewable energy and applicability of projects in rural environmental settings.
3) CIIs Climate Change Centre works to spread awareness on climate change issues within the Indian industry; promote consensus on climate change mechanisms; build local capacity to develop climate change mitigation projects; facilitate dialogue between Indian and US businesses for collaborations on climate change mitigation projects.
4) FICCI, in collaboration with ICICI had initiated the Environmental Information Centre to promote and facilitate industry actions for environmental improvement and management; compile and disseminate information relevant to business on global climate change, energy efficiency, clean and climate friendly technologies, and other environmental issues.

Other organisations such as Winrock International India, the Infrastructure Development Finance Company (IDFC), and Indira Gandhi Institute of Development Research (IGIDR) are also working on this issue. While IGIDR focuses on academic research on CDM potential and modalities, Winrock and IDFC are more oriented towards project development activities. The Indian branches of international consulting and certification agencies such as Pricewaterhouse Coopers and Det Norske Veritas have also become active in this field.

3) Potential business opportunities

India is currently in the process of developing a detailed GHG inventory as part of its first National Communication to the UNFCCC. This inventory is being developed for the base year 1994 using country-specific emission factors, and will cover sectors like energy, industrial processes, agriculture, land use, land use change, forestry, and waste. So far, the most comprehensive national GHG inventory available is the one prepared under the GoI-endorsed ALGAS (Asia Least-cost Greenhouse gas Abatement Strategy) project (ADB 1999).

1) Sectoral mitigation options

The inventory as Table 4.2 shows that major increase in emissions over the next 20 years would be related to energy consumption in the economy. Energy efficiency and increasing use of renewable energy (or a move towards low carbon options) are the two main measures that can greatly reduce emissions of green house gases. Power generation has a great potential for mitigation. Transmission and distribution losses are the other major source of energy losses and, hence, emissions.

Options such as bagasse-based cogeneration, combined cycle plants and renewables are already profitable and generate fewer emissions per kilowatt-hour of electricity than conventional generation. Alternative low carbon fuel options to current energy sources are another major mitigation option. Small hydro-, wind- and biomass-based power provide significant abatement opportunities. Renewable sources are also a reliable energy option for irrigation.

Table 4.2 Sectoral emissions (Gg)

Sector	1989/90	1994/95	CAGR (%)
Power Generation	175126	262932.60	8.47
Industry	207878	261483.00	4.70
Transport	86226	103659	3.75
Residential	30256	35713	3.37
Commercial	6646	6912	0.79
Agriculture	1797	2756	8.92
Total	507,932	673,457	5.80

CAGR is *compounded annual growth rate*

Source: ADB-GEF-UNDP (1998)

Energy consumption in industrial processes is another area where substantial reductions can be achieved. These include bettering process efficiency and other demand-side management options. Typically, these options lead to an improvement in energy efficiency and resource conservation and introduce advanced technologies, thus laying the foundation for long-term sustainable development. Table 4.3 lists the carbon mitigation potential in power generation and industry.

Table 4.3 Carbon mitigation potential in power generation and industry*

	Size of mitigation opportunity	Investment potential (billion US$)	Expected carbon reduction (million tonnes per year)
Coal washing	5000-6000 MW	1.8	11
Fuel switching	3800 MW	3.1	4
Conventional efficiency	6500 MW	0.15	4
Integrated gasification combined cycle	1000 MW	10	5
Renewable energy	35000 MW annually	25	60
Conversion of mercury cell process to membrane cell process in caustic soda production	0.9 Mt of capacity	8.4	0.12
Upgradation from wet to dry process in cement production	45 Mt of capacity	4	1.1
Upgradation to Hall-Herault process in aluminium production	BALCO and INDAL plants	8.4	NA

Source: Raghuraman (2002)

*** Some of the listed options may not be relevant in the present day context**

2) Priority CDM projects

The interim approval criteria drawn up by the MoEF states that the CDM should be oriented towards improving the quality of life of the very poor from environmental standpoint. The Ministry has identified the following considerations in designing CDM project activities:

a) Social well-being: Alleviation of poverty by generating additional employment, removing social disparities, and contributing to the provision of basic amenities leading to improvement in their quality of life.
b) Economic well-being: Additional investment consistent with the needs of the people.
c) Environmental well-being: Assessing impact of the project activity on resource sustainability and resource degradation, if any; biodiversity-friendliness; impact on human health; reduction of levels of pollution in general.
d) Technological well-being: Transfer of environmentally safe and sound technologies with priority to the renewables sector or energy efficiency projects.

Table 4.4 lists the various energy efficiency options.

Table 4.4 Supply-side and demand-side energy sector options

Energy efficiency options		
Power sector	Industrial sector	Domestic sector
Combined cycle plants	Diesel cogeneration	Efficient refrigerators Efficient air
	Iron and steel Basic oxygen furnace Ultra-high-power electric arc furnace	Conditioners
Inter-cooled stream injected gas turbine (ISTIG)	Continuous casting Dry quenching route	Efficient lighting (including the commercial sector)
Pressurized fluidised bed combustion (PFBC)	Paper Continuous digesters in paper industry	
Pulverized coal super-critical boilers		
Industrial cogeneration	Caustic soda Membrane process	
Amorphous core transformers	Soda ash dual process and Akzo lime process Waste heat recovery High efficiency burners (low excess air) Heat pump High efficiency motors Efficient lighting	
Renewable energy options		
Power generation	Agriculture sector	Domestic sector
Biomass-fired power generation Solar (PV) photovoltaic power Solar thermal water heating Wind farms Small hydropower	PV water pumps Wind pumps Biomass gasifiers	Improved biomass Cookstoves Biogas plants Solar cookers PV home systems PV lanterns

4) Recommendations

India’s immediate national priorities are focused more on local environmental issues, there are several opportunities for India to further national development priorities through participation, collaboration and contribution to international agreements. Developments and agreements in the area of climate change may provide supplemental resources for mitigation of greenhouse gases and adapting to the impacts of climate change. For instance, in the long term, the allocation of emissions rights based on equity criteria will provide additional resources through the trade of surplus emissions allocation for developing countries.

1) Data requirements

Adequate and reliable information is the minimum basic requirement for proper planning and initiation of any positive action and to effectively combat climate change. Broadly, the data requirements include:

a) Development of GHG inventories
b) Information on the impacts of climate change
c) Assessment of the vulnerability of different socio-economic segments to these impacts
d) Identification of strategies to reduce vulnerability to climate change
e) Identification of options and technologies to reduce GHG emissions leading to a definition of a project portfolio for potential investors
f) Assessment of financial resources required to achieve mitigation of GHG emissions
g) Better the capacity to adapt to adverse impacts of climate change

National capacity has to be developed to address the following areas:

a) Identification of research needs for the country including identification of knowledge gaps on inventory building, impacts of climate change, and technology requirements.
b) Building awareness on the funding opportunities and potential mitigation options. It is also required to develop domestic institutional capacity on operationalising CDM.
c) Developing adaptive capacity to combat the negative impacts of climate change

The government needs to initiate and coordinate a programme to address the above capacity-building requirements and may also require making capacity-building plan so as to provide direction to existing institutions.

2) Short- and medium-term strategy

The potential to increase energy utilisation efficiency has not been exploited because of the scarce capital resources or subsidised energy prices. Steps are already under way to address the issue of subsidised energy prices. However, resources available under initiatives to mitigate GHGs can be used to meet the additional costs of environmentally sustainable technologies that shall assist in moving towards a clean energy path by improving the level of penetration of such technologies. The country strategy on CDM has to ensure that these resources are invested in appropriate projects that meet national priorities and also help in attracting additional resources by instituting transparent guidelines and procedures.

In order to address the national priorities, the appropriate ministries and departments should identify the technologies that require additional support and can be obtained under the CDM. Accurate identification of such technologies requires the government to either undertake or commission research and analysis of various alternatives available. In addition to initiatives required for any investment (e.g. streamlining of investment procedures), the government should prioritise the type of projects it is willing to consider as potential CDM projects and:

a) clearly define rules for exclusion or inclusion of certain types of projects as CDM proposals
b) clearly list transparent evaluation criteria to establish how a potential project meets these sustainable development conditions
c) provide easy access to information to facilitate the flow of resources by potential investors
d) identify and develop an institutional structure that assists in the evaluation, implementation, and monitoring of CDM projects.

3) Long-term strategy for mitigation

India should institute policies that provide incentives and direct different sectors to improve the performance standards of their processes, products, and services. Such policies include correcting market distortions and promoting efficient processes and devices. In addition to direct savings of energy and other resources, a higher level of efficiency will generate a greater surplus of emissions allocations for trading in the international market thereby providing additional financial resources for development.

This shall also require a system for allocation of responsibilities domestically. Part of the reduction could be achieved through macro policies such as taxes and providing incentives for early action to control GHG emissions. Mechanisms have to be built to facilitate development of national as well as international emissions trading system. Also, the government could consider instituting emissions trading market domestically for local pollutants prior to the commencement of an international trading regime. This will not only address the problem of local pollution but will also develop capacity for operating in an international environmental market and internalise the external cost of pollution.

4) Adaptation strategy

Assistance and resources for adaptation to climate change can be used to design and plan more efficient systems that reduce vulnerability not only to climate-change-induced impacts but also improve overall planning and development. For example, resources available for adaptation can be invested in designing, planning, and constructing an improved sanitation system that will reduce the probability of water-borne diseases. Likewise, constructing a more effective and efficient storm water drainage systems will prevent flooding in cities.

Generating awareness among the general public will equip people to better combat the negative impacts of climate change by building their adaptive capacity as well as face other environmental and developmental challenges on a firmer footing. Resources for adaptation and for reducing vulnerability could be used to design a better public health system, which will reduce the existing high level of exposure to diseases as well as reduce the vulnerability to higher probability of such diseases with a change in climate.

6. Environmental Management

1) Overview

The society's awareness of environmental issues and change in its expectations of business have shifted the trend from resistant compliance to sustainable business decision-making. Concern about the environment is rising, one tangible manifestation of this being the growing environmental activism. The number of environment and development-oriented NGOs in India has risen sharply in the last 10–15 years, from about 600 in the mid-1980s to about 12 000 by 1997. Supported by judicial activism, the frequency of public protests and public interest litigation has also risen. There has been a surge in the scope as well as stringency of environmental regulation alongwith a growth in regulations running form about 60 pages in the early 1970s to about 2900 pages today. The following provide an overview on the emerging trends in India:

1) The Government of India enactment the following environmental legislation in 1990s:
   a) The Public Liability Insurance Act (1991)
   b) The Environment Audit Notification (1992)
   c) National Environmental Tribunal Act (1995)
   d) Amendment to EIA Notification (1997)
   e) National Environment Appellate Authority Act (1997)
   f) Policy statement on the abatement of pollution (1992)
2) Judicial intervention related to environmental impact of industries has risen as seen from the:
   a) Ganga pollution case (1988) wherein the Supreme Court ordered some 350 units to close down; 5000 others in the Ganges basin were required to install ETPs
   b) Vellore case (1996) wherein 900 tanneries were issued closure notices
   c) Taj Trapezium ruling (1997): About 6300 small-scale industries and several large units including the Mathura Refinery were affected
   d) Supreme Court ruling on Delhi industries (1996) wherein 168 industries in Delhi were ordered to close and relocate and later 1560 more faced the same order
3) The number of companies going in for EMS ISO 14001 and getting them certified has also increased from 1 in Dec 1995 to 605 by the end of Dec 2002.

   India has however lagged in adopting other environmental management system approaches and introducing market-based instruments (MBIs) for pollution abatement in

India. Environmental policy in India has been dominated primarily by a command-and-control (CAC) regime even though MBIs for pollution control were introduced in India long back with the Water (Prevention and Control of Pollution) Cess Act, 1977. However, the purpose of this cess was not so much to control pollution as to generate revenue for the state pollution control boards. Moreover, the cess rate was so low that it neither generated sufficient revenue nor encouraged the efficient use of water.

2) Critical issues

1) Environmental policy in India has been primarily dominated by a command-and-control regime with the product, process and/or emission standards being the major instruments for management.
2) The Government's policy of control and protectionism over the years has infact resulted in myopic business decision-making and, in general, made entrepreneurs complacent to change.
3) Most Indian organisations have strong hierarchical and centralised decision structures that are dictated by habit and personal attitudes. These at times also lack depth and vision with focus only on parameters like production and costs and do not realise the significance of training, process control and quality.
4) There have been question marks on the quality of EIAs, EMS and environmental audits executed by poorly trained consultants and using poor quality data. Such efforts are usually guided by the sole objective of getting requisite approvals or certifications. Most of the times follow up on recommendations of these exercises like preparation and implementation of Environmental Management Plans (EMP) is also not carried defeating the purpose of carrying such studies.
5) Environmental performance of Indian corporates, particularly SMEs, is restricted to compliance aspects only with limited focus on resource-intensity, quality of discharges and quality of work environment. Level of commitment on issues like genuine monitoring and resource allocations for the same; 3rd part auditing and benchmarking and; information disclosure is generally low.
6) Comparative information on different products and processes is not available with the consumers/users. As a result, it is the product/process infrastructure cost and not its eco-friendliness that becomes the sole guiding criterion for selection. Life Cycle

Analysis (LCA) for product evaluation is yet to gain currency in India, the failure of the MoEF-sponsored Ecomark scheme is an excellent case in point.

Box 4 highlights the findings of a survey of Environmental Management practices in Indian corporates carried by TERI along with Business Today.

Box 4: BT-TERI Survey of Environmental Management Practices in Indian Corporates

TERI began with the first ever survey of environmental management practices in Indian Corporates, in March 2000. Of the 450 corporates approached for the survey, in different manufacturing sectors, 48 corporates responded.
The exercise aimed at:

- Identifying the Top 10 corporates in terms of the maturity of environmental systems and practices adopted by them
- Analysing the key trends and dominant environmental practices currently observed in Indian corporates, in general and for different categories of corporates (categorisation based on sale turnover, exports, sectors represented and parentage)

The broad findings of the survey are:

- With a response from 48 corporates i.e. 10.62%, it seems that transparency and information sharing, in Indian corporates, on sensitive issues like Environment is not upto the desired levels. Corporate's apprehensions against responding to the poll varied as:
  1. Information sharing on issues could result in more stringent standards
  2. Responding on environmental issues is not a priority job
  3. Response on such questions already a part of the corporates reply to different enforcement agencies.
- 60% of the corporates had an ISO certification in either of their facilities. But the number of facilities with such certification or certification process in progress is a mere 24% implying that Indian corporates are still to realise the benefits and potential of getting their environmental management systems accredited
- System of filling the legally mandatory environment statement (Form V audits) and comprehensive audits was popular with only 55% of the corporates. This raises a concern that corporates are merely abiding by the regulatory requirements and usually do not have adequate systems in place to measure our performance
- Though target setting vis a vis resource conservation and improvement in environmental performance is in place in most of the corporates, benchmarking is primarily wrt own facilities (63%). Only 21% of the corporates benchmark against Indian industry leaders
- As only 61% of the corporates had a separate department looking after their environmental functions, the concern is if environmental responsibilities are co-ordinated in an organised manner

Comparison of the performance of Top 10 with other respondents reflected:

- Getting their environmental management systems recognised was more customary with the Top 10 corporates
- The leaders additionally had environmental policies at both corporate and facility level; separate environmental departments; better system of auditing and reporting performance levels
- Target setting was also better with mixed benchmarking against own facilities, Indian leaders and counterparts

3) Potential business opportunities

Promising business opportunities in this sector primarily include Consultancy services for establishing EMS in industrial facilities, ISO 14001 Accreditation agencies, Environmental auditing and impact assessments, Corporate Reporting on Environment and Social responsibility. Upcoming areas with high potential include life cycle assessment of products and processes, performance evaluation and benchmarking, product design and labeling.

4) Recommendations

The performance of businesses is being watched even more closely with the increase in:

1) scope and stringency of regulatory mechanisms
2) international pressures of quality and trade
3) gap between resource demand and its supply
4) stakeholder calls for more transparency and accountability on account of greater awareness
5) competition in domestic as well as international markets

The need is to have change in mindsets towards judicious use of the available resources in accordance with the definition of sustainable development. This has to come from the top through a greater management commitment both in terms of purpose as well as resource allocation. Government policies also need to shift from that of a watchdog to facilitator. A changing paradigm shall encompass following efforts:

1) Better information availability in public domain: This calls for generating more user-friendly information through life cycle studies and voluntary dissemination of such information. Dissemination of easy replicable best practices can save resources on reinventing the wheel.
2) Better tracking of operations and resource consumption by developing indicators for all and benchmarking with pre set targets. This shall also include monitoring waste streams before and after treatment to establish their efficacy, auditing consumption of resources like water and packing material, examining in plant exposure levels etc.
3) There is a need to realise the potential of a successful EMS, which in turn calls for better understanding and awareness of the multi-disciplinary subject. Rather than viewing ISO

certification as an image building exercise, concerted efforts need to go in to reap benefits out of this through a greater level of employee involvement and commitment.

4) Operations that have detrimental effect on environment need to replace their conventional accounting systems with *environmental accounting* that additionally books intangible or contingent environmental costs (e.g. future compliance and remediation costs, legal expenses etc) and benefits resulting from eco-friendly approaches. Such an accounting system can result in more sound decisions and ultimately in a more competitive company.
5) Government needs to lead from the front by integrating sustainable development into its policies and day to day activities.
   a) Urban local bodies and Public sector enterprises should opt for EMS for their operations, greater public disclosure and accountability.
   b) Government procurement practices have a notable impact upon the National Economy and the type of goods and services available. Measures such as purchasing environmentally friendly office products and supplies, paper products and alternative fuels are examples of initiatives to advance sound environmental management for government operations. This shall then be replicated by other businesses in the private sector.
   c) There is a need to move from the present rigid and poorly enforced command and control approach to market-based instruments that have a potential to provide cost-effective solutions to environmental problems and stimulate environment-friendly technological progress. This calls for strengthening the networks for better information generation, change in the current legal and institutional structures and to enhance the capacities to deal with market-based instruments.

7. Experience of Funding Agencies

1) USAID[17]

USAID has funded many projects in India over the last ten years, following India's leap into industrialisation. These urban and industrial pollution programs supported interventions in one or more of these five areas: economic policy reform, environmental regulations and standards, education and awareness campaigns, institution building and technological change. The programs under which the funding were allocated are discussed.

1) Trade in Environmental Services and Technologies (TEST)
Designed as a major industrial pollution project, this 5 -year project aimed to develop US India business linkages that would lead to increased trade opportunities for American companies and to improve environmental conditions in India. By the end of 1997, the project had provided technical assistance to 92 Indian enterprises authorising about $25 million over five years (1992-97). The prospective success of TEST was based on assumptions of a growing market demand; US having the capability to provide some of the technologies; shortage of financing options for transfer of commercial environmental technology and; presence of strong regulatory and market incentives to invest in pollution control technologies. Unfortunately, some of these assumptions, critical to project’s success, proved invalid.

2) Clean Technology Initiative (CTI)
Designed as follow-on project of TEST and aiming to promote industrial environmental management and adaptation and transfer of cleaner technologies.

- The first component focused on providing US technical assistance to promote improved environmental management through four market-based initiatives: ISO14001 certification, greening the supply chain, benchmarking techniques and industrial extension services to deliver information on environmental technologies and best practices. Total authorised funding was increased from $25 million to $29.95 million; the project assistance completion date was extended by five years to September 2002.

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[17] Impact Evaluation, REDUCING URBAN AND INDUSTRIAL POLLUTION IN INDIA, USAID, August 2001 and USAID Program and Operations Assessment Report No. 30, October 2002

- The second, trade-oriented component of CTI, like TEST, offers financing to Indian companies to procure cleaner process and energy-efficient technologies from the United States that help reduce greenhouse gas emissions. Unlike TEST, though, which worked with individual companies, it uses the "wholesale" approach (working with trade associations of the strategically targeted industries) to facilitate knowledge transfer.

3) Financial Institutions Reform and Expansion (FIRE)
Unlike TEST and CTI, both designed to address industrial pollution, FIRE addresses urban pollution. It has two components: FIRE-R for "regulatory" covers government regulation of the stock market; FIRE-D for "debt" covers the debt market. The original FIRE project was implemented over five years (1994-98) but has been extended for another five years with an ending date of September 2003.

The FIRE-D project addresses issues of mechanisms to finance urban environmental infrastructure and actual delivery of infrastructure to benefit the urban poor. The FIRE project is supported by up to $125 million in loans from USAID's Environment Credit Program and seeks to finance urban environmental infrastructure, including water supply, sanitation, solid-waste management, and area development.

Program impacts and performance

USAID funded urban and industrial pollution prevention programs had effects in the spheres of economics, environment and health. The sale of air and water pollution control equipment totalled US $33.33 million by one of the US-Indian joint ventures in the period between 1992-99. American exports of environmental equipment to India increased by 29% per year during 1992-95. As of early 1996, the United States had the largest share of environmental joint ventures with Indian enterprises at 40%. In 1991, American suppliers were exporting about $6 million of environmental equipment to India annually, or about 4percent of the total market estimated at $135 million. In 2000, they were exporting $150 million of pollution control equipment and services, 6% of the much larger $2.5 billion Indian market.

However, due to lack of solid baseline data the environmental and health impacts that resulted due to implementation of these projects could not be quantified. However an assumption can be drawn, that the installation of pollution control technologies in the industries and provision of basic services such as potable water and trash pick-up and of environmental infrastructure in low-income areas is bound to improve human health.

Program performance is normally assessed in terms of its effectiveness, whether benefits were sustained after donor funding ended, and the extent to which activities were replicated beyond the project. Following lessons have been learnt from the experience of these USAID supported bilateral urban and industrial pollution programs in India:

1) Changing the mind-set of key business and government leaders with respect to environmental management takes considerable time, but is essential if pollution control technologies, environmental management systems, and urban development are to be widely adopted.
2) Financial benefits: Companies will not invest in pollution control technologies or environmental management systems unless they perceive it in their business interest to do so.
3) Regulation: Companies are more likely to acquire pollution control technologies if there is strict enforcement of environmental standards and regulations.
4) Trade: Both supply-side and demand-side barriers hamper U.S.–India trade in environmental services and technologies.
5) Credit: Lack of financing is typically not a constraint for large Indian firms that want to procure pollution reduction technology. However, it does often hinder individual small and medium-size firms and municipalities that want to finance environmental infrastructure.
6) Replication: A key to replicating technology transfer projects is careful targeting with an eye to sharing and spreading successful results.
7) Baseline data: Baseline data are needed to assess any program's impact.

2) Industrialisation Fund for Developing Countries(IFU)[18]

The study *Environmental review of 89 investments in India and Poland* is based on investigations by independent environmental consultant's during 1998-1999 of projects, each one co-financed by one or two of four investment funds:

1) Industrialisation Fund for Developing Countries (IFU)
2) Investment Fund for Central and Eastern Europe (Iϕ)
3) Nordic Environmental Finance Corporation (NEFCO) and
4) Environmental Investment Facility for Central and Eastern Europe (MIϕ)

[18] FOREIGN DIRECT INVESTMENT AND THE ENVIRONMENT, Summary Report, IFU IØ MIØ NEFCO

This review looked at 25 projects in India financed by IFU for promotion of economic activity in collaboration with Danish trade and industry. The consultants visited the projects and collected information through interviews and questionnaires. The conclusions and recommendations of the Environmental Panel are as under:

1) 20% of project managers in India reported that they faced major environmental challenges in one or more specific areas.
2) Project managers in both India and Poland reported that the environmental challenges were primarily related to occupational health and safety.
3) 44% of the projects in India were in compliance with Danish standards.
4) The investment funds influenced the projects indirectly through the Nordic partners by propagating their environmental policies and by requesting annual reports on environmental improvements. Small and medium-sized enterprises appeared to be especially influenced by the funds' environmental policies and procedures.
5) The major barriers to environmental improvements, as seen from the perspective of project managers, were identified to be the following:
    a) Lack of awareness and motivation among the employees when dealing with environmental and occupational health and safety issues
    b) Financial constraints, especially in the largest projects
    c) Lack of environmental infrastructure such as wastewater treatment plants and facilities for controlled waste treatment
    d) Lack of clear national regulations and enforcement
6) The Environmental Panel recommended the companies continuously to strive to identify areas in which it is financially and technically feasible to bring environmental performances up to international standards so as to:
    a) improve productivity and efficiency
    b) capture the growing green markets and improve the access to export markets
    c) keep them ahead of future legal requirements and satisfy stakeholders

- All project companies should establish EMS appropriate to their size and activity
- Poor training and motivation of the work force is a main barrier to improve environmental performance. This can be mitigated through effective environmental management measures and training programmes.
- Environmental management measures such as monitoring and reporting will sharpen the management's awareness of environmental costs and benefits.

The study made following recommendations to the Investment funds and their owners:

1) The funds should further develop their environmental appraisal procedures with the objective of ensuring that project promoters carefully consider potential environmental challenges and risks.
2) The funds should use their representation on the Boards of the project companies to motivate the companies for compliance with local requirements and for further improvements.
3) The funds should extend their network of environmental advisers in host countries and facilitate their involvement in project preparation and implementation.
4) The funds should help the partner companies to ensure that clear and manageable environmental performance targets and indicators are defined and continuously monitored as the basis for regular environmental stocktaking and reporting.
5) Investment officers and other relevant fund staff must continuously receive updated training in appraising environmental aspects of projects.
6) The funds should ensure adequate and reliable reporting from the project companies, as this will help them stay up to date on their environmental performance and provide a tool for dialogue.
7) The funds should use their influence in host countries to increase awareness of the importance of environment and occupational health and safety issues.
8) The Panel advised the investment funds to improve transparency and accountability in environmental matters and regularly report on the environmental status and progress of their investments.

List of abbreviations

AAQ	Ambient Air Quality
ADB	Asian Development Bank
BAU	Business As Usual
BCM	Billion Cubic Metres
BOD	Biochemical Oxygen Demand
BOO	Build-Own-Operate
BOOT	Build-Own-Operate-Transfer
BTU	British Thermal Units
CAC	Command-And-Control
CDM	Clean Development Mechanism
CETP	Common Effluent Treatment Plant
CII	Confederation of Indian Industries
CNG	Compressed Natural Gas
CO	Carbon mono Oxide
CO2	Carbon di oxide
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
DO	Dissolved Oxygen
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
GAP	Ganga Action Plan
GHG	Green House Gas
GoI	Government of India
HC	Hydrocarbons
HWM	Hazardous Waste Management
IAP	Indoor Air Pollution
IPCC	Inter-governmental Panel on Climate Change
ISO	International Standards Organisation
LCA	Life Cycle Analysis
LPG	Liquified Petroleum Gas
MBI	Market Based Instruments
MNES	Ministry of Non-conventional Energy Sources
MoEF	Ministry of Environment and Forests
MSW	Municipal Solid Waste
MTPA	Million Tonnes Per Annum
MW	Mega watt
NGO	Non Governmental Organisation
NLCP	National Lake Conservation Plan
NOx	Oxides of Nitrogen
NRAP	National River Action Plan
O&M	Operation and Maintenance
ODA	Overseas Development Assistance
PSP	Private Sector Participation
RSPM	Respirable Suspended Particulate Matter

RWA...Resident Welfare Association
SME ....Small and Medium scale Enterprises
SO2 ....Sulphur dioxide
SPCB ....State Pollution Control Board
SPM .... Suspended Particulate Matter
SSI ....Small Scale Industries
STP .... Sewage Treatment Plant
SWM.. Solid Waste Management
T&D ....Transmission and Distribution
TDS ....Total Dissolved Solids
TPD ....Tonnes Per Day
ULB ....Urban Local Body
WHO...World Health Organization

Chapter III

Promoting Technology and Business Partnership for Sustainable Development through Environmental Industry: Indonesia Case

RTM. Sutamihardja

Summary and Recommendations

Indonesia is an island country with abundance of natural resources, include rivers, mountains, hardwood forest, flourishing, as well as significant reserve of minerals, natural gas and oil. Also Indonesia is no 4 populated area in the world after China, India and US. Population in 2000 is 206,2 millions and it is projected that Indonesia population will exceed 300 million in 2030. Urban areas have been growing very rapidly in Indonesia. The highest urbanization is in Java island where nearly two - third of Indonesia population live.

Because of increasing in economic and social development e. g : population, industrial, urban development and natural resources extraction and exploitation have resulting in decreasing or depleting natural resources and decreasing the environmental quality event environmental pollution.

Accesses to clean water is a problem in Indonesia because many of the rivers are highly polluted only 42 % of Indonesia population have access to clean water. A fall many region in groundwater level, that use for industrial purpose, is found in Jakarta , Medan, Cilegon, Bandung, Semarang and Bali. The regional water utility company (PDAM) can provide top water to only 20 % of the population. The poor performance of PDAM is due to high level of debt and lack of investment as well as inefficient management. Sustainable water management in Indonesia is partly hampered by the lack of data on hydrology, including freshwater source demand and supply in many regions.

Land resources management is an important issue in Indonesia. The large scale conversion of fertile agricultural land into industrial states and the large scale conversion of forested are, wetlands and pet swamps for agricultural purpose are main problem land degradation is mainly caused by the fact that national an regional spatial plans have not been fully implemented. The impact of urban development is another factor which be taken into consideration.

Present low waste service standard have cause the level pollution for water., land and air. Household liquid waste and human waste is a major source of water pollution. Industries polluted rivers is in the range of 25 - 50 % . Program that target reduction of industrial discharge have not achieved their stated goals because of major shortcoming in the governments capacity monitor actual industrial effluents and to enforce the standard and also because of short comings in the private sectors capacity to design and operate pollution abatement system.

The available information indicates that Indonesia faces serious and growing problems related to air pollution its major urban centers. With the expansion of economic activities, air pollutant emissions are expected to grow rapidly.

Some consideration should be put forward to understand the policy and measure for environmental management such as major barriers to sustainable development include : lack of awareness and common flat form, centralized and fragmented approach to development; inadequate political will, institutional capacity and law enforcement; inadequate provision for the involvement of major group; inadequate financial for the technological and human and resources. The other are Public sector investment, protecting the urban environment, and controlling industrial pollution. Public sector investment in infrastructure include power, transport, communications, irrigation, municipal water supply and sanitation are important thing to support the rapid growth of private sector investment. The main challenge to protecting the urban environment is to define a strategy for the management of urban areas that accommodates the need for growth while protecting the quality of the environment. At stake is not only for overall economic growth but also the health and welfare of Indonesia's urban citizens. The issues of industrial pollutions control facing Indonesia today are : (a) what to do about pollution from existing firm and (b) how to "delink" future pollution loads and the damage they cause from the expansions of industrial output.

As in most developing countries, the institution responsible for environmental management face a variety of constraints in carrying our their mandate. As a result environmental issues and concerns are not yet effectively integrated in development planning and implementation. The importance of institutional strengthening should be considered seriously. There are a large number of institution in Indonesia that have an important role to play in environmental protection and the sustainable management of natural resources, at both the national and provincial levels. Most are in the public sector, but non-governmental institutions, including universities and NGOs, will be increasingly important in the coming years. At the national level, the key agencies include the State Ministry for Environment, central agencies responsible for the management and use of natural resources (forestry, agriculture, industry, etc.) and others responsible for key aspects of development planning and coordination (e.g. the State Planning Agency – BAPPENAS, and the Ministry of Home Affairs – responsible for administration of provincial and local governments).

To prevent at least reduce the level of environmental pollution, the government with the approval of the House of Representatives issued Law Number 23/1997 on Environment Management. The law stipulates among others that the development activities especially in the field of economy must take into account their impacts on the conservation of the environment. These are the basic needs that for participation of the business World and Non Governmental Organization (NGO) in Environmental Management are necessary. A pro-active move by the industrialists to find a positive incentive to change and to improve environment performance, makes possible the reduction of the level of pollution problem in accordance with the existing regulation. The move can also improve the communication with the society, enhance the industrial development and finally materialize the social sustainable future for all people and generations in the world. It is becoming increasingly clear that the members of business world should be concerned about environmental issues. They are called upon to take responsibility for lowering the amount of waste produced, protecting environmental quality and human health, as well as increasing efficiency of resource use.

Slow recognition by the public and the government of the substantial health and economic damage afflicted upon the population has resulted in lack of required standards, regulatory frameworks, minimal monitoring and enforcement, and inadequate human and financial resources to meet the environmental challenges of the country. Three environmental submarket segments are : air water, and soil pollution, including industrial waste processing and disposal. Those subsegment market should be handled through the development of environment of environmental industry. (EI). EI refers to : Environmental management systems and reporting at corporate level. Environmental technology and processes (software), and Environmental product, equipment and instrument (hardware). Effective and rational management and use of natural resources, growing economies fueled by expanding export and high quality of life for the people, are directly linked to a dynamic and technologically advanced EI. Likewise, constantly large domestic and foreign investments, combined with R&D and transfer of technology, are essential requirements for a dynamic market-driven EI.

A multiplicity of agencies and institutions responsible for environmental management, combined with incompatible and conflicting laws, as well as lack of required data and information, has further aggravated the county's ability to generate effective real demand for environmental products, technology and services. More recently, with increased domestic (including NGOs) and external, political and market-based pressure, Indonesia has embarked on a process to "green" the economy and to improve health and overall quality of life for the population.

In Indonesia, the international agencies and financial institutions along with the major donors are contributed significantly beside the MNCs, including the national corporations, to the development of EI and more generally to sustainable management of natural resources. Overall, Japan, the US and Germany are the major donors active in the country. They are also the major exporters of pollution control products and technology.

Environment Industry future development, would benefit from the creation of conditions for converting potential demand for environmental products, technology and management services into effective, and real demand, and market based incentives, combined with effective management of streamlined and strengthened regulatory and monitoring frameworks and standards, will also contribute to the above endeavor. It will also facilitate participation by MNCs and national companies, to discover that investment in environmental protection and control is good business nowdays and in the future.

1. Introduction

Indonesia, which located in the tropical belt, that stretch along the equator from a latitude $06^{o}08'$N to $11^{o}15'$S, and longitude of $94^{o}45'$ to $141^{o}05'$E, is the largest and widest archipelago country in the world and know as a tropical maritime continent country with a coast line length of 81,000 km. It consists of 17,846 island. It includes 3.1 million km2 of territorial waters, and 2 million km^2 of land. When the Economic Exclusive Zone (EEZ) of 2.7 million km^2 is include, the total territorial area of Indonesia becomes 7.8 million km^2.

More than 56 per cent of the island are nameless and only 7 per cent are permanently inhabited. Main islands are Sumatra with a total area of 47.606 km^2; Java with a total area of 132,107 km^2; Kalimantan, comprises two-third of the island of Borneo, with a total area of 539,460 km^2; Sulawesi with a total area of 189,216 km^2; and Irian Jaya with a total area of 421,981 km^2.

The country is predominantly mountainous with approximately 400 volcanoes, of which 100 are active. The three most famous volcanoes, Merapi, Galunggung, and Krakatau, located in Java, are considered among the most active volcanoes in the world. Mountains higher than 3,000 meters are found on the Islands of Sumatra, Java, Sulawesi, Bali, Lombok, and Sumatra. The highest mountain of all is the perpetually snowcapped Mount Jayawijaya at 5,030 meters in Irian Jaya.

Indonesia's natural resources are among the world richest that include hardwood forest, flourishing, as well as significant reserves of minerals, natural gas and oil. Although Indonesia covers only 1.3 per cent of the earth's surface, it includes 10 per cent of the world's plant species, 12 per cent of mammal species, 16 per cent of reptile and amphibian species, 17 per cent of bird species, and 25 per cent or more of the world's fish species.

Indonesia is currently the fourth most populous nation in the world after China, India and the United States. The total population was 183 million in 1990 increased to 191 million in 1994. Population in 2000 is 206,2 million. The growth rate of the population was 2.3 per cent during the period of 1871-1980, decreased to 1.98 per cent during the period of 1980-1990, and 1.66 per cent in the period 1990-1995. It is projected that Indonesian population will exceed 300 million by the year 2030.

Indonesia was considered very successful economically in its national development program, including in alleviating poverty. In 1970's around 60 per cent of its population (or some 70 million people) were in absolute poverty. By 1990, the number of the pour had dropped to about 27 million, or only 15 per cent of the population. In 1994 the figure dropped further to 25 million or 13 per cent of the population.

Life expectancy in 1971 was 45.7 years and approaching 63.5 years in 1995, while adult illiteracy rate dropped from 39 per cent in 1971 to 16 per cent in 1980 and to 13 per cent in 1994.

Urban areas have been growing very rapidly during the last two decades. Urbanizations is highest in Java island where nearly two-thirds of Indonesia population live. In 1970, urban population was still less than 15 per cent and subsequently increased to 22.4 per cent in 1980 and reached 34.3 per cent in 1994. It is estimated that the figure may reach 50 per cent by 2020.

Indonesia has made signification progress in advancing education as indicated by increasing adult literacy rate from 39% in 1960 to 88% in 1999 (BPS 2000). This percentage varies according to age. Of the population above 50 year old, 66% are literate while among the population below 50 year old, 93.4 are literate. Another indicator is the increase in the percentage of the population above 10 years old who passed junior high school, i.e. from 32.2% in 1999 to 33.6% in 2000. School attendance of 7-12 year old children in 2000 was 95.5%, 13-15 years 79.6% and 16-18 year 51.2%. This is an increase of 0.1 – 0.6% compared to 1999.

Because of increasing in economic and social development e.g: population, industrial, urban development, and natural resources extraction and exploitation have resulting in decreasing or depleting natural resources, and decreasing the environmental quality event environmental pollution as described in following.

2. Present and Future Conditions

1) Water Resources

Water is one of the most important elements of the environmental for life. Without water, the various processes of life would not be possible. A large proportion of the bodies of living things consist of water. Plain water makes up only 3% of all water resources on earth, and of this percentage only percent or point percentage is available in a form which can be directly utilized. The rest is frozen is the poles.

In Indonesia, accesses to clean water is often a problem. The quality of water is rise a problem. A study published in 1991 show the many of Indonesia's rivers are highly polluted.

The pollution of surface water (rivers) and the groundwater means that the water quality is no longer sufficient for some purpose, including drinking. Water contamination is generally caused by human waste, household waste such as detergents and industrial waste which is dumped without first being treated. This waste poses great health risks, not only for the people who have to use river and reservoir water of drinking, bathing and washing, but also for those who are customers of PAM, the state water company. Which takes its water from these same sources. Water pollution from this waste also decrease the river and reservoir capacity to support water organism, resulting in a decrease in oxygen in the water.

In addition to domestic, irrigation and industrial demand, the demand for water for electric power generation is also projected to increase as a result of the village electrification policy, industrialization, increased standards of living and urban expansion. Meanwhile a comparison of available water and demand shows that in Java demand will reach a critical level. In the year 2000 demand for water in Java is projected to be 153% of the supply.

The increasing use of groundwater for industrial purposes results in a drop in the aquifer levels in places such as Jakarta between Cengkareng and Grogol, and between Cempaka Putih and Cakung, where it is 17 meters below see level.

A fall in groundwater level is also found in Medan, Cilegon, along the north coast lowlands of West and Central Java, Bandung, Semarang, and Bali. In addition, there has been land subsidence in large cities such as Jakarta and Bandung which endanger buildings.

Falling levels of groundwater an aquifer also result in the intrusion of salt water into the aquifer, contaminating the fresh water. This intrusion of salt water is also caused by increased cutting of mangrove forests without concern for their function as a buffet in keeping the coastal land from being eroded of abraded by the salt water and to prevent salt water intrusion.

Indonesia is facing increasing freshwater supply problems, particularly on the islands of Java and Sumatra where the demand for freshwater is the highest. Issues associated with freshwater are population growth, industrialization, urbanization, overuse, and inadequate supply of freshwater in some regions. The demand for water for domestic use only is projected to be about 81 billion meter3 in 2015, which means an annual increase of 6,7% between 2000 and 2015. This figure has not included freshwater consumption by agricultural sector that account 98% of Indonesia's water resources and is growing by 6,67 % annually until 2015 (MoE, 1997).

On the other hand, only 42% of the Indonesian population have access to clean water The Regional Water Utility Company (PDAM) can provide tap water to only 20% of the population, of which 90,2% is used by the domestic sector. The poor performance of PDAM is due to high level of debt and lack of investment as well as inefficient management. Limited supply has forced people to increasingly utilize groundwater, leading to over utilization by household and industries, resulting in reducing groundwater level. This problem is exacerbated by pollution both from industrial and domestic wastes, causing a decline in the annual per capita availability of water. Indeed, some causes of water use conflict has been reported from some densely populated areas with intense development activities (MoE, 1997).

The National Agenda 21 calls for the need to formulate and integrated water resource management, focusing on the provision of adequate and safe drinking water, enhancement of efficiency in water utilization and improvement in the quality of water resources.

To date there is no integrated water resources management as yet, but some efforts have been conducted as a part of water resources conservation program. For instance, in order to protect water resources from pollution the MoE launched the Clean River Program (Prokasih) which by 1999 involved 37 watershed areas in 17 provinces. The project encourage water pollution reduction from industries, voluntarily However, the success of this program is debatable, since law enforcement is weak. It is hopped that government regulation no. 82/2001 on Water Quality Management and Water Pollution Control might serve as another policy tool to manage and prevent further water pollution.

Another important issues is the privatization of water supply through partnership between the regional water utility company (PDAM) with the private sector. This was attempted to improve the performance of PDAM. It has to be notice, however, that the cooperation between PDAM and the private sector created some problem related to public services. The profit orientation of the private sector often undermines the need to provide public services, particularly for the poor. There is a tendency that services to the poor community will deteriorate, on the other hand they have to play higher prices for water.

Sustainable water management in Indonesia is partly hampered by the lack of data on hydrology, including freshwater source, demand and supply in many regions.

2) Land Resource Management

Land resources management is an important issue in Indonesia since a large part of the nation's production depends on land. The large-scale conversion of forested areas, wetlands and peat swamps for agricultural purposes is one of major problem in land resources management. This results in land degradation, the size of which is currently 30 million hectare and is expected to increase by 1 – 2 per cent (about 300.000 to 600.000 hectare) per year. Another problem is the large – scale conversion of fertile agricultural land in Java which will expand by almost 15,000 hectare per year. An additional expansion is also anticipated for roads and industrial development amounting to about 40.000 hectare per year (World Bank, 1989).

The World Bank (1992), quoted , further estimates that until 2010, about 390.000 hectares (13 percent) of the 3,4 million hectares of rice fields in Java may be converted into non agricultural land. Another problem is the lire -scale conversion of fertile agricultural land into industrial estates and urban settlements; in 2000 such conversion reached almost 250.000 ha in many cases, land conversion also occurs in conservation areas which, according to spatial planning regulations, must not intensively developed.

Land degradation is mainly caused by the fact that national and regional spatial plans have not been fully implemented. The impact of urban development is another factor which must be taken into consideration. The conversion of agricultural into non agricultural land in Java for purposes such as housing, industrial uses, fall role roads etcetera appears to be more pronounced and faster than anticipated in World Bank Projection. The mythical picture of Java turning into a "City Island" is be common more and more a reality. This development further reinforces the need for effective innovations in the development of agriculture, energy and water supply, urban development and sustainable land use.

Development planning efforts have already reclaimed coastal areas in Northern Jakarta, up to 2.700 hectares. Similar plans have been developed for Kapuk Naga (7.000 hectares) East Surabaya. The approach being taken in Jakarta and East Sumatra will be used as a model for the development of other Coastal cities in Java.

Unfortunately, no standard procedure exists yet for the land reclamation process, this is a cause of some concern due to the prospect of floods. Furthermore; the destruction of mangrove forest causes problems of foreshore erosion, salutation of beaches and inshore reefs, depletion of fish tocks, habitat loss and resource depletion. The growing interest in land reclamation may also be interpreted as a symptom of the inability to balance socio-economic activities with land use planning.

In many cases, this is associated with conflict of interest among parties involved in the management of land resources.

The problem is exacerbated by the lack of coordination among government agencies and development sectors, complex regulations and mechanisms related to and resources and by the limited participation of major groups, especially local and indigenous people in land-use planning. Such problems have led to both horizontal and vertical conflicts. An example is the failure of the national project to develop one million hectares of peat swamps into rice fields in Kalimantan, which damaged the tropical peat swamp ecosystem as well as created social problems.

Another important issue associated with land management is the marginalization of customary land laws, even though formally it is recognized bay the National Agrarian Law (Law No 5/1960). The government, in may cases; undermines traditional law on the grounds of national interest. Disregard for the customary land laws have often led to social conflicts sometimes leading to violence. The Spatial Planning Law No. 24/1992 was issued as a policy basis to achieve an interacted and environmentally sound spatial use. It was followed by Regulation No. 47/1997 on Regional Spatial Planning. However, the implementation and enforcement of these laws are weak and therefore the above problems are yet to be resolved.

As stated before, the MPR Decree No. IX/MPR/2001 on Agrarian Reform and Natural Resources management may be able to address some of the above problems as well. However, differences of opinions on the effectiveness of this decree need to be resolved, and the decree itself will need implementing regulations in order to be effective.

3) Liquid and Solid Waste Management

Liquid and solid waste as defined in this chapter, includes both domestic waste (human waste/sanitation and solid waste), which is often known as “brown waste”, or industrial waste. It is useful to differentiate domestic waste from industrial waste not only because of the different nature of the waste and the consequently different technological approaches, but also because different sectors carry the responsibility of managing different waste.

Present low waste service standards have caused the level of pollution for water, and in some instances, land and air to exceed environmental standards. Sanitation coverage, for example, has remained static since 1980 and is barely able to keep pace with population increase. In 1993, only 52% of families had access to adequate sanitation, including 39%

rural areas and 78% in urban areas (UNDP, 1995). Household liquid waste is a major source of water pollution and is estimated to contribute 50-75% of the organic loading in rivers in urban areas. Human waste is also polluting water supplies from shallow wells. A survey of shallow wells in Jakarta, where 84% of the samples were contaminated by fecal coli forms, illustrates that groundwater is contaminated on a large scale. Water pollution causes adverse effects for human health, particularly increases in diarrhea, increases in the cost of treatment for drinking water sources, and increases in the cost of transporting water from distant sources. Estimated the implied cost of water pollution in Jabotabek at Rp. 187.7 billion/annum and by the year 2005 it will be almost double unless control measures are introduced.

The service level for solid waste is not much better. On a national level only 40% of the urban population has its waste collected, the rest burn it and dispose of it in streams or on open land. In Jabotabek, for example, solid waste burning is estimated to contribute to 20% of particulate and 11% of hydrocarbons in air pollution. The disposal of solid waste in water bodies not only degrades water quality but also causes clogging of drams which in return causes flooding.

In the case of industrial pollution, it is estimated that the typical contribution of organic loading from large industries to polluted rivers is in the range of 25-50%. Programs that target reduction of industrial discharge have not achieved their stated goals because of major shortcomings in the government's capacity to monitor actual industrial effluents and to enforce the standards, and also because of shortcomings in the private sector's capacity to design and operate pollution abatement systems. The existence of numerous cottage industries that are intermixed with housing poses additional problems in enforcement and monitoring of treatment and discharge. Furthermore, these small-scale industries do not have the funds or the technical resources to build wastewater treatment plants.

In addition to population growth and urbanization, future problems in liquid solid waste management will be exacerbated by waste originating from increased industrialization.

Three trends are important to note ;

1. The first is the pace of industrial growth itself. With increased reliance of the Indonesia economy on industrialization, the manufacturing sector by 2020 is likely to expand 13-fold (World Bank, 1994) with a ten-fold waste increase.
2. The second trend is the spatial distribution. More industries will be concentrated in provinces with high population densities, particularly in Java. As a result, traditional water pollutions (BOD and suspended solids) will expand eight –fold from the current high levels.
3. The third trend is the shift of manufacturing from material processing to assembly.

Indonesia has started to realize the importance of this approach and in 1995 made a national commitment to minimize waste generated during the production process by implementing cleaner production principles. Some pilot projects have been tried under the Clean Production Program coordinated by National, Development Planning Agency in paint, textile, food, plastics, and pulp and paper industries with relatively good results; waste, water consumption and often energy and raw material use was reduced with additional investment being paid back in one to five years. Minimization potential as expressed in terms of a "minimization factor" has not been determined yet for Indonesia, however studies done in other countries could give some indication of the potential. Studies in developed countries have estimated a minimization factor (a factor that measures the reduction of waste generation because of minimization efforts) of 50-60% in the next 10-15 years as a possibility. With the assumption that there is much to be achieved through improving housekeeping practices and upgrading dirty technology, a minimization factor of 50% over a period of 20 years does not seem overly ambitious and can be used to estimate the potential reduction in levels of waste generation.

4) Air Resource Management

As with water and land, air is important requirement for every living thing. The air we breathe is part of the atmosphere which is particularly sensitive to environmental influences, including those of man. Air pollution affects the climate and lowers the air quality. Air pollution can be caused by gas or dust. Pollution from gas comes from moving objects, such as motor vehicles, ships and aircraft, as well as from fixed objects such as factories. Meanwhile, pollution from dust comes from industrial activities and dryness.

Recently a number of climate parameters have indicated that change is taking place. Deviations in atmospheric conditions are thought to be a cause of unstable weather conditions. Climate changes in Indonesia are predicted to have a clear impact on the agricultural sector in general and on the rise in sea levels coasts. Calculations by the Bandung Institute of Technology (ITB) indicate that over the past 60 years the sea level has risen by 0.5 cm/year along the coasts of Jakarta, Semarang and Surabaya. Increases in concentrations of manmade gases, such as chlorofluorocarbons (CFCs) and halon have caused the ozon layer in the stratosphere to thin, which may be hazardous to human life. These gases contribute to global warming which causes rising sea levels.

Inventarization and monitoring of the Blue Sky Program activities in metropolitan cities shows a correlation between decreasing air quality and traffic density. In large cities, particularly in business and transportation centers, there is air pollution from dust and aerosol in the lower atmosphere. Industrial activities have great potential to pollute the air because of emissions of SO_2, NO_2 and CO. Without active effort SO_2 and NO_2 pollution will increase from the 1994 levels of 200,000 tons and 600,000 tons respectively per year to 2,4 million tons and 1.5 million tons in the year 2010. And with an estimated growth in the transportation sector of 6-8% per year air pollution by motor vehicles in the year 2000 is estimated to be double that of 1990 rising to 10 times that by 2020. Other studies have shown that air conditions in several large cities already surpass the established maximum allowable standards for air quality.

These high levels of pollution appear to cause a high incidence of respiratory ailments. For example, in Jakarta, 12.6% of all deaths are from respiratory tract infections. According to a report of the Health Ecology Research Center of the Ministry of Health in 1991, this total is twice the national average. If preventive measures are not taken immediately the same conditions will be found in six other provinces by 2010. In that year, the total suspended particulate (TSP) in the air in Central Java, East Java, Yogyakarta, Bali, North Sumatra and South Kalimantan will equal the 1990 levels in Jakarta and West Java. This means that 85% of those whose health is affected by this type of pollution live in Java.

With the remaining 15% living in Bali, North Sumatra and South Kalimantan. Complaints will be of respiratory problems, frequent asthma attacks, eye irritation and possibly cancer. Table 1.5 in the Appendices shows some sources of pollution and their effects.

The available information indicates that Indonesia faces serious and growing problems related to air pollution in its major urban centers. Moreover, with the expansion of economic activities, air pollutant emissions are expected to grow rapidly. This condition, coupled with the population growth pattern, will mean that at least half of Indonesia's population will be exposed to serious urban air pollution by 2020. The seriousness of urban pollution can be shown by the projected situation in Jakarta, where, air pollutant emissions will grow to more than double the 1990 levels by 2000 and six times the 1990 levels by 2018. These factors will seriously risk continuing social and economic development in Indonesia, as result of the high social and economic costs from air pollution.

Information from the year 1990 shows that efficiency in energy usage in Indonesia is still very low This can be seen by the high rate of energy consumption per unit of the Gross National Product (GNP). In 1990 energy intensity in Indonesia reached 366 Ton Oil Equivalent (TOE) per million US$, compared to 251 and 258 for the Philippines and Singapore respectively, and 210 for the developed countries.

Therefore in 1991, the government issued Presidential Decree No.43, concerning the implementation of energy conservation programs in all energy sectors with the Minister and the head of the government institution having the responsibility for implementing and supervising conservation activities.

Table 1. ***Projected Energy Demand***
(Peta Joule)

Sector	**1991**	**2001**	**2011**	**2021**
Industry	*538.50*	*1,039.36*	*1,911.74*	*3,674.26*
Transportation	*536.80*	*1,040.31*	*1,841.72*	*3,246.74*
Residential	*1,124.42*	*1,367.58*	*1,574.10*	*1,792.49*
Commercial	*29.08*	*66.35*	*143.22*	*319.42*
Others	*251.05*	*584.90*	*1,085.85*	*2,030.18*
Total	***2,479.85***	***4,098.50***	***6,556.63***	***11,063.09***

Source : BPPT-KFA, Markal Study 1992.

Table 2. ***Projected Domestic Energy Supply***
(Peta Joule)

Sector	***1991***	***2001***	***2011***	***2021***
Oil	*1,291.63*	*1,671.11*	*2,334.67*	*4,719.71*
Natural Gas	*710.97*	*1,565.98*	*2,300.41*	*2,977.35*
Coal	*193.96*	*790.24*	*2,660.18*	*6,512.26*
Geothermal & Hydropower	*141.75*	*419.07*	*544.17*	*534.68*
Biomass	*1,003.39*	*1,238.59*	*1,436.84*	*1,712.14*
Total	***3,341.70***	***5,684.99***	***9,276.27***	***16.465.14***

Source : BPPT-KFA, Markal Study 1992.

Table 3. ***Projected Oil Consumption In Indonesia (Kilo Liter)***

No.	***Product***	***1998/99***	***2003/04***	***2008/09***	***2013/14***	***2018/19***
1.	*Avgas*	*9,189*	*9,149*	*9,141*	*9,139*	*9,139*
2.	*Avtur*	*1,875,092*	*2,399,543*	*2,921,361*	*3,358,376*	*3,839,529*
3.	*Premium*	*11,016,790*	*15,072,014*	*18,977,991*	*22,146,115*	*26,486,719*
4.	*Kerosene*	*10,884,523*	*11,108,211*	*10,965,596*	*12,892,088*	*15,046,057*
5.	*ADO*	*22,423,379*	*29,832,931*	*39,256,424*	*49,062,911*	*63,030,325*
6.	*IDO*	*2,642,754*	*3,461,640*	*4,572,515*	*6,081,763*	*8,133,625*
7.	*Fuel Oil*	*4,672,208*	*5.656,924*	*7,260,102*	*9,972,543*	*13,679,036*
	Total	*53,523,935*	*67,540,422*	*83,963,130*	*103,522,935*	*130,224,430*
	Growth Rate (%/year)	*(1994 – 98) 4.77*	*(1999 – 03) 4.56*	*(2004 – 08) 4.49*	*(2009-13) 3.78*	*(2014 – 18) 4.78*

Source : Direktorat Pengolahan, Pertamina, 1995

Electricity consumption in Indonesia has grown rapidly. During the first 25 year Long-term Development Plan, 1969-1994, the demand for electricity has grown at an average rate of 15% per year. In 1968/69, total electricity consumption was merely 1,4 TWh, but in 1993/94 it increased to 63.4 TWh and it will reach 188 TWh in 2003/2004. This rapid growth is expected to continue at average of 8.2% year from 51.2 TWh in 1990 to 555 TWh in 2021 (see Table 7.4.), in which the share of consumption from the industrial sector will increase from 68% in 1990 to 73% in 2021 (Zuhal, 1995).

This annual growth rate is higher than the Asian average of 7.9% and much higher than the world's average of 3.6% (1980-1987). The electrification ratio (ratio of number of households with electricity to total households) increased from 3.4% in 1969 to 38.7% in 1994 and expected to be 60.0% in 1998/99 and 74.0% in 2003/2004 (Zuhal, 1995). Although Indonesia's total electricity consumption is the highest in ASEAN countries, the consumption per capita is the lowest among the ASEAN (246 GWh compare to 1,075 and 5,218 for Malaysia and Singapore). This condition will likely lead to the rapid growth of this sector in Indonesia.

Table 4. Electric Power Demand
(TWh)

Sector	***1990***	***2001***	***2011***	***2021***
Residential	*10.0*	*22.2*	*40.8*	*70.0*
Commercial & General Services	*6.4*	*15.3*	*33.9*	*78.7*
Industry	*35.4*	*84.8*	*183.4*	*405.1*
Transportation	*0.1*	*0.3*	*0.7*	*1.2*
Total	***51.9***	***122.6***	***258.8***	***555.0***

Source : BPPT-KFA, Markal Study 1992. (Agenda 21-Indonesia).

Thermoelectric plants are considered major emission sources which can effect local and regional air quality. In terms of total energy-related emissions at the national level, the greatest concern from the power sector activity is SO_x emissions. The power sector is however less of a contributor to these emissions in urban areas, as most power plants are located in rural areas. The shift to coal as primary energy source will increase concerns regarding the environmental implication of power plants, since coal combustion will produce more pollution than many other energy sources, if emissions are not properly controlled.

In the future, the emission loads corresponding to the above expansion of the power plant sector, assuming unchanged environmental control practices, are projected to expand by 20 times for the case of SPM, 17 times for the case of NO_x, 12 times for Sox and 16 times for CO_2 emissions (World Bank, 1993).

The Government of Indonesia has taken some steps to reduce emissions from power plant activity. These measures include the requirement for an environmental impact analysis for power projects, the establishment and implementation of the ambient air quality and emission standards for coal fire power plants, the use of low sulfur coals, the increased use of natural gas in combined cycle power plants, the reduction of transmission and distribution losses from a high of about 21% in 1983 to 12.38% in 1990 (11.81% in Java and 13.82% outside Java) and a target of 10% by 2000 (World Bank, 1993)

Table 5. ***Power Generation Forecast: Unchanged Practices Scenario (TWh)***

Primary fuel	***1990***	***1998***	***2008***	***2018***
PLN				
Oil	*15.4*	*7.1*	*16.4*	*24.4*
Coal	*9.8*	*27.7*	*117.9*	*336.8*
Natural Gas	*1.4*	*34.6*	*34.6*	*34.6*
Hydropower	*7.6*	*11.8*	*24.4*	*27.4*
Geothermal	*0.8*	*4.0*	*4.5*	*5.5*
Sub Total	*34.9*	*85.3*	*197.8*	*428.7*
				Captive
Oil	*12.6*	*33.8*	*68.4*	*174*
Coal	*1.0*	*8.8*	*13.8*	*31.8*
Natural Gas	*2.0*	*4.9*	*10.4*	*17.4*
Hydropower	*1.7*	*1.7*	*2.2*	*4.2*
Geothermal	-	-	*1.0*	*4.5*
Sub Total	*17.3*	*49.3*	*95.8*	*232.3*
TOTAL		***134.5***	***293.6***	***661.0***

Source : World Bank, 1993.

Table 6. ***Emission From Power Plant * (Without Control)***

Year	*Power Generation (TWh)*	*NOx (1000 tons)*	*SOx (1000 tons)*	*Particulate (1000 tons)*	*CO2 (million tons)*
1990	*52.2*	*182.2*	*229.8*	*11.1*	*35.3*
1998	*134.6*	*455.0*	*368.1*	*26.6*	*87.3*
2008	*293.6*	*1212.5*	*1036.1*	*83.3*	*221.0*
2018	*660.9*	*3086.8*	*2648.1*	*224.7*	*553.2*

Source : World Bank, 1993 PLN and Captive*

Climate change is caused by increased concentration of greenhouse gases, notably carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) due to combustion of fossil fuel, deforestation, and agricultural practices. As an archipelago developing country, Indonesia stands to lose much from climate change. Its agriculture and fishery sectors, which are vital for food security and income generation will be threatened. Some models predict that if the concentration of CO_2 double, regional temperature in Indonesia will change by between 1.6^o Celsius and 4.3^o Celsius, which might disrupt hydrological cycle and reduce food productivity. For instance, productivity of soy bean, corn and rice will be reduced by 20%, 40%, and 2.5% respectively, with a loss of Rp 23 billion per year (MoE, 1998).

Public health will also be threatened by climate change. It is predicted that the incidence of malaria, dengue fever, and diarrhea will increase. In case the concentration of CO_2 doubles, the incidence of malaria will increase from about 2,700 cases in 1989 to about 3,200, while dengue fever will increase more than four-fold from 6 to 26 cases per 10,000 people (Asian Development Bank,1994)

A rise in sea level will affect the islands and coastlines, making much of the low-lying lands practically inhabitable. A sea-level rise of 60 cm will inundate about 800,000 houses will be inundated, and make 1,000 km of low-lying roads and five seaports vulnerable to floods, costing Indonesia about Rp. 30 billion per year. Meanwhile tourism industry will lose about Rp. 4 billion per year due to devastated beaches. The economic toll from climate change may run as high as 10% of Indonesia's income by 2070 (Asian Development Bank, 1994).

Meanwhile, despite the efforts to mitigate them, Indonesia's greenhouse gas emissions are projected to increase rapidly. Indonesia's emissions of major greenhouse gases in 1994, the last year for which an emission inventory is available, amounted to approximately 343 million tons (megatons, MT) of CO_2 equivalent. A further 156 MT of net CO_2 emissions were caused by changes in land use, primarily deforestation. Between 1990 and 1994 Indonesia's emission of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) grew at a rate of 1.8% per year. CO_2 accounted for approximately 70% of the total emissions (MoE, 1998).

Economic sectors with high-energy consumption (such as energy, industry, transport), accounted for approximately 35 to 60% of the total emission between 1990 and 1994. The forestry sector was the second largest contributor, responsible for between 20 and 50% of emission while the agriculture sector contributed between 15 and 25%. Fluctuations in emission during this period were caused primarily by changes in the rate of forest harvesting. As economic growth is projected to pick up again after the 1997 crisis, so too will the emissions, *albeit* at a lower rate. Carbon dioxide emission from the sectors with high energy demand is projected to triple between 2000 and 2020 as the share of coal in the energy supply is expected to increase by a factor of ten (MoE, 2001).

Nevertheless, Indonesia contributes to only about 2% of the billion tons (Gigatons, GT) of global total emission, therefore the mitigation measures should be undertaken collectively with the international climate negotiations since the early 1990s. It has ratified the United Nations Framework Convention on Climate Change (UNFCCC) through Law No.6/1994, and signed the Kyoto Protocol with a plan to ratify it soon. The Ministry of Environment has coordinated various studies related to climate change, ranging from the socio –economic impact of climate change to possible actions to be taken Indonesia to mitigate climate change. The latest is the national strategy study on the clean development mechanism under the Kyoto Protocol. A National Action Plan has been formulated by the government, with the assistance of non-governmental organizations and academic institutions.

Both the UNFCCC and the Kyoto Protocol allows developing countries such as Indonesia to increases their emission due to their development needs, but in cases where choices of low emission technologies. Taking the path of a more efficient and environmentally friendly development is a precautionary approach that will be beneficial for Indonesia in mitigating climate change.

In Indonesia, policy development on climate change is the responsibility of the Ministry of Environment who also chairs the National Committee on Climate Change, which has been in operation since 1993. The National Committee functions as a coordinating forum for relevant agencies, academics, and non governmental organizations on climate change issues. However, weak coordination remains the main obstacle to better policy development.

3. Policy and Measure for Environmental Management

1) Major Barriers to Sustainable Development

The main national constraint in implementation of the sustainable development in Indonesia is the lack of accountable representation and democratic governance, or good governance. Not enough effort has been take to raise the awareness of the general public, including corporations, about the significance of Agenda 21. As a result, the National Agenda 21, which provides a guideline for planning of sustainable development at various levels has not been fully implemented. In addition, the term sustainable development is use as jargon denote environmental consideration only, rather than a holistic concept for development. For the past thirty years, the development planning an implementation has been conducted in a centralize and fragmented manner. These conditions were exacerbated by inadequate political will and lack of a strong an effective system to implement sustainable development and Agenda 21.

Indonesia has limited financial, technological and human resources capacity to support its efforts in implementing Agenda 21. Funding for sustainable development is limited due to inappropriate budget allocation and a relatively high rate of debt service. Meanwhile, Indonesia has limited knowledge and capacity to make maximum use of the new institutional and financial opportunities that are emerging, such as debt swap for sustainable development and clean development mechanism. Low budget allocation for education and poverty are factors leading to inadequate human resources for development This was exacerbated by the under utilization of existing qualified human resources as well as inappropriate placement of highly qualified people. Furthermore, budget allocation for research and development in public and private sector is also low. In term of International constrains, the declining trends of ODA flows from developed countries has raise the concern of less financial availability for sustainable development in the future for countries like Indonesia, particularly given the current economic crisis. Similarly, developed countries have not fulfilled their commitment to provide, including Information and Communication Technology (ICT). This is very important tool for the development an archipelago country like Indonesia.

On the other hand, Indonesia often receives international transfer of obsolete technology which are environmentally and socially harmful.

Finally, the international sustainable development discourse has somewhat undermined by economic liberalization agenda, particularly the trade liberalization. Many rules for multilateral trade, particularly at the World Trade Organization (WTO), may not be in harmony with the existing regulations for ecological and social sustainability.

Like many other countries, particularly developing countries, Indonesia faces many constrains in the implementation of Agenda 21 and national sustainable development. These constraints need to be identified so that they can be addressed in future development planning.

1)-1 Lack of Awareness and Common Platform

There is an almost general lack of awareness about both Agenda 21 and sustainable development among government officials, communities and corporation, even academicians. For instance, only the Ministry of Environment, Ministry of Foreign Affairs, few officials at sectoral ministries (mining, forestry, tourism), a few NGOs and a handful of academics know about the National and Sectoral agenda 21 documents. This is due mostly to the fact that not enough effort has been made to raise general public awareness about the significance of Agenda 21. As a result, the National Agenda 21, which provides a guideline for planning of sustainable development at the national, local or sentral level, has not been fully implemented.

In the same manner, sustainable development is an issue that is often discussed at seminars and policy discussions, but the government has not formulated integrated policies, let alone facilitated the implementation of sustainable development. In addition to a general lack of awareness, there is no common platform on what constitutes sustainable development and how it should be implemented. Often, the term sustainable development is used as a jargon to denote environmental consideration only, rather than a holistic concept for development.

Even the environmental concern has not been fully integrated into development planning. There is also a lack of common perception about what constitution good government for sustainable development.

1)-2 Centralized and Fragmented Approach to Development

For the past thirty years, development planning and implementation has been conducted in a centralized and fragmented manner. Most major decision are made by the central government, leaving very little space for local governments to plan development based on local potentials and needs. In the same manner each sector particularly with strong economic interest (such as forestry, mining, fishery, agriculture, industry), implements programs without coordination among each other or with relevant agencies such as the Ministry of Environment. Ministry of Health or even the Coordinating Ministry of Social Welfare. As a result the integration of environmental and social concerns into the decision making for economic development is good only on pepper, but is week in actual implementation. Although Indonesia has ratified many environmental agreements and even formulated many of its own laws, they are note effective for two reasons; fist the sectoral laws have not taken the environmental regulations into account; secondly, often the environmental law are not followed by implementation guidelines and therefore enforcement and compliance are week.

Some efforts have been made and are being formulated to address the above constraints. Among others, the formulation of the Indonesian National Planning Program (PROPENAS) is now a more open, albeit not perfect, process than in past. Thus there is room for major groups to advocate for the three pillars of sustainable development (economic, social and environmental) to be address in a balanced and integrated manner. Secondly, the Law No.22/1999 on Regional Governance now enables local governments to formulate their own development plan with input from the local population.

Law No.25/199 on Fiscal Balance should be able to provide local governments and communities with more financial resources and independence in managing natural resources for economic development. But after decades of centralization, there is need to strengthen local capacity. Also an ideal arrangement needs to be worked out between the national and local level governments.

1)-3 Inadequate Political Will, Institutional Capacity and Law Enforcement

The implementation of sustainable development has been hampered by inadequate political will. This is reflected from the fact that the government has only recently started the process to put in place basic arrangements for the functioning of good governance, which is the main prerequisite for the conduct of sustainable development. The decision making process within government structures has not been fully transparent and often does not involve the participation of stakeholders. This is exacerbated by poor access to information.

An attempt was made to address some of these constraints through the Good Environmental Governance project undertaken by BAPPENAS with the assistance of UNDP in 1998-1999. The project produced an Advisory Document which provides recommendations to the government, private sector and civil society on priority reforms that might be taken to resolve major environmental problems facing Indonesia.

Indonesia also lacks a strong and effective system to implement sustainable development and Agenda 21. Thus far, the Ministry of Environmental is charged with developing the national and sectoral Agenda 21, in cooperation with various agencies. It is also responsible for the coordination of line ministries in terms of environmental management. However, Agenda 21 and, for that matter, sustainable development, is more than just environmental management and the MoE does not have a mandate to plan and implement sustainable development.

Thus the arrangement has not been effective, But recently the government has put the MoE under the umbrella of the Coordinating Ministry for Economic Affairs (Formerly it was under the Coordinating Ministry For Social Welfare) and this is considered more appropriate in the effort to mainstream sustainable development issues into economic development. The process of setting up the Indonesian NCSD is another attempt that may be able to address this issue.

Sustainable development is also hampered by insufficient legal instruments and weak enforcement. Many of the relevant policies and regulations are incomprehensive, ambivalent and overlapping, thus making enforcement difficult. They are often formulated without public participation thus communities do not know about these regulations and therefore cannot participate in their enforcement. Law enforcement agencies themselves are weak due to lack of funding, quality human resources and infrastructure, In many cases law enforcement agencies have not understood regulations particularly in cases such as pollution, forest fire, illegal logging and illegal trade of endangered species.

1)-4 Inadequate Provision for the Involvement of Major Group

For more than three decades, development process in Indonesia has been conducted in top-down manner by excluding the participation of major groups. It is one of the reasons that the largest part of the Indonesian people has never heard of Agenda 21 or sustainable development, as well as the international commitments that the government has made. This also means that the governments has made. This also means that the government has not tapped the potentials of major groups to ensure sustainable development. For instance, nongovernmental organizations have an important role to play in policy reform, community education and empowerment and in social work geared towards sustainable development. Yet, their voices have been very little heard. Similarly, local and traditional communities have experiences and knowledge in local level sustainable practices.

But their role has not been recognized and they have in fact been marginalized from the entire development process.

Although currently there are attempts to integrate ideas and practices of major groups into the development process, in general genuine public participation has not been fully realized. This is mainly due to inadequate political will on the part of the government and lack of adequate systematic and transparent mechanisms to ensure public participation in sustainable development planning and implementation.

1)-5 Inadequate Financial for the Technological and Human and Resources

Indonesia has limited financial, technological and human resources capacity in its effort to implement Agenda 21. Even before the 1997 economic, when Indonesia was enjoying a high economic growth rate, funding for sustainable development was already limited due two to inappropriate budget allocation and a relatively high rate of debt service. The situation has been worsened since the crisis occurred. Indonesia's dependence on loans and grants from international financial institutions and bilateral donors/creditors is relatively high. A disproportionately large part of the fund is spend on subsidizing the ailing banking sector while the country lacks a comprehensive economic recovery scheme. Meanwhile, Indonesia has limited knowledge and capacity to make maximum use of the new institutional and financial opportunities that are emerging. The opportunities to utilize the debt for nature swap or, the better derivative of which such as the debt for sustainable development swap schemes have increased in the last five years, but only few have realized these opportunities.

Financial constraints have caused problems in human resources development. Low budget allocation for education and poverty are factors leading to inadequate human resources for development.

The government has a low capacity to capitalize on the limited skilled and qualified human resources since appropriate economic and administrative incentives are lacking. This has exacerbated the under utilization of existing qualified human resources as well as inappropriate placement of highly qualified people.

Technological constraints are due to lack of proper planning and incentives at the national level and lack of technology transfer at the international level. Domestic technology development, particularly for sustainable development, is very weak because budget allocation for research and development in public and private sector is low. In most cases the government merely imports the technology, which may not be suitable for local purposes.

2) Public Sector Investment

Investment in infrastructure include power, transport, communications, irrigation and municipal water supply and sanitation. In order to support the rapid growth of private sector investment, and thus the creation of jobs and non-oil exports, infrastructure investments should increase significantly (by nearly 50% in comparison with expenditures under REPELITA IV). Investments in human resources development and poverty reduction, including health, education, basic agriculture, population and family planning and other related programs should also absorb a higher share of a growing public sector budget. (Investments in human resources development, which have benefited from massive investments in physical capacity in the past, will emphasize increasing quality, while poverty-related programs will emphasize a more targeted approach to the remaining pockets of poverty on Java and in the outer islands). Other investment, particularly in state-owned enterprises, have declined markedly, and-consistent with the role of the private sector as the new “engine of growth-this trend is expected to continue.

Table 7. ***Priorities for Public Sector Investment***

	Actual (%) 1984/85-1988/89 (REPELITA IV)	Estimated (%) 1989/90-1993/94 (REPELITA V)	Indicative Projection (%) 1994/95-1998/99
Infrastructure	43.0	59.0	61.0
HRD/Poverty Sectors	25.0	25.0	27.0
Other	32.0	16.0	12.0
Percent of GDP	8.8	9.4	10.2

Investment in urban water supply and drainage, sewerage and sanitation (including related investments under the Kampung Improvement Program), and solid waste management should rise substantially, from Rp 2.0 trillion in REPELITA IV, and an estimated Rp 1.3 trillion in REPELITA V, to about Rp 5.9 trillion during REPELITA VI (all in 1989 prices). The share of these expenditures as a percentage of GDP would rise from 0.2% to 0.4%. Similarly, within the growing allocation for road transport, investments in urban roads and other transport-related infrastructure are expected to expand substantially in order to deal with the challenges of congestion and vehicle emissions arising from the rapid pace of urbanization and the increasing number of motorized vehicles. Urban transport investment, therefore, would represent roughly 0.5% of GDP (excluding investment in natural gas/CNG development under the power sector).

The budget allocations whose sole or primary purpose is either to provide an environmental public good or to address some negative environmental externality. They include four categories of expenditures: (1) routine expenditures by agencies that exist solely for environmental management; (ii) routine expenditures on conservation, protection and rehabilitation by natural resource management agencies (but not units that primarily support natural resource extraction); (iii) routine expenditures by environmental units in other line agencies; and (iv) development expenditures on projects that are totally or primarily aimed at environmental management.

The Ministry of Finance (MOF) classifies expenditures in both the routine and development budgets into 20 budget sectors. These sectors relate to functional categories, such as defense and education. The sector that nominally pertains to environmental management is sector 10, Environment and Spatial Planning. This sector include the major environmental agencies, in particular the Ministry of Environment (Kementerian Lingkungan Hidup, KLH) and the Environmental Impact Management Agency (Bapedal, Badan Pengendalian Dampak Lingkungan). As the analysis below reveals, however, only a minority of expenditures in sector 10 are actually environmental, an a substantial amount of environmental expenditure occurs in sectors whose primary function are non-environmental.

Figure 1 compares the sum of development and routine expenditures on all activities in sector 10-non-environmental as well as environmental-with the sum for just core environmental activities in the sector. As noted in the previous section, the estimates of development expenditures include expenditures of own resources only.

The figure reveals that official statistics on total expenditure in sector 10 greatly overstate core environmental expenditure in that sector, which was only about one-fifth of its total expenditure in most years. The figure also shows that core environmental expenditures declined sharply during the crisis years, after rising steadily through

FY96/97. Because of the cumulative declines during FY97/98, core environmental expenditures in FY98/99 were only three-fifths of the amount in FY94/95.

Figure 2 decomposes the estimates of core environmental expenditures in sector 10 were finance by the development rather than the routine budget. The heavier cuts in development expenditures during the crisis did not reverse this patern, because the difference between the development and routine budgets was so great before the crisis (more than an order of magnitude). The budget for natural resources/environmental/spatial planning sector for the year 2003 estimated around 0.76% of the total development budget (67.05 trillion Rp). This budget should be increased for 4.0 – 5.0 % of the total budget for development.

Figure 1. Sum of Development Expenditure (Own Resources) and Routine Expenditure in Sector 10 (Environment and Spatial Planning) of the National Budget (Rp billion, constant 1993/94 prices)

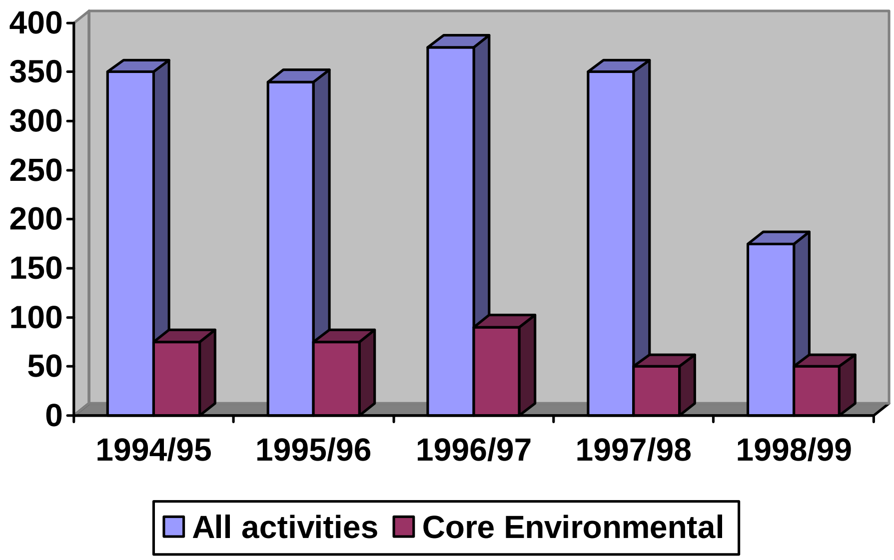
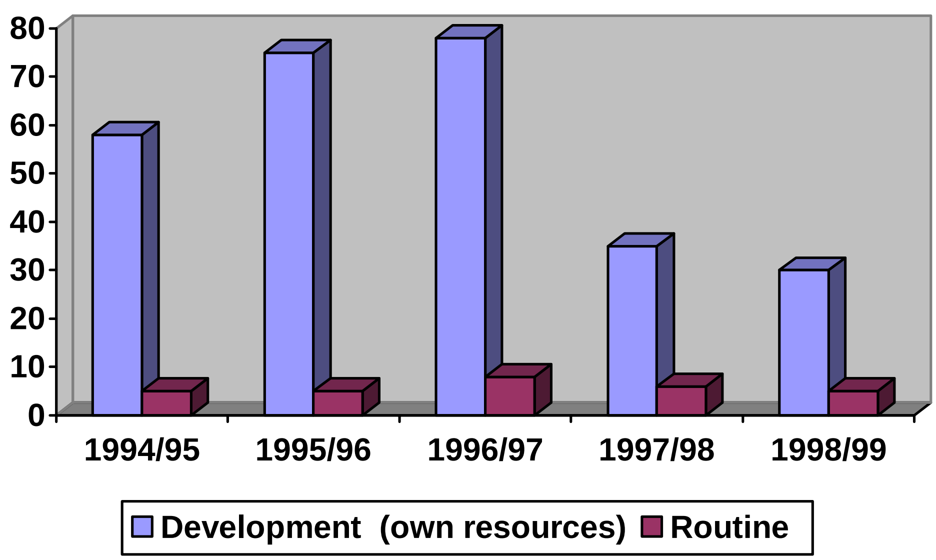


Figure 2. Composition of Core Environmental Expenditure in Sector 10 of the National Budget (Rp billion, constant 1993/94 prices)



3) Protecting the Urban Environment

To deal with the rapid growth of urban areas, and to meet the existing backlog of demand for urban services, will require a substantial increase in public sector investment. It will also require more effective policies and incentives for environmentally responsible behavior by firms, households and individuals, and greatly enhanced institutional capacities for urban environmental planning and management. The main challenge is to define a strategy for the management of urban areas that accommodates the need for growth while protecting the quality of the environment. At stake is not only the efficiency of the "urban-enterprise"–with significant implications for overall economic growth-but also the health and welfare of Indonesia's urban citizens.

In most large cities, improving the availability of safe water will require a major expansion of the piped water supply. While the distribution network will need to be extended, most cities could increase in the supply of treated water significantly simply by reducing "unaccounted for" water in the current system, which is often as high as 35-40%. Increasing the number of connections is constrained by the high "up-front" cost of connection. To overcome this difficulty, part of the connection fee could be included in the monthly charges for water. Supply interruptions and low pressure in the pipes force many households to install home reservoirs, to use pumps applied directly to the pipes, or rely on other sources of supply (e.g., shallow wells). Given the deteriorating condition of many large urban water supply networks, low water pressure, combined with fecal contamination of groundwater, leads to contamination of piped water through infiltration. To improve quality and reliability will require a major effort to improve the quality of construction and "O&M". This will also help to reduce "unaccounted for" water, and thus improve the reliability of the system. Greater reliability of piped water is also needed to reduce the demand for groundwater in cities where excessive extraction for industrial and residential use is a major problem.

To reduce fecal contamination of urban water supplies will require a significant improvement in the availability of **sewerage and sanitation services**.

Many parts of most Indonesian cities can continue to rely on "private sector" approaches (pit latrines and septic tanks), but the conditions of their use will have to be improved (e.g., the proper removal and disposal of septic tank sludge). Water-borne sewerage collection systems are highly expensive, and are unlikely to be economically justifiable for most residential areas in the near future. The intensive development of commercial areas, however, may justify the investment costs needed in trunk lines, and could be cost-effective for high-rise buildings that would otherwise have to invest in their own treatment plant to meet local environmental standards. GOI has already initiated a planning exercise covering up to 25 cities to assess their sanitation needs. Preliminary indications are that up to 60% of the urban areas can continue to rely on-site solutions, but the rest will need to be connected to a sewerage system. The “least cost” technical options will need to be defined, and issues of financing and cost-recovery-and the institutional arrangements for managing the system within each city-will need to be resolved.

Improvements are needed in both the collection and disposal of **urban solid waste** in all of the larger cities of Indonesia. Even in the poorest neighborhoods, waste removal is a high priority, and primary waste collection is often managed by local residents. Greater involvement of the private sector in waste collection should be encouraged, including the design, construction and operation of “transfer stations” in larger cities. Long-term planning is needed for the sitting of future landfills, and improved management of existing landfills should be a high priority-especially those located in environmentally vulnerable areas. Waste recycling can reduce the need for landfills, and is already a thriving activity in many cities-with strong support from non-governmental organizations.

The number of motorized vehicles in Indonesia more than doubled during the 1980s, to 9 million vehicles, a third of which are in urban areas, and this trend will continue. Expansion of the urban road network, however, has lagged behind, leading to rapidly growing traffic congestion and vehicle emissions in the major metropolitan areas. Reducing the growth of traffic congestion will be essential for minimizing efficiency losses and for protecting the health of the urban population.

(In Bangkok, for example, nearly a third of the city’s potential GDP is lost because of congestion-induced travel delays). While much can be accomplished in the medium term through a combination of policy reform and public sector investments, longer-term solutions will require a comprehensive approach, including : more effective land-use planning; improved traffic management and engineering; higher technical standards for motor vehicles; the introduction of cleaner fuels; expansion of public transport system (and their quality and reliability; and more effective policies for demand-side management.

The potential for reducing energy-related air pollution in Jakarta was examined in a recent Bank report. That report concludes that pollution-based fuel taxes, together with the introduction of unleaded gasoline and CNG (Compressed Natural Gas), would pay significant dividends. Compared with a six-fold increase in SPM (Suspended Particulate Matter) by the year 2020 under the “unchanged practices” scenario, SPM would only increase by about 90%, and emissions of lead would decline by 80%. The economic benefits, in term of reduced health costs, would be quite significant. Health damages from energy use would be reduced by 84%, and total health damages from SPM and lead would be reduced by over 50%. As these results suggest, however, without complementary measures to control the emission of non-energy-related pollutants (from industry and the burning of solid waste), the health costs of air pollution will continue to rise.

4) Controlling Industrial Pollution

There are two keys issues of industrial pollution control facing Indonesia today : (a) what to do about pollution from existing firms, and (b) how to "delink" future pollution loads, and the damage they cause, from the expansion of industrial output. The first is important, given the current level of industrial pollution, but the second is the more critical issue : by the year 2010, assuming continued rapid growth, existing firms will represent only about 15% of total industrial output and, by the year 2020, less than 8%. Coming late to the challenges of industrial pollution control carries with it enormous advantages-not less of which is the opportunity to learn from the mistakes of others.

The recommended strategy for cleaning up pollution from existing firms involves six keys elements. **First**, continue to improve the incentives framework for efficient private sector growth, including market-based prices for natural resources and "full-cost" pricing of urban services. **Second**, carefully target the pollution control effort, by industry, by pollutant and by area-focusing on the worst polluters and the most damaging pollutants in the most threatened areas of the country. **Third**, continue efforts to strengthen the institutional capacity for pollution monitoring and the enforcement of pollution standards, especially at the provincial level. **Fourth**, give highest priority to encouraging the adoption of "clean technology", and especially waste minimization initiative, to reduce pollution loads at the least cost while simultaneously enhancing industrial efficiency and competitiveness. **Fifth**, rely increasingly on the power of public information-about trends in ambient environmental conditions and firm-specific pollution practices-to build consensus, capture the attention of industry leaders, and bring community pressure to bear on unresponsive firms. Finally, move quickly to develop and implement plans for controlling toxic and hazardous waste, including storage, transport and treatment issues, with special attention to the needs of smaller firms and emphasizing the importance of reducing the use of such materials in the production process.

Reducing the level of pollution from new and expanding firms will require more effective attention to environmental issues and concerns at the initial stages of project design and approval. The recommended strategy includes four key elements. **First**, use existing environmental impact assessment ("EIA") procedures for prior review of potential environmental effects, but target the effort and ensure professional and expeditious reviews-possibly by "contracting out" with an experienced firms. **Second**, expand the review to include issues of technology choice. Wherever, there are significantly different options available, require further justification for adopting older, less inefficient and more highly polluting technologies. **Third**, ensure that provisions are made for appropriate "end-of-pipe" pollution abatement in new and expanding firms, to avoid more expensive "retro-fitting" latter on. **Fourth**, ensure effective local government input on location issues, especially for major projects but also for any that are highly polluting, and encourage the location of medium-and larger-scale firms in private sector-sponsored industrial estates.

4. The Importance of Institutional Strengthening

Indonesia has had a long-standing commitment to the basic concept of sustainable development and environmental protection, and has already established a legal framework and regulatory procedures designed to implement those concepts. As in most developing countries, however, the institution responsible for environmental management face a variety of constraints in carrying our their mandate. As a result, environmental issues and concerns are not yet effectively integrated in development planning and implementation.

There are a large number of institution in Indonesia that have an important role to play in environmental protection and the sustainable management of natural resources, at both the national and provincial levels. Most are in the public sector, but non-governmental institutions, including universities and NGOs, will be increasingly important in the coming years. At the national level, the key agencies include the State Ministry for Environment, central agencies responsible for the management and use of natural resources (Forestry, Agriculture, Industry, etc) and others responsible for key aspects of development planning and coordination (e.g. the State Planning Agency – BAPPENAS, and the Ministry of Home Affairs – responsible for administration of provincial and local governments).

The State Ministry of Environment. The origins of MLH can be traced to the preparations made by GOI for the UN-sponsored "Conference on the Living Environment" held in Stockholm in 1972. As a follow-up to that work, a "Committee for the Formulation of Environmental Policies" was set up under the leadership of the Vice Chairman of BAPPENAS, reporting directly to the President. In 1978, a Minister of State for Development Supervision and Environment (PPLH) was created, out of which grew the State Ministry for Population and Environment (KLH) in 1983. The last major reorganization of KLH occurred in 1988, and resulted in the formulation of a "priorities and planning committee" (to be assisted by a Policy Analysis Unit) directly under the Minister, and four division, each headed by an Assistant Minister. With the recent cabinet changes, however, the population responsibility of KLH were combined with Indonesia's Family Planning Program activities to form a new Ministry, and the State Ministry for Population and Environment (KLH) became MoE.

Table 8. The Institutional Framework for Environmental Management

------------------------------ National Level Institutions ---------------------

Central Ministries	Environmental Agencies	Other Key Agencies
- Industry - Agriculture - Forestry - Mines and Energy - Public Works - Communication and Transportation Assessment - Ministry of Home Affairs - Health, etc.	- State Ministry for Environment (MLH) - Environmental Impact Management Agency (BAPEDAL) - Environmental Studies - Centers Network (BKPSL) - Government-sponsored Agency (BPN) and Non-Profit Research Organization - Private Sector / Non Government Organization (NGOs)	- State Planning Agency (BAPPENAS) - Central Bureau of Statistics (BPS) - Mapping Agency (BAKORSURTANAL) - Land Management - Technology Agency (BPPT)

------------------------ Regional Level Institutions --------------------------

Offices of Central Ministries	Environmental Agencies	Key Government Agencies
- Industry - Agriculture - Forestry - Mines and Energy - Public Works - Communication and Transportation - Health, etc.	- Bureaus of Population and Environment (BKLHs) - Government Laboratories - University Environmental Studies Centers (PSLs) - EIA Commissions (Komisi Industry Daerah AMDAL) - Prokasih Teams etc. - Private Sector /NGO	- Office of the Governor and Staff - Planning Agency (BAPEDAs) - Provincial Government Office for : Agriculture Forestry Police, Prosecutors and the Courts

The Environmental Support Network (PSLs and NGGs). A part of MoE mandate is to develop environmental skills, encourage greater awareness of environmental issues, an enhance the opportunities for wider participation in the process of environmental management. A major initiative supporting these objectives has been the development of university-based Environmental Studies Centers (PSLs). A primary objective of the PSLs has been to enhance the availability of environmental expertise to GOI officials responsible for environmental planning and policy analysis. The demand for sound economic analysis of environmental issues, however, has greatly exceeded the supply of well-trained university graduates. Despite its best efforts, therefore, MNL has not bee able to establish its planned Policy Analysis Unit, and has had to rely on (mostly expatriate) consultants to carry out policy-related studies. Government-sponsored and non-profit research organizations.

A second initiative has been to encourage the development of environment of environmental NGOs (non-governmental organizations). There are literally hundreds in Indonesia, at the national, provincial and local level. Many focus their activities on issue of sustainable growth and environmental protection. They are quite diverse, and their roles are continuing to evolve. Many, such as the national Consumers Union (YKB), have sponsored education and awareness campaigns; others, such as the Government-sponsored Family Welfare Movement (PKK), have worked directly with local communities in trying to improve environmental conditions; and still others, such as the national level, and for more equitable implementation of those policies at the local level. More recently, NGOs with links to the business community (such as the Business Council for Sustainable Development, which includes a number of leading Indonesian businessmen) are beginning to emerge.

A few NGO’s have managed to grow in both size and sophistication, an their views are increasingly represented in public discussion of emerging environmental issues. Many of these NGOs belong to WALHI, the umbrella network of environmental NGOs, which was established in 1980. In most cases, however, environmental NGOs are relatively small organizations characterized by voluntary (or low-paid) staff and a shortage of professional expertise and administrative skills. While official Government policy encourages the involvement of community and self-help.

1) Environmental Management in the Provinces

The Provincial government is responsible for environmental management at the regional level. In principle, the authority vested in the provincial government is wide-ranging : to coordinate the implementation of development plans; to set environmental standards; to approve location permits and other licenses for new projects; to monitor adherence to environmental laws and regulations; and to enforce those laws. The institutional capacity for environmental management at the provincial level, however, is still quite weak. This shortcoming is compounded by a number of other factors, including the strongly hierarchical administrative structure of the national government, the fact that development planning is largely sector ally-oriented and centrally-driven, and the rather severe shortage of environment-related skills available to provincial and local government agencies.

Capacity for Pollution Monitoring and Control. A noted above, provincial governments have primary responsibility for pollution monitoring and control. Their capacity for doing so, however, is constrained by a combination of factors, including the diffusion of responsibility and authority for various aspects of environmental monitoring, shortcomings in the quality of laboratory analysis of industrial waste emissions, and the lack of experience by the judicial system with the administration of environmental laws and regulations.

2) Policy Responses and Legislative Framework for Water Quality Management

Water pollution control is administered by various laws. Many of these laws were originally enacted to primary regulate the use and management, rather than protection, of natural resources and the environmental.

With decentralization, municipalities and rural kabupaten (districts) are entitled to plan and manage environmental services, construction and operation of central treatment facilities for wastewater. Decentralizations may eventually brig about improvements in the management of water quality, since decision-makers will be nearer the problems and the affected constituencies.

It is too early to assess any change in the situation, but one negative result is that ambient river quality monitoring data are no longer being sent to a central location. It will therefore become increasingly difficult to assess the condition of Indonesia’s waters in any comprehensive manner.

Other major obstacles to improving water quality include weak and inconsistent enforcement of existing laws and regulations, failure to implement the 1995, effluent discharge permit program, lack of standard operating procedures for hospitals to handle wastewater, and lack of sufficient effluent flow data to determine hospital pollution loads.

Enforcement of existing environmental laws is weak due to inadequate coordination among various agencies low technical capacity for proving violations, and limited access to information. However, to initiate regulatory reforms and improve firms compliance with environmental standards, GOI has been trying to complement existing command-and-control regulations with market-based instruments and public disclosure tools, albeit with limited success. These instruments are intended to provide incentives that will result in a change in the behavior of water users and polluters. Although a pollution charges program is outline to control water pollution from industrial enterprises, implementation has been only limited to the pilot phase in one region in the country. The challenge before decision makers is to apply this program in a coherent way to allow for reductions in the cost of compliance and provide incentives for polluters. In addition, application of economic instruments (such as taxes) for the extraction of ground and surface water, as well as appropriate water resources pricing, will also spur conservation efforts.

Currently, water quality in many rivers is not regularly monitored. In addition where water quality monitoring is conducted, some sites are monitored weekly and daily, but results are reported monthly/yearly. There is no mechanism to incorporate monitored data in a timely manner, into rehabilitation schemes.

The Clean River Program or Program Kali bersih (PROKASIH), inaugurated in 1989 by GOI, was devised as an innovative response to growing pollution loads in critical watersheds. The program targeted the worst industrial polluters, in 24 highly polluted rivers, with a stated goal of reducing their pollution loads by 50 percent within two years, on a voluntary basis.

The Prokasih Program involved five steps : (I) establishing of local Prokasih teams; (ii) identifying specific firms in highly polluting industries; (iii) getting these firms to sign voluntary letters of commitment to reduce pollution loads by 50 percent within an agreed timeframe; (iv) monitoring subsequent result; and (v) applying increasing pressure on those not making efforts to comply with their commitment. As of 1994, voluntary agreements were in place for more than 2,000 firms; pollution loads appeared to have been reduced in some provinces, particularly those with the strongest technical capacity to pursue the objectives of the PROKASIH program.

The implementation of PROKASIH was carried out by provincial authorities, with the support of central agencies as need. In addition, the media were encouraged to report on environmental damage caused by pollution and on significant clean-up efforts, and NGOs helped to facilitate the participation of community groups in related environmental activities. Despite its achievements, the overall impact of the Prokasih Program is considered mixed, due to the limited, voluntary nature of the program, as well as the NGOs limited capacity to monitor the program.

Table 9. ***Water Quality Legislation***

Legislation	Regulated Activities and Issues
Water Pollution Control and Management Regulation - 2001 (Government Regulation No. 82)	Currently being drafted to replace Government Regulation No. 20 of 1990 and the National Water Act
Sea Pollution Control Regulation 1999 (Government Regulation No.19)	Regulates discharges of pollutants into sea water
National Water Act – 1997	Provide a framework for water quality management
Water Pollution Control and Management Regulation – 1997	Provides for the preparation of a water quality strategy, regulates the classification of water bodies' use, and monitoring of water pollution
Decree for Coastal Conservation Program (Program Pantai Lestari No. KEP-45/MENLH/11/96)	Provides framework for pollution control of coastal and mangrove areas and coral reefs.
Surface Water Quality Standards – 1995	Classifies surface water according to use functions
Control of Water Quality in Water Resources regulations – 1990	
Liquid Waste Quality Standards – 1990	Regulate the levels of effluent discharges and restrict concentration of levels of chemical and/or metal pollutants from different types of activities
Clean River Program Decree – 1995 (Program Kali Bersih No. KEP-35/MENLH/7/1995)	Designates rivers, water quality an monitoring standards for the PROKASIH program

3) Policy Response and Legislative Framework for Air Quality Management

Efforts to manage air quality have been hampered by weak enforcement capacity. In addition, the knowledge base to effectively manage these pollutants is poor-there is little in the way of detailed emission inventories or source characterization, dispersion or economic modeling and government monitoring capacity is limited. Overall, air pollution control has not received GOI attention and funding at anywhere near the level warranted by the very large and well-documented health consequences.

The number of public participation in Indonesia is mainly passive, with authorities providing information to the general public. In the national Ambient Monitoring Networks program, there are thirty data display screens which display Pollution Standard Index (PSI) values for the public. However for reasons that are not at all clear, actual monitoring information for individual pollutants is not available to the public. Thus, this index would have limited usefulness for individuals and agencies interested in making assessments and investigations on the short-term and long-term averages of specific pollutant concentrations. This is nevertheless a positive step towards informing the public of air quality. Before 2000, neither print not electronic media published monitored air quality data.

The Ministry of Environment launched “Program Langit Biru” (Blue Sky Program) in 1991 to address air pollution problems. For stationary sources, the program gives priority to power plants, cement, paper and pulp, and steel industries.

The Clean Air Program (CAP), announced in 1991, is an effort by the City of Jakarta to increase public awareness of air pollution. Under CAP, emission tests were conducted in road and parking lots in Jakarta by the City Environmental Impact management Agency (BAPEDALDA) in cooperation with the City Police (POLDA) between 1996-2000. Parameter such as HC, CO, and opacity were tested. In addition, pilot “Emission Reduction Weeks” (PUTE) were held in Jakarta under CAP where free emissions testing were conducted on vehicles.

Cars not meeting the emissions standards were then serviced. Emissions were tested after servicing to ensure that they finally met the standards. The results of the PUTE reveal that for the majority of cars, HC and CO emissions drop to acceptable levels just after servicing ad rice again within a few months if vehicles are not regularly maintained.

Table 10. ***Air Pollution Legislation***

Legislation	Issues and Regulated Activities
Degree No. KM-8-1989 of the Minister for Communications addresses Vehicle Emissions Standards in the Context of Road Worthiness	This decree limits CO and HC emissions from idling gasoline powered vehicles
Act No. 14 (1992) on Traffic and Land Transportation	States that all motorized vehicles are subject to testing with respect to emissions and noise
Government regulation No. 41 regarding the Control of Air Pollution of 1999	This regulation describes responsibilities for air quality monitoring and data collection, such as emissions inventories. A permit process and sanction was also outlined. Implementation and supervision of vehicle road worthiness (including emissions testing) is to be conducted by the Ministry of Communications
Ministry of Energy and Mineral Resources Degree No. 1585/K/32/ MPE(1999) on criteria for Marketing of Gasoline and Diesel in Indonesia	Specified the date of lead phase-out in gasoline as January 1, 2003
Government of DKI Jakarta Decree No. 95 (2000) on Jakarta Tightening of Emission Quality Standard from Moving Source	Requires that all vehicles comply with Emission Quality Standards Describes that inspection will be followed by maintenance, using a decentralized I & Management system. Involves the private sector, with local government as facilitator
Governor of DKI Jakarta Decree No. 1041 (2000) on Motor Vehicle Emission Standards for DKI Jakarta	Sets emission standards, Voluntary based. Issued by local/city government

4) Policy Responses and Legislative Framework for Solid Waste Management

Specific laws and regulations were developed to properly and efficiently manage solid waste services. With decentralization, municipalities and rural kabupaten are entitled to plan and manage environmental service, including solid waste management. While decentralization is expected to bring about improvements in the quality of services offered, it is too early to assess any change in the situation.

Before decentralization, solid waste management spanned across several departments and ministries ; the Ministry of Public Works, Ministry of Home Affair, Ministry of Health, Agency for Technology Assessment and Development, BAPEDAL, and the Sub-Directorate for Solid Waste Management. This structure resulted in overlapping responsibilities and weak implementation and enforcement of solid waste laws and regulations.

With decentralization, local governments have acquired more responsibilities in planning and implementing solid waste management programs within their locality.

Enforcement of existing law is generally weak due to lack of political will, inadequate coordination among various agencies, low technical capability for proving violations, limited access to information, and lack of adequate funding. To improve compliance, GOI and local governments are trying to complement existing command-and-control regulations with market-based instruments and public-private partnerships.

The KENALI B3 Program, set up by BAPEDAL in 1998 is a strategic partnership program for managing toxic and hazardous waste. It aims to increase awareness among hazardous waste producers about regulations and the need to comply with them. Under this program, an increasing number of companies are said to have applied for permits to deal with hazardous wastes.

Table 11. ***Hazardous and Toxic Waste (B3) Legislation***

Legislation	Regulated Activities
Environmental Management law-1997	Contains general provisions for solid, toxic, and hazardous waste management
Government regulation No. 74 of 2001 Concerning Hazardous and Toxic Waste management	Regulation states that : - Every person and corporation is prohibited to dispose of B3 waste directly into water, soil, or air; - B3 waste producer are required to process B3 waste; - Permits are needed for collecting, transporting, and processing, including final dumping
Head of Environmental Impact : Agency Decree No. KEP-68/BAPEDAL/05/1994 concerning Permit Procedure and technical Requirement Storage and Collection of Hazardous and Toxic Materials activities	Permits needed for storing, collection, operating, and treatment of hazardous and toxic material
Head of Environmental Impact Agency Decree No. KEP-01/BAPEDAL/09/ 1995 concerning Procedure and Technical Requirement Storage and Collection of Hazardous and Toxic Materials	Collection and storage of hazardous and toxic material
Head of Environmental Impact Agency Decree No. KEP-02/BAPEDAL/09/ 1995 concerning Documentation of Hazardous and Toxic materials activities	Documentation requirement for hazardous and toxic material
Head of Environmental Impact Agency Decree No. KEP-03/BAPEDAL/09/ 1995 concerning technical requirements for treatment of Hazardous and Toxic materials	Treatment of hazardous and toxic material
Head of Environmental Impact Agency Decree No. KEP-04/BAPEDAL/09/ 1995 Concerning procedural requirements for material after treatment, treatment and storage location, for Hazardous and Toxic materials	Location for treatment and storage of hazardous and toxic material
Head of Environmental Impacts Agency Decree No. KEP-05/BAPEDAL/09/ 1995	Use of symbols and labels for hazardous and toxic material

concerning Simbol dan Label Limbah Bahan Berbahaya dan Beracun	

5. Public and Business Potential for Developing Environment Industry in Indonesia

To prevent at least reduce the level of environmental pollution, the government with the approval of the House of Representatives issued Law Number 23/1997 on Environment management. The law stipulates among others that the development activities especially in the field of economy must take into account their impacts on the conservation of the environment.

The principal of the sustainable development cover the integration of environment criteria into economic practice to guarantee that the strategic plans of the companies meet the demand for business growth and sustainable evolution, at the same time meet the demand for the conservation of natural capitals. This require great changes not only in the control of air pollution, the holes of ozone layer, water conservation, use of raw materials and the management of waste treatment, but also in international issues effecting transaction, trade, finance and political agenda.

Therefore, the industrialists have a key role in the realization of the sustainable development. The government can only make policies and programs on the development. But if not supported by the industrialists, the policies and programs make not sense. With their activities, they have power to affect sources of raw materials, production process, consumer reaction and waste disposal methods. A pro-active move by the industrialists to find a positive incentive to change and to improve environment performance, makes possible the reduction of the level of pollution problem in accordance with the existing regulation. The move can also improve the communication with the society, enhance the industrial development and finally materialize the social sustainable future for all people and generations in the world.

International trade has experienced various changes in its system. And the most monumental change is the process of globalization sweeping all economic aspects. The globalization is not limited in the establishment global market for products and services but also in the development of the production system which applying a global vision, international technology of innovation and creativity and dynamic employment. The global economic system becomes increasingly competitive.

To win the global economic competition, it is necessary for businessmen to understand the rule of the game in the competition. The rule of the game is determined by the high production of products and services and their low selling prices, but also by the characteristic of other products and services offered to the consumers. The characteristics cover the products' quality, conformity with the taste and need of the consumers, comforts and availability of the products, quick and on time delivery.

In addition, in managing environmental impacts applying high technological equipment and involving environmental consultants, the companies should use a standard recognized by international business community. The use of the standard is aimed at ensuring the world that the companies have manage environmental impacts brought about by the production of their products and telling the world that their products are friendly to the environment.

The international business community recognizes a number of environment management systems. The most popular standard is that introduced by the international Standardization Organization (ISO), namely ISO 14000. the standards generally suggest the application of a system in dealing with environmental impacts. The implementation of the system ensures real results on the improvement of environmental performance producing goods / services of low price and high quality while conserving the environment.

International and pressures for the implementation of environmental impacts then create business opportunity with promising prospect for producers and suppliers of environmental technological products as well as consultants providing services on the management of environmental impacts. Some five thousands of manufacturing companies operate in Indonesia. But the manufacturers implementing the management of environmental impacts in accordance to international credible standards are still in a small number, amounting to less than 500 companies. So, the market is still big.

Companies in Indonesia including state-owned enterprise and major private companies pay a great interest in the management of environmental impacts as reflected by a large number of companies participating in an exhibition entitled “Environment Expo 2000 organized in Jakarta Convention Center in June 2001.

Besides, a great intention of Indonesia companies to sell their products in export market due to poor buying power of the people in the country has prompted the companies to implement environment management system as the key to entering the global market. Therefore, environment technological equipment and environment management services are at present in high demand. So there must be business opportunities and environmental industry development hidden in problems facing the environment

1) Pollution Abatement Investment

There is very little information available on the actual costs of pollution abatement in Indonesia's manufacturing sector. Experience in the industrialized countries, however, can provide at least an order of magnitude sense of the required investments in "end-of-pipe" abatement. In the OECD countries, total costs varied from 3-5%, and averaged about 4%, of total investment in the 1970s and early 1980s.

To examine the potential impact of abatement costs on Indonesian industries, an effort was made in this study to estimate these costs-using a combination of U.S data on the unit costs of pollution control and BPS data on the level of output from existing Indonesian firms. One of the most important features of the estimated "abatement cost curve" is that unit costs rise with the proportion of total pollution eliminated, increasing rapidly in the higher ranges. According to our estimates, for example, abatement costs range from about US$275 million at the 30% level, to US$1.9 billion at the 70% level, and US$4.8 billion at the 90% level.

Abatement costs also vary quite significantly between pollutants, which reflects differences in the nature of the abatement technology that is available, and between industries since, different industries have quite different pollution intensities per unit of output. To further complicate matters, pollution intensity—and thus the costs of abatement—will also vary significantly between different firms within the same industry, depending on the age and type of production technology employed and the efficiency with which it is used.

The costs of pollution abatement actually imposed on Indonesia industry, of course will depend on the standards that are set and the extent to which individual firms comply with those standards. Applying the goals of the PROKASIH Program (i.e.,a 50% reduction standard), total (capitalized) costs would amount to about US$700 million for existing firms. Amortized over 10 years, this would imply an annual cost of about US$70 million-which would be equivalent to about 0.6% of GDP, but less than 0.5% of total industrial sector sales-and only about 1% of value added.

Larger reductions, of course, would result in higher costs, and that fact will need to be taken into account in setting pollution control standards. In deciding on the appropriate level of standards, the first consideration should be the social and economic benefits associated with a cleaner environment. It is extremely difficult to come up with precise estimates of these benefits. Based on the qualified estimate of the health costs of water and air pollution in Jakarta, however (approximately US$ 500 million a year), it is clear that they are not negligible.

2) Participation of the Business World and Non Governmental Organization (NGO) in Environmental Management

It is becoming increasingly clear that the members of business world should be concerned about environmental issues. They are called upon to take responsibility for lowering the amount of waste produced, protecting environmental quality and human health, as well as increasing efficiency of resource use. Agenda 21, a United nations action program, demands the full participation of the business world in environmental management and Law No. 4/1982 states that any person engaging in measures which preserve the environment and contribute to sustainable development.

The role of the business world is strategic, especially in PJP II, the era of industrialization it is expected that the share of private investment will be more than twice that of government. The increase in business activity, especially industries which involve the processing of natural resources or involve a change in the landscape has the potential to cause environmental problems.

Thus the implementation of environmentally friendly business principles and strict enforcement of environmental laws will determine the success of environmental development.

At this time environmental consciousness in the Indonesian business world is beginning to develop. This is demonstrated by the appearance of foundation and other environmental agencies which involve the business world. Even so, at this point the most obvious results of this involvement is the contribution of funds used to promote environmental cause.

The business world should care about the environment considering :

- The increasing environmental consciousness which is giving rise to green consumers who prefer environmentally friendly products. The business world also needs to care because of increasingly strict regulations and provisions in the environmental field, both national and international, which are directly related to business interests, such as environmental standards, ecolabelling, ISO 14000 and clean production. This development is an opportunity as well as a challenge for businesspeople to develop products which are clean and environmentally friendly.
- The business world, an particularly the industrial sector, is the main variable affecting the supply of need natural resources both for its own needs and for development general. Therefore, any damage or pollution of natural resources which occurs during the extraction, production, distribution and transportation process of a business will in turn threaten the sustainability of the business itself.
- The intensity with which environmental issues arise can environmental an opportunity as well as a threat for the business world to create new fields of work relate to environmental management, such as technologies for cleaning the air and water and for recycling
- International agreements such as those found in Agenda in Agenda 21 Chapter 30 which states that business and industry must be full partner in managing the

environment and must consider that environmental management is the highest priority for the company and the determining factor in successful sustainable development

- The business world can become a supporting resource in providing funding or capital / loans for environmental activities and this will improve the image of companies, particularly those which are clean and environmentally friendly.

2)-1 KADIN (Indonesian Chamber of Commerce)

KADIN is the primary organization of all associations and business groups in Indonesia. KADIN is organized as a federation and functions as a forum for communication and consultation between Indonesian government and between Indonesian business people and foreign business people in the areas of trade, industry, and services. Kadin has branches (Kadinda) in all 27 provinces of Indonesia.

In order to increase environmental awareness in the business world as well as introduce business opportunities in the environmental area, Kadin has formed a special environmental bureau. In the current period the organizational structure includes a Kadin representative for the environment. Kadin has launched an activity which is meant to protect natural resources and prevent environmental damage.

2)-2 Indonesian Environmental Forum

WALHI is national forum of NGOs and nature groups who are concerned about environmental issues. Founded on 15 October 1098, WALHI aims to increase the participation of NGOs in environmental improvement and development, to channel the aspirations of NGO members in a national forum with the goal of creating a development process which improves the social welfare of the most vulnerable members of society without causing the degradation natural resources.

Members of WALHI are found in all provinces of Indonesian and are grouped in regional forums. Every three years, they meet in the National Environmental Meeting. This meeting elects a Presidium which represents all of Indonesia.

The Presidium also elects an executive director who manages routine WALHI activities.

The principal function of WALHI is to facilitate the exchange of information among NGOs, the community at large, and the government. WALHI's program includes :

- Development and management of an environmental information center.
- Human resources development through training, internships, seminars, and field work.

- Development of programs, campaigns and advocacy.
- Development of local, national, and international cooperative networks.
- Policy research and campaigns related to biodiversity conservation, eco-system management and environmental advocacy.
- Facilitate dialogue between the community, the government, universities and the private sector.

2)-3 Indonesian Center for Environmental Law (ICEL)

ICEL was established on July 19, 1993, as a private foundation. This non-profit organization maintains a strong commitment to saving the environment through an environment through an emphasis on environment law.

ICEL's goals are :

- Make an active contribution to the development of environmental law in Indonesia, both regional and international
- Improve the application of environmental law for the benefit of the Indonesian public
- Support efforts by the members of the community to bring environmental issues to court
- Disseminate information about legal principles and developments and changes in law in relation to sustainable development in Indonesia and other countries.

2)-4 Care International Indonesia

Care International is a non-profit agency supported by 11 member countries including UK, Canada, Australia, USA, France, Germany, Japan, Italy, Denmark, Austria, Norway. The member countries support programs in 45 developing countries.

Care International has worked in cooperation with the government of Indonesia since 1967. Care International's Indonesia headquarters are locate in Jakarta with representative offices in Ujung Pandang, Pacitan, Mataram, and Maumere. Projects carried out in Indonesia include.

- Community self-funding for Drinking Water and Sanitation Facilities (1991-94)
- Rural Community Development in Sulawesi (1994-96)
- Dry lands/farming systems (1984-94)
- Provision of environmental education materials
- Assistance in preparation of Drinking Water Delivery and Sanitation for Low Income Groups Project. This project targets two million people in six provinces (1994-98).

3) Multinational Corporation

The Contribution of multinational corporation to EI refer to :

- Environmental management system and reporting at corporate level
- Environmental technology and processes (software) and
- Environmental product, equipment and instrument (hardware)

EI of the MNCS come through wholly owned companies, joint ventures, and through sub-contracting and transfer of technology (licensing) to national conglomerates or large public enterprises. As shown below in the Table : During 1967-1968 there were 3773 project with total investment 139.449.8 US $

Table 12. ***Foreign Investment Projects (Extraction Projects) 1967-1998***

Industrial Classification	Projects	Percentage (%)	Infestation (US $ million)	Percentage
Food and Beverages	279	7,4	5.717,6	4,10
Chemicals	782	20,7	64.623,1	46,30
Textile & textile products	640	17,0	7.216,9	5,20
Pulp and papers	105	2,8	25.930,7	18,60
Wood and wood products	302	8,0	1.499,0	1,10
Non-metallic mineral products	155	4,1	7.120,7	5,10
Basic metals	125	3,3	8.458,7	6,10
Fabricated metal products	1.220	32,3	17.828,0	12,80
Pharmaceuticals	47	1,3	418,4	0,30
Others	118	3,1	636,7	0,40
Amount	3.773	100.0	139.449,8	100,00

Source : BKPM,Capital Investment Coordination Bureau

There are three categories of environmental market segments : air. Water and soil pollution, including industrial waste processing and disposal. EI represent a wide range of social, political and economic conditions, is critical to sustainable development and to enabling nations to attain the Millennium Development Goals (MDGs) and to realize the Johannesburg Plan of Implementation by 2015. Effective and rational management and use of natural resources, growing economies fueled by expanding exports, and high quality of like for the people, are directly linked to a dynamic and technologically advanced EI like wide, constantly larger domestic and foreign investments, combined with R&D and transfer of technology, are essential requirements for a dynamic, market – driven EI.

In Indonesia, the international agencies and financial institutions along with the major donors have so for contributed significantly more than the MNCS, to the development of EI and more generally to sustainable management of national resources. The major donors active are Japan, US and Germany. They are the major exportiers of pollution control product and technology with market share in 2001 of 26%, 21% and 12%.

4) International Environmental Cooperation

International cooperation is based on two premises. First, the environmental is a global issues and therefore its monitoring and preservation are the responsibility of the world community. Secondly, there is a growth in feelings of international solidarity in working together to solve environmental problems, particularly in the third world. In Indonesia, many environmental preservation activities are undertaken jointly among the government, communities and foreign parties. This cooperation takes the form not only of technical assistance and loans, but also practical cooperation which directly involves all parties.

Cooperation can be bilateral, regional or global, through international institution. Additionally, international banks also play a major role in handling environmental issues in Indonesia.

4)-1 Bilateral Cooperation

(1) Australia – Indonesia

Of all its development cooperation programs, the main sectors are education and training, health, infra structure and agriculture.

Australia's development cooperation policy is particularly concerned with women's issues, nature conservation and human rights.

The East Java Pollution Control Implementation Project – PCI is a project of AIDAB with Bapedal which began in December 1993 with AIDAB of aid approximately $ 20 million.

The target of the project is to help the Indonesian government.

Institutional development ;

- Control of hazardous waste and coastal water quality ;
- Minimization of waste and waste processing practices ;
- Public awareness and participation ;
- Formation of trade and education relations ;
- Development of human resources through practical training in Indonesia and Australia.

(2) Japan - Indonesia

JICA is the Japan International Cooperation Agency, was established on 1 August 1974 and is an official representative of the Japanese Government with the main responsibility being increasing technical cooperation with development countries.

JICA activities in the environmental fields in Indonesia :

- Research on tropical rain forest
- Center for training in the fields of clean water and residential environmental sanitation
- Logging management practice in Madiun Central Java
- Pilot plantation project in Banakat, South Sumatera
- Forest study at Banakat, South Sumatera
- Feasibility study of the Industrial Growth Forest (HTI)

(3) United Kingdom – Indonesia

One of the seven main priorities of British Development Cooperation is to help developing countries deal with environmental problems. The program is managed by ODA (Overseas Development Agency) ODA has operated in Indonesia since 1964, and ODA support includes :

- Loan for increasing protection capacity, particularly for infrastructure development
- Technical assistance grants
- Support for NGOs such as VSO (Voluntary Service Overseas), OX form and AWB (Asian Wetland Bureau)
- Investment loans and shares in the government and community sectors
- Monitoring of ground water
- Biological research for biodiversity
- Initiative related to conservation of biodiversity

(4) Canada – Indonesia

Official Canadian aid is managed by the Canadian International Development Agency (CIDA). The main aim of Canadian development cooperation is to support the process of sustainable development in developing countries.

(5) U S A

USAID began work in Indonesia in 1950. In general USAID Indonesia cooperation covers the field of agriculture, conation, family planning, health, industry and infrastructure, food problem and disaster preparedness, and environment and population.

In the 1960s USAID focused its assistance on controlling the rate of population growth, infrastructure improvement and efforts to increase the role of private sector.

In addition to increasing economic capability, urban and regional development planning an increasing agricultural production, education and family planning, USAID also developed a natural resource management program.

Against a background of environmental damage and pollution due to development, USAID worked with Indonesia to find a solution its many environmental problems through the following programs :

- Natural Resources Management
- Sustainable Agriculture
- Biodiversity

4)-2 Regional Cooperation

(1) ASEAN Environmental Cooperation

ASEAN cooperation on the environmental began about two decades ago when the ASEAN Environment Programme (ASEP) was launched in 1978 At first this cooperation was carried out by the committee on science and Technology (COST) and the ASEAN Experts Group, ASEAN senior officials on the Environment (ASOEN) established at the June 1990. ASOEN was pioneered based on the Jakarta Resolution for Sustainable Development at the October 1987 ASEAN Ministerial Level Meeting and the Manila Declaration (1987) on ASEAN function cooperation. ASOEN took on the mission to develop systematic and integrated principles for sustainable development for the overall development process an to focus itself on implementation guidelines for protecting natural resources and the environment in ASEAN.

(2) EC-Asia

Cooperation between the EC and developing countries in Asia is becoming more intensive. This is because this region hopes to maintain rapid economic growth and is impressed with the EC's good economic growth, stable political conditions, good economic policies and technology mastery. The presence of the EC in Asia, particularly Southeast Asia, is for economic cooperation and also for purposes of technological innovation. The main EC interests in Asia are in transfer of technology, particularly development of agricultural production. Other interests are issue of population policy, telecommunications and energy production infrastructure in rural areas.

In the fields of the environment there are there important aspects of EC-Asia cooperation, i.e. :

- Care of tropical rain forest, particularly in Southeast Asia
- Dealing with the problem of deforestation due to population pressure, particularly in the Himalaya valley
- Limiting negative impacts of industrialization in densely populated areas.

The EC also provides support so that the war against the production and use of narcotics can continue and be intensified. The EC began cooperation with Indonesia in 1976, Through 1992 the EC has allocated 242.93 million ECU for :

- Development assistance, 224.20 million ECU (92.30%)
- Economic cooperation, 17.03 million ECU (7.03%)
- Humanitarian assistance, 1.70 million ECU (0.70%)

(3) Indonesia – UNDP

UNDP is the largest multilateral institution in the world which provides development cooperation assistance. UNDP has been in Indonesia since 1967, focusing its programs mainly on human resource development, institutional development and transfer of technology programs. For nearly three decades cooperation between UNDP and the government of Indonesia has stressed socioeconomic and human resource development. In line with Repelita V, the UNP areas of activity have aimed to develop socioeconomic capability in order to raise the standard of living.

In the 1994-1995 period, the final stage of the UNDP program was covered in the Fourth Country Programme (CP-4).

This program was also in line with the general orientation of Repelita V for increased standards of living, achieve economic balance, availability of food, diversification of agriculture, a strong infrastructure base, and develop the sectors of industry and export growth.

(4) UNEP

UNEP mobilizes program with UN agencies, government institutions, and NGOs, on a regional and international level. UNEP's focus is on issues of climate change, pollution, water, forest, resources, nonrenewable resources, industrial management with an environmental perspective, hazardous chemicals and development of international environmental law.

The UNEP center for industry and the Environment provides access to practical information and brings together industry and the government in the fields of environmentally-friendly industrial development through technical cooperation and information transfer.

Indonesia was one of 58 members of the UNEP Board of Leadership, a 4-year position, from 1 January 1990 to 31 December 1993. The UNEP mission in Indonesia is to :

- Support Indonesia in environmental education and training, public information, development and cooperation planning, environmental law and legal instruments.
- Development close cooperation with experts and decision-makers, scientists and funding agencies, industrialists and environmental activities, for the purpose of environmental preservation.
- Initiate funding support for seminars, workshop, studies and report-writing on sustainable development with an environmental perspective and studies of carbon dioxide and other green house gases and the impact on air temperature and agricultural output.

One important environmental effort of UNEP is the global Environment Facility program (GEF) aimed at supporting activities to protect the ozone layer and biodiversity, reduce global warming and protect international waters.

With GEF which is co-managed by UNDP and the World Bank, projects for the preservation of biodiversity in Indonesia will protect flora and fauna in Kerinci-Seblat National Park, and develop policy studies on environmental conservation.

4)-3 Asian Development Bank (ADB)

The main aim of ADB presence in Indonesia is the increase Indonesia's competitive advantage in the international world by developing capability in the sectors of infrastructure, human resource management and by decreasing the level of environmental damage. In 1993 ADB ha development signed 190 projects worth US $95 million.

During 1991 ADB provided US$ 340.000 in grants to Indonesia (through the Ministry of Mines and Energy) to improve environmental impact analysis management and improve the Ministry’s capability in analyzing environmental impact. ADB also provide technical assistance for a project on biodiversity conservation. Technical cooperation in the amount of US$597,000 will be funded by the Japan Special Fund to develop a tropical rainforest ecosystem conservation and biodiversity project in seven provinces in Indonesia.

The ADB provide financing for development project the major project are (Schmidt 1999; ADB 2003) : capacity building for reduction of loses in water supply, water pollution project, Irrigation project, coral reef, rehabilitation and management, central Sulawesi Integrated Area Development and Conversation. Marine and Coastal Resources Management and conversation and Clean Vehicle Fuel for Blue Skies with total amount 178,6 million US $.

4)-4 World Bank Indonesia

The Work Bank has been in Indonesia for over 20 year. Until 30 September 1992 Indonesia had received 40 credits from IA with a total value of US$901.6 million and 170 IBRD loans with a total value of US$17,047.54. Its first priority is the agriculture sector.

Over a third of IBRD assistance has been for agriculture with the aim of assisting the government to increase rice production through investment in irrigation, fertilizer distribution, research and agricultural development.

Secondly, assistance has been given for development of electricity and energy. Investment in this field is intended to help balance the high demand for energy by the industrial sector with consumer demand in both rural and urban areas. This assistance supports the development of non-oil and gas sectors and helps ensure that Indonesia uses its energy resource wisely.

One environmental management program funded by the World Bank (IBRD) is the Integrated Pest management Program (IPB) which began in 1993. This US$32 million program is training approximately 800.000 farmers to apply IPM. One aim of the IPM program is to reduce the dangers of hazardous waste by reducing the production and use pesticides.

The world Bank has, invested US 80 million into a project designed to improve the potable water quality, easy access to the water supply and sanitation services (Unternehmens Beratung, 1998). This investment also aims to implements a program that will increase people’s awareness in health and hygiene.

6. Recommendations

1) General Recommendation

Strengthening Environmental Management

1. Expand Ministry of Environment mandate to review environmental implications of macroeconomic and sectoral policies.
2. Implement the revised Environmental Impact Assessment regulations to make procedures more efficient and result more effective.
3. Clarify the legal mandate for pollution monitoring and control, including establishment of a permit system and the introduction of direct charges on industrial effluents/emissions by provincial, municipal and river basin authorities.
4. Continue to explore and support “alternative dispute resolution” mechanisms and other means to resolve conflict over natural resources and environmental degradation.
5. Continue strengthening Ministry of Environmental and other central, provincial and local agencies responsible for environmental planning and management and pollution monitoring and control.
6. Strengthen policy analysis capacity available to Ministry of Environment for review of environmental effects of proposed macroeconomic and sectoral policies.
7. Strengthen Environmental Impact Assessment implementation, including Review Commissions and private sector capacity, and promote the involvement of local community group and NGOs in the \ Environmental Impact Assessment process.
8. Expand the quality, timeliness and availability of data on environmental conditions and trends.
9. Promote the preparation o f sectoral EIAs, and strengthen the capacity of central agencies to prepare and implement sectoral action plans for addressing environmental impacts.
10. Partnerships should be format between public and private stakeholder interested in environmental protection. The partnerships should include representatives in government agencies, policy maker, companies (inside and outside the environmental industry)
11. Establish a clearing house for environmental technology and services that is ready accessible and user friendly.
12. Reduce the multiplicity of agencies and bureaucratic levels involved in the approval in the approval / licensing of el initiative and in administering and monitoring compliance with standards and regulations.

2) Water Resources

1. Adopt me Integrated River Basin Development approach for the management of surface and groundwater resources, especially for the critical watersheds on Java.
2. Clarity the legal provisions for a permit system and the charging of effluent fees by provincial or river basin authorities.
3. Incorporate rural water supply and sanitation improvements more systematically in targeted poverty programs.
4. Provide for community participation (including womens'group) in the design and implementation of projects to improve the availability of safe water.
5. Evaluate the efficiency implications of existing policies and incentives for the allocation and use of surface and groundwater.
6. Strengthen the capacity and authority of the agencies responsible for the sustainable use of groundwater.
7. Develop more effective mechanisms for cross-sectoral and inter-agency coordination for water resources management, through the formulation of provincial and national "Water Boards".
8. Strengthen the collection, analysis and monitoring of data on water pollution in rivers, streams and aquifers, including measure of the efficiency of water use in irrigation, municipal and industrial uses.
9. Strengthen the institutional capacity of GOI agencies involved in rural water supply and sanitation, and cooperative efforts with NGOs and the private sector.

3) Urban Environmental Management

1. Develop spatial plans to guide urban growth as a participatory process to ensure consensus on priorities and a "shared vision" of the future spatial development.
2. Ensure community participation in defining urban service needs, and involve project beneficiaries in project design.
3. Promote constructive partnerships for improving urban environmental quality, such as recent NGO initiatives to support recycling.
4. Continue efforts to strengthen the capacity of municipal government agencies to plan and implement development projects, as a key element in the devolution of additional authority and responsibility.
5. Strengthen the capacity for urban sector environmental planning and management, including the design and implementation of "strategic structural plans", the development of policies and incentives for encouraging environmentally responsible behavior by firms, households and individuals and improve mechanisms for inter-agency coordination.
6. Strengthen the collection and analysis of data on ambient quality of water and air in urban areas, and the extent of compliance with GOI standards.

a. Urban Water Supply

1. Formulate a regulatory framework for the Municipal Water Supply that would strengthen their structure and increase their managerial autonomy.
2. Provide for community participation (including women’s groups) in the design and implementation of projects to improve the availability of safe water.
3. Improve the quality or initial construction and pay increased attention to O&M needs.
4. Strengthen the capacity of Municipal Water supply to implement the needed investments, improve the reliability of supply and reduce water losses in urban areas.
5. Strengthen the collection and analysis of data on access to safe water and sanitation and surface and groundwater contamination.

b. Sewerage, Sanitation and Solid Waste

1. Determine institutional arrangements for development of public sewerage systems and strengthen the capacity of the selected agency for planning, implementation and operations and maintenance.
2. Improve the management of existing landfills, especially those located in environmentally vulnerable areas.
3. Strengthen the collection and analysis of data on volumes of solid waste collected and recycled, and toxic and hazardous wastes.
4. Explore the least cost options for the expansion of sewerage and sanitation services, including in situ and off-site approaches.
5. Evaluate strategies for financing and cost recovery arrangements for the expansion of sewerage and sanitation systems.
6. Recover the full costs for the provision of sewerage, sanitation and solid waste management services from industrial and commercial developments, and increase cost-recovery from households to the extent feasible.
7. Take advantage of the potential for community self help in the design and implementation of sewerage, sanitation and waste management projects.
8. Encourage greater involvement of private operators in solid and hazardous waste collection and disposal, but improve management and regulation of landfills and ensure safe operation of hazardous waste treatment facilities.
9. Develop a long term plan for the sitting of future landfills.

c. Urban Transport and Vehicle Emissions

1. Coordinate development of transport networks, employment centers and residential areas so as to reduce the need for long distance commuting and encourage non-motorized transport, and improve alternative forms of communications.
2. Improve the quality and efficiency of urban bus systems, relying as much as possible on private sector participation for both investment and management skills.
3. Develop an education and awareness program, including published data on ambient air quality trends to strengthen the consensus for needed policy measures.
4. Review technical options for vehicles and fuels, including engine design and emissions standards, CNG and unleaded gasoline.
5. Develop carefully designed program to phase out two-stroke motorcycle engines.
6. Evaluate the feasibility of a ”mass transit” system for Jakarta, including issues of financing and cost recovery.
7. Review prospects for congestion pricing and other market-based incentives for reducing reliance on private vehicles and encouraging public transport.
8. Consider the introduction of pollution-based fuel taxes to promote the use of cleaner fuels, such as unleaded gasoline and CNG.
9. Introduce vehicle emissions inspection for high use (“fleet”) vehicles in key urban centers wherever feasible.

4) Energy Resources

1. Implement a program to facilitate the transfer and application of energy efficient technology and practices in the industrial sector.
2. Implement a demand side management program to increase the efficiency of electricity use in all sectors.
3. Consider the feasibility of introducing pollution-based fuel taxes that reflect the social damage of energy-related pollution.
4. Review the policy and incentives framework for expanding the use of renewable energy sources in rural areas.
5. Evaluate the impacts of air pollution, including acid rain, on human health, construction materials and natural ecosystems.
6. Evaluate the fuel efficiency in the transport sector and its implications for air pollution.
7. Strengthen the institutional capacity for the promotion of energy efficiency and expanded use of renewable energy resources (especially non-traditional resources for use in rural electrification).

8. Strengthen the collection and analysis of data on energy resources and consumption, including measures of the efficiency of energy production and use.

5) Industrial Pollution Control

1. Clarify the legal mandate for pollution control, and strengthen the institutional capacity to implement pollution control strategies, including laboratories, pollution monitoring and control authorities, and the legal system, including alternative procedures for resolving disputes.
2. Establish a capacity for supporting "pollution prevention pays" campaigns, including environmental efficiency audits and industry-specific technical assistance.
3. Finalize the draft regulations on the storage, transport and treatment of hazardous waste, and develop the institutional capacity for effective regulation and emergency response.
4. Strengthen the AMDAL capacity of key government agencies responsible for industrial sector investment approvals and the integration of waste minimization, "clean technology" and cost-effective pollution control measures into industrial sector policy.
5. Review the legal and administrative issues involved in the introduction of direct charge on industrial water and air pollution, including the possibility of "earmarking" those charge to fund pollution monitoring and control programs and a program of positive incentives for waste reduction and treatment-especially for smaller firms.
6. Develop more precise estimates of the current and future level of toxic and hazardous waste generated in specific areas as a key element in planning for waste treatment facilities.
7. Encourage private sector development of industrial estates to improve the location of industrial firms and to take advantage of economies of scale in the provision of waste-treatment facilities.
8. Encourage the adoption of more responsible attitudes to sustainable development by the business community, including a "waste minimization / clean technology" approach to process innovation as an element of competitive business development strategy for the longer term.

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Abbreviations

PAM	Perusahaan Air Minum Water Utility Company
PDAM	Perusahaan Daerah Air Minum Regional Water Utility
PROPENAS	Program Perencanaan Nasional Indonesia National Planning Program
BAPPENAS	Badan Perencanaan Pembangunan Nasional National Planning Agency
PPLH	Pengawasan dan Pengembangan Lingkungan Hidup Office of the State Minister for the Supervision of the Development and the Environment
MLH	Menteri Lingkungan Hidup Ministry of Environment
KLH	Kependudukan dan Lingkungan Hidup Population and Environment
WALHI	Wahana Lingkungan Hidup Indonesia Indonesian Environmental Forum
YLKI	Yayasan Lembaga Konsumen Indonesia Consumer Association
PKK	Pendidikan Kesejahteraan Keluarga Family Welfare and Education
PROKASIH	Program Kali Bersih Clean River Program
BAPEDALDA	Badan Pengendalian Dampak Lingkungan Daerah City Environmental Impact Management Agency
POLDA	Polisi Daerah City Police
REPELITA	Rencana Pembangunan Lima Tahun Indonesia Five Year Development Plan
KADIN	Kamar Dagang dan Industri Indonesia Chamber of Commerce
ITB	Institut Teknologi Bandung Bandung Institut of Technology
BKPM	Badan Koordinasi Penanaman Modal Capital Investment Coordination Bureau

Chapter IV

Environmental Industry in Korea: Current State, Prospects and International Cooperation Potentials

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Summary and Recommendations

The Bank of Korea estimated that ROK's pollution abatement expenditure was 8,023.1 billion won 1999 and 7,969.0 billion won in 2000 (See Table 6). In 2000, the share of environmental expenditure in GDP was 1.54 %. ROK's environmental market is expected to increase in terms of sales performance from 9 trillion won in 1999 to 19 trillion won in 2005, reaching 32 trillion won in 2010, and the growth rate is forecast to be 12% annually by 2010.

ROK's environmental industry market has a high potential. Since Korea's environmental pressure is already high and expected to be higher in the future and Korean economy is expected to grow steadily, the demand for environmental goods and services is certainly to increase sharply. This is an attractive market for EI businesses both in and out of Korea.

Korea's environmental industry's growth is indebted to foreign influences of international NGOs and MEAs. Influences from MNEs operating in and/or out of Korea are very significant in supply side, particularly technology aspects. However, in the demand side, no meaningful evidence is found yet. An important foreign element in driving forces for Korea's environmental industry is the discipline from the export markets. In particular, semiconductor and automobile industry are prominent examples.
The strong grassroots environmental groups also contributed to the demand side of the industry. Bbusinesses who consider participation in the Korean market may get some benefit by analyzing the Korean NGOs' activities.

In Korea, air quality improvement in the Seoul-Kyunggi Metropolitan Area, water quality improvement in the four major watersheds, and the reduction and recycling of

wastes are the three most compelling tasks in the upcoming several years. Therefore, low emission motor vehicles and emission reduction technologies in industrial plants, water treatment facilities and water treatment services, waste treatment and recycling technology deserve special attention for businesses seeking opportunity in Korea's environmental market. Recently, finding land for filling site for radioactive waste from nuclear power plants became a major source of social conflict. Although the risk of radioactive waste is exaggerated, it became a political reality that nuclear power is becoming very costly. Given another constraint from the Kyoto Protocol, market potential for environmentally friendly energy sources seem brighter than before.

A few points can be raised as policy recommendations to the government of ROK regarding the desirable development of environmental industry in ROK. First, for appropriate policies to be established and implemented, it is a prerequisite to have correct and relevant information on the environmental industry. In ROK, correct statistics for the environmental industry is not yet available. Main problem is the lack of classification that allows the environmental industry as a separate item in industry and trade statistics. Earlier adoption of new statistical classification system is urged.

Second, for the domestic market for the environmental industry, a combination of more stringent environmental regulation (it means bigger market size) plus better facilitative policies to encourage more investment in technology and capital equipments is recommended, rather than a combination of loose environmental regulation (it means smaller market size) plus some subsidizing policies for technologies with vague strategic concepts. In this case of stringent regulation and facilitative policies, some part of the domestic market might be taken by foreign firms because of low competitiveness of domestic firms in terms of technology and financial capacity. However, this loss would be compensated by dynamic beneficial effects from technology spillover and competitive learning effects. Government may impose some guidelines to encourage joint ventures and/or technology cooperation between Korean and foreign advanced firms to induce technological improvement in the local environmental industry.

Third, some elements of government procurement procedure need amendments. Under current screening system, firms' experiences in environmental projects are not differently treated from the experiences in general construction projects, so environmental businesses have a disadvantage in competing with large general construction firms in getting the public sector bids. This system is considered as one of the major hindrances for the specialization and technological accumulation of environmental businesses in ROK.

1. Introduction

1) Environmental Industry: A Win-Win Strategy?

Environmental industry is believed to be an opportunity for a win-win solution for the conflict between environmental concerns and industrial interests. Therefore, environmental industry is sometimes considered to be a candidate for government's support. It is justified for the externality of the environmental problems and the externality of science and technology. However, this argument is questionable. Environmental externality justifies government intervention as environmental policy, not as industrial policy. When environmental externality is appropriately corrected by environmental policies, industrial policy for environmental industry is redundant and could be even harmful. Then, if a country's environmental policy is not stringent enough, government support to environmental industry is desirable? I think the answer depends on specific conditions. But it is evident that this situation is not the first best.

2) What is Environmental Industry?

Environmental industry is a loosely defined concept. Narrowly defined, environmental industry is an industry that produces goods and services to measure or improve on the state of environment. This is related to the end-of-pipe technologies of pollution prevention and control in air, water, soil, solid wastes, etc. Recently, recycling industry and clean technologies minimizing the emission of pollutants and consumption of energy and resources tend to be included in the environmental industry. Therefore, the environmental industry, broadly defined, includes all goods and services related to the environmental conservation.

2. State of the Environment and Environmental Policies

1) Status of the Economy, Society and the Environment: A Brief Overview of the Republic of Korea

Table 1 gives a brief statistical overview of the ROK's social, economic and environmental conditions. The ROK's population density in 2000 was 472.7 persons per square kilometer, the third highest in the world. The GDP per unit area as an index for potential environmental pressure in 1990 was US$2.46 million per square kilometer, less than that of Japan (US$7.96 million) and Germany (US$4.19 million), but higher than that of the US (US$0.56 million) and France (US$2.17 million). In 2000, the ROK's GDP per unit area was US$4.62 million per square kilometer, roughly double that of 1990 (in constant dollars). The ROK's per capita GDP was lower, but the environmental pressure in terms of GDP per unit area was almost the same as advanced countries. However, the level of environmental investment remains much relatively lower. SO2 emission per unit area is several times higher than in the major advanced countries such as the US, France, and Germany, while per capita available fresh water is 1,500 m2, an level insufficient for sustainability.

<Table 1> Summary of Statistics on Socioeconomic and Environmental State of the ROK

Population (million people)	47.27(2000) 51.7(2015, projected)
Population Density (2000, person/sq.km)	472.7
GDP (2000, billion US$)	457.4
GNP Per Capita (2000, US$)	8,581
GDP/Area (2000, 103 US$/km2)	4,620.2
Energy Efficiency (2000, TOE/ US$)	0.40

Source: National Statistical Office and The Bank of Korea

The ROK's GDP had been growing at a rapid pace since 1992, but fell considerably in 1998 with the financial crisis. It began to increase in 1999 and has been growing ever since (see Table 1). Consumption of primary energy in the ROK rose sharply from 116 million TOE in 1992 to 192 million TOE in 2000. Of considerable concern is that energy consumption per GDP has been on the rise since the 1970s, with no signs of declining after 1992. This indicates that the economic structure of the ROK is not transforming into one that is favorable to sustainable development.

2) Institutional Setting in the Government

The Ministry of Environment (MOE) and related ministries are the primary government-run institutes for sustainable development. In realizing sustainable development, the most important institutional foundation is the implementation capacities of each ministry.

As the key ministry spearheading the environmental preservation effort, the MOE is not only responsible for the planning, development, and execution of environmental regulations and policies, but also for overseeing and coordinating environmental affairs in other ministries and agencies. Nine agencies, including the Ministry of Construction and Transportation (MOCT), are implementing environment-related policies or projects that are specific to their own sector. In addition to these, the MOE exercises jurisdiction over provincial governments in matters relating to the environment.

The MOE was upgraded from a vice-ministerial level Office of Environment to a full ministry in 1990. In 1994, during the major government restructuring, the ministry was elevated to the status of the present Ministry of Environment. At this time, responsibility for water sewerage was transferred to the MOE from the MOCT, and drinking water, which fell under the jurisdiction of the Ministry of Health and Social Affairs, was also transferred to the MOE. The Environmental Conservation Act was reinforced and developed into six major laws: Basic Environmental Policy Act, Water Quality Preservation Act, Air Quality Preservation Act, Noise and Vibration Control Act, Hazardous Chemicals Control Act and Environmental Dispute and Settlement Act. In the 1990s, enforcement of Natural Environmental Preservation Act and the Environment Impact Assessment Act were legislated, and the Natural Park Act and the Law on the Protection of Birds, Beasts and Hunting were transferred to the MOE.

In 1985, under the 36th Basic Environmental Policy Act, the Environmental Conservation Committee was established to coordinate and adopt mid- and long-term plans on environmental conservation and improvement. Headed by the Prime Minister, the committee comprised of 23 members, including 13 cabinet ministers. In addition to developing conservation and environmental improvement plans, the committee was responsible for identifying preservation and investment priorities, and serving as the final decision maker for matters pertaining to the environment.

The government’s role in contributing to sustainable development is not limited to environmental policy formation and enforcement. Sustainable development is attained by integrating environmental factors into the socio-economic policies of all government bodies. In order to appropriately integrate environmental and social factors into the decision-making process of economy-related functions, it became clear that an established institutional mechanism to facilitate inter-ministerial coordination would be needed. Hence, the Presidential Commission on Sustainable Development (PCSD) was established in September 2000.

The PCSD is responsible for preserving the environment and minimizing the conflicts that could arise during the course of implementation of major environment policy measures by reviewing them at the planning stages. This commission is expected to understand the international status of environmental preservation and consider possible domestic applications or countermeasures. It consists of 33 persons total: 13 ministers and 20 members from civil society, academia and the business sector.

The commission includes six sectoral sub-committees: land conservation, water resources, ecosystem and public health, energy policy, industry and environment, and international/regional cooperation. Mid- to long-term plans for environmental conservation, important global environmental issues, and other matters are expected to be addressed by this commission, which will also serve a mediating function in resolving conflicting interests among government ministries and agencies, and between the government, NGOs and the industrial sector. As such, the PCSD played an important role in evaluating the sustainability of the controversial Saemangeum Reclamation Project, which had ignited a series of intensive debates throughout the nation for its potentially adverse impact on the environment.

As the main agency for national land use management, the Ministry of Construction and Transportation (MOCT) is in charge of enhancing sustainability in land use planning, urban planning, housing development, and balanced regional development planning systems. It is also responsible administering land development regulations relating to roads, ports, dams, and airports. During the 1999 government restructuring, the Construction Environment Division was instituted in the MOCT to enhance the sustainability of construction projects.

The founding of the Ministry of Maritime Affairs and Fisheries (MOMAF) in 1996 brought together an integrated marine management by combining marine-related functions, previously distributed among other ministries. By entrusting seemingly conflicting functions, such as the development of marine resources and conservation of the marine environment, to the same ministry, a balanced and integrated approach was possible, providing the foundation for marine sustainable development.

The Ministry of Health and Welfare (MOHW), whose responsibilities include managing the social aspects of sustainable development, pursues strategies to combat poverty and disease by overseeing social safety nets and public health infrastructure. With the financial crisis, the importance of a social safety net was highlighted. Unemployment and poverty increased with the subsequent recession and corporate restructuring, while a more flexible labor market was formed in the domestic economy.

Korea promotes sustainable development through both comprehensive and sectoral strategic plans. Long-term strategic plans, such as Green Vision 21 and the National Environmental Vision for the New Millennium, provide a holistic environmental framework for the nation's strategy. Based on this framework, the government develops strategic plans in major sectors. These strategic plans are systematically linked to the thematic chapters of the National Action Plan of Agenda 21 and continue to be promoted as such.

A major characteristic of Korea's national strategic plans is the promotion of integrated policies that combine both regulatory elements and market-based measures. Recently, relying more on market forces rather than regulations and standards, the government has striven to internalize environmental costs through both economic incentives and disincentives, thereby encouraging major sectors to operate in an environmentally friendly manner. These efforts have proven to be effective in implementing national strategies for sustainable development.

The government acknowledges that sustainable development can be achieved only with active participation and cooperation from each major group. The roles and participation in the decision-making process by civil society, women, local governments, and the private sector have increased over the years, and this trend is expected to continue.

The results of Korea's implementation of sustainable development strategies are visible in many areas. Most importantly, the ambient air and water quality in major cities have improved drastically over the last ten years. Controlling greenhouse gas emissions and preserving the ecosystem, however, are expected to pose major challenges to Korea in the 21st century.

3) Policies and Measures

Sustainable development can only be attained when environmental costs are fully considered in economic decision-making processes. This can be accomplished by establishing and promoting strategic-level plans. But at the public policy level, it can also be achieved through direct regulations such as land-use zoning, licensing and permits, economic instruments or other market-based measures, provision of relevant information, or voluntary participation. The ROK is active in all these areas. Specific policies discussed in this section include charges and fees, impact assessment systems, and voluntary environmental measures.

3)-1 Emission/Effluent Charges and Environmental Improvement Charges

3)-1-1 Emission/Effluent Charges

The Effluent Charge System was first introduced in accordance with the provisions of both the Air Quality Preservation Act and the Water Quality Preservation Act of 1983. Until 1996, charge was levied only on manufacturers that released more effluents than were permitted under the environmental standards. However, in 1997 a minimum charge system was introduced in which even the manufacturers discharging pollutants below the allowed levels were required to pay a basic fee. This system enhanced the efficiency of environmental policy measures by functioning as an environmental tax. The current emission/effluent charge system in the ROK, however, still contains provisions of penalty.

The charges imposed grew sharply in 1997 but declined in 1999, which may be interpreted as a decrease in the number of violators since the maximum level permitted was expanded.

3)-1-2 Environmental Improvement Charges

An environmental improvement charge system was initiated in December 1991 based on the Environmental Quality Improvement Charges Act. The system was designed to reduce pollution by requiring those who caused pollution through production, distribution and consumption activities to bear the cost of treating the effects (in accordance with the Polluter Pays Principle), and to finance environmental investments. Facilities and/or equipment defined in the relevant regulations, as well as diesel-powered vehicles, are subject to these charges.

While the system has proved helpful in financing environmental investments, collecting around 300 billion won in 1999, its environmental and economic efficiency is somewhat in doubt. The linkage between the policy tool and policy target is weak, since the owner rather than the user of the facilities and/or equipment is charged. Moreover, efficiency remains low because the charge is levied on particular facilities based on the amount of water and fuel consumed, rather than their actual emission quantity.

3)-1-3 Deposit-Refund System for Solid Waste

The Deposit-Refund System for Waste, based on the Promotion of Saving and Recycling of Resources Act, is designed to promote waste recycling from products consumed in large quantities that are easily collectable and recyclable. It requires the manufacturers or the importers of the products to deposit funds covering the cost of collecting and recycling the used products or containers. Once collected, the money is returned, thereby encouraging recycling. Currently there are 6 types of paper containers and 12 items in this program. This system has contributed to the securing of financial resources for the government recycling program, but has been criticized for not providing sufficient incentives for recycling. However, the system has recently shown a sign of improvement in efficiency as the recovery rate has increased.

3)-1-4 Waste Disposal Charge System

The Waste Disposal Charge System was launched to capture the environmental costs of products and reduce their environmental impact by imposing a disposal charge on the products, materials, or containers that contain toxic materials or which are unable to be collected for recycling. This system was established under the Promotion of Saving and Recycling of Resources Act.

The system covers 32 items in 12 different product groups that include pesticides and containers for toxic chemicals. However, the system has room for improvements in item selection and in better defining the linkage between policy measures and policy targets.

3)-1-5 Water Resource Usage Charges

The Water Resource Usage Charge System is designed to impose the cost of supplying water, incurred in the upper portion of Han River, on people residing in the lower stream of the river in accordance with the User Pays Principle. The charges are now being imposed in addition to the tap water tariff. Areas in and around Paldang Lake were designated as a Water Supply Source Protection Zone in 1975, and as a Special Reserve Zone in 1990, in which land-use is severely restricted. In 1999, a Waterside Zone and a Buffer Forest were designated as a reinforcement measure, and the Pollution Quota System was introduced the same year. A charge of 110 won per ton of water supply is imposed on those living in the lower stream of the river. The collected money is transferred to a local autonomous body in the upper stream for constructing environmental infrastructure, and for providing financial support to the residents living in the Waterside Zone. The Water Resource Usage Charge system has been implemented as water quality and supply management policy and is expected to provide incentives to technology development as well.

3)-1-6 Traffic Load Charge System

The Traffic Load Charge System is a policy measure aimed at reducing traffic by enforcing the originator of the traffic to provide a partial payment of funds equivalent to the social costs of the increased traffic. This charge is applied to the owners of facilities with a total area larger than 1,000 m2 in cities with populations exceeding 100,000 people. The revenue collected is to be used for public transportation programs in the respective city.

The current revenue amassed from the charge, approximately 70 billion won from the 33 cities where the system is being enforced, is used for programs for the expansion and improvement of operations, such as the regulation of bus-only lanes and a management information system for bus networks.

3)-1-7 Volume-based Waste Collection Fee System

The Volume-based Waste Collection Fee System was initiated in 1995, requiring waste to be packed in a standard disposal bag that has been purchased from a local vendor. Rather than charging according to size of building or property taxed, this system charges for the actual waste disposed. With the system, waste disposal fell by 23%, from a daily volume of around 58,118 tons in 1994 to around 44,593 tons in 1998. Based on these figures, the daily waste disposal per person in 1994 was 1.3 kg and in 1999 was similar to England and Germany at 0.97 kg. Recycled items rose 74%, from 8,927 tons per day in 1994 to roughly 15,566 tons in 1998. Expressed in terms of economic value, this figure would amount to almost 2.9 trillion won.

3)-2 The Environmental Impact Assessment (EIA)

3)-2-1 Environmental Impact Assessment and the Prior Environmental Review

Although the System for Environmental Impact Assessment (EIA) was initiated in 1981, the actual supporting policies and actions began after the Environmental Impact Assessment Act was enacted in 1993. Activities requiring EIA consist of 62 project types in 17 fields that include urban planning, industrial park development, public road construction, and public or private sector development projects.

The EIA System has played a key role in sustainable development in the ROK. However, the system needs improvement in terms of the timing of the assessment, coordination between relevant authorities, and the implementation of consultation results for the assessment. The EIA System will need to follow up on these problems.

Those who are planning a project that is subject to an EIA are expected to hold a public hearing on the project, and the authorities responsible for project approval should consult with the Ministry of Environment.

The System for Environmental Impact Assessment is carried out for larger development projects at the project execution stage or after the final plan is confirmed. Its scope is limited to examining the measures for emissions reduction and other environmentally friendly developments. In order to address these problems, the Prior Environmental Review System (PERS), based on the Basic Environmental Policy Act, was devised in 2000. The PERS aims to ensure the environmental friendliness of development projects by considering their environmental impact at the initial stages of planning through feasibility studies and evaluations. Among others, the system evaluates the environmental adequacy of the proposed site and the appropriate scale of the project.

3)-2-2 Traffic Load Impact Assessment

The Traffic Load Impact Assessment System, introduced in 1986 with the enactment of the City Traffic Regulation Act, is a policy measure to secure the smooth flow of urban traffic and the public's demand for pleasant commuting. It is designed to improve traffic flow inside business sites or facilities as well as in adjacent areas by reviewing and analyzing the traffic load created by new activities or facilities with sizes exceeding a certain level.

To address the severe traffic problem due to rapid urbanization and the dramatic increase in the number of motor vehicles, the government introduced the relatively broad City Traffic Regulation Act. However, local traffic problems generated by new development projects needed separate measures. Therefore, a pressing need was expressed for an effective and sophisticated method by which the government agencies could examine and analyze overall transportation problems and traffic load induced by the individual activities or facilities, thereby allowing the agencies to minimize congestion on adjacent main roads.

From then on, considering the reality of traffic congestion, accidents, and environmental problems generated by the rapid increase in automobiles and further urbanization, there was concern that a serious situation might occur even in non-transportation sectors. The Traffic Load Impact Assessment System was introduced against this backdrop.

Under the system, those who operate activities or facilities over a certain size are to submit a report of the traffic load impact assessment to the Minister of Construction and Transportation or to the head of the province or the metropolitan city. The Traffic Load Impact Assessment Committee examines the report and may ask for supplements or revisions. Submission of a revised traffic improvement plan, responding to the request of the committee, is required to obtain permission for the project.
The Traffic Load Impact Assessment System greatly contributes to minimizing the impact of traffic at apartment complexes and department stores from early project planning stages.

3)-2-3 Integrated Impact Assessment

Apart from the EIA and the Traffic Load Impact Assessment System, the Calamity Impact Assessment System is also being implemented. Although these impact assessment systems are contributing to the minimization of the adverse impact of development programs at early stages, problems of duplicate procedures and excessive costs have been pointed out. The government enacted an integrated law in December 1999, the Impact Assessment Act on the Environment, Traffic Load, and Calamities, to ameliorate the situation.

3)-3 Voluntary Environmental Measures

3)-3-1 Environmentally Friendly Business Designation Scheme

The Environmentally Friendly Business Designation Scheme, introduced in 1995, is a policy measure by which a given enterprise voluntarily endeavors to improve the environment by assessing the environmental impact of the entire processes of business activities and setting concrete environmental improvement goals. Under this system, 107 firms have been designated as Environmentally Friendly Businesses as of 2001. For the designated firms, the government waives regular direction and inspection, replaces permission for emission facilities with reporting, and, in the case of small-medium enterprises (SMEs), offers priority in obtaining loans.

Moreover, the private sector has made an effort to satisfy global standards for environmental management. The number of sites awarded ISO 14000 (Environmental Management System) certificates in the ROK reached 544 in 2000, ranking 9th in the world. It is understood in the ROK that ISO 14000 not only contributes to environmental improvements, but also plays a positive role in marketing and business management by improving productivity, which outweighs the additional costs to the enterprises involved.

3)-3-2 Eco-labeling System

The Eco-Labeling System was introduced in 1992 based on the Environmental Technology Development and Support Act. The Korea Environmental Labeling Association, whose members include the government, industry, and consumers, has been in charge of awarding environmental labels. In the first year of application, four product groups, including recycled paper products and tissues made of recycled paper, were deemed eligible for the labeling program. Gradually, this increased to 62 product groups, many of which are durable goods, now eligible for the labeling program as of May 2001. In February 2001, the government introduced the Type III environmental labeling system of the ISO 14000 series, which certifies the environmental performance of the product.

3)-3-3 Target Recycling Ratio, Workplace Waste Reduction Program, and Producer Recycling Liability System

Based on the Promotion of Saving and Recycling of Resources Act, the Target Recycling Rate scheme was introduced in 1993. It was intended to raise the recycling rate of resources like waste paper and iron scrap. The targets are set up by consultation between the government and the business organization and are expected to be carried out by firms voluntarily.

The Workplace Waste Reduction Program was introduced in 1996 under the Guidelines for Workplace Waste Reduction, which was derived from the Waste Management Act as amended in 1995. Under the program, applicable workplaces may draw up and implement a reduction plan. After a careful analysis and assessment of the performance of the plan, the business organization has until March the following year to request that the workplace be designated as a “good workplace.”

The Producer’s Recycling Liability System, introduced in 2000, is a program in which producers form an organization that conducts recycling of waste generated from the use of their products at its own expense. The system has an incentive effect for firms to improve the designs and materials of products so that they generate less waste and make recycling easier. The system works on the basis of voluntary agreements with business groups of home appliance manufacturers, fluorescent light bulb manufacturers, and glass bottle manufacturers.

3)-3-4 Voluntary Agreements

In Korea, the first voluntary agreement was adopted in the energy sector among others. The Voluntary Agreement scheme in the energy sector was first introduced in 1998. 15 agreements between government and firms were signed in 1998, 52 in 1999, and 145 in 2000. The total number of firms that have signed agreements so far is 212. By signing and implementing the voluntary agreements, these firms are expected to save 830 billion won per year through efficiency improvements resulting from the total investment of 2.7 trillion won. In 1999, the amount of energy consumed by 176 firms that signed the agreement with the government was 39.4 million TOE, approximately 40% of the 99.7 million TOE for the entire industrial sector. Based on the survey and assessment of 46 firms, who together invested a total of 269 billion won in 1999, energy savings reached 775 thousand TOE, or 142 billion won, and CO2 emissions were reduced by 7.8% in 1999. In 2001, around 150 firms are expected to sign Voluntary Agreements. By the end of 2001, the number of firms is anticipated to reach 362 if the program is implemented as intended. Voluntary Agreements in the energy sector are a newly introduced environmental measure in the ROK, and have significantly contributed to energy savings and reduced CO2 emissions.

In these days, voluntary agreement became a broadly accepted environmental policy measure in Korea. It is reported that several cases of voluntary agreements are adopted recently. In October 2002, a voluntary agreement to reduce disposable articles used in takeout fast-food stores or fast-food restaurants was signed between 7 fast-food restaurant chains and 24 takeout coffee chains stores and the Ministry of Environment. This agreement was activated in January 1, 2003. According to the agreement, the fast-food and coffee chain store are to adopt a refunding scheme for disposable cups and to disclose regularly the record of refunding, while the Ministry of Environment is to offer waiver of regular inspection and to support recycling of recollected disposable cups.

4) Issues in Major Environmental Sectors

4)-1 Land Use

Land use management deals with the direct management of the decisions and regulations on the use of land resources. In order to ensure the sustainable land use, the Korean government has devised two strategies: the Comprehensive Land Use Plan and the National Land Use Zoning System.

4)-1-1 The Comprehensive Land Use Plan

The Comprehensive Land Use Plan is the overarching national plan that deals with basic strategies and policy measures on how to use, develop and preserve national land resources. It has gone through four alterations since its adoption in 1962. The plan provides basic directions for and coordinates policies and programs related to land use across agencies, thus laying the basic foundation for pursuing sustainable development strategies nationwide. In the Third Comprehensive Land Use Plan (1992-1999), the concept of sustainable development was explicitly introduced. It established resource-saving land use as one of its basic goals and strengthened investment in the quality of life and environmental oncerns. However, it was with the launch of the Fourth Comprehensive Land Use Plan in January 2000 that the environment and sustainable development were brought to the forefront and considered the most compelling tasks in land use management.

The current plan lays the integration of environmental and developmental considerations as a basic cornerstone of national land use management from 2000 to 2020. At this point, it is safe to say that sustainable development and environmental factors are the guiding concerns for all areas of national land use management, including regional development, industrial siting, social overhead capital (SOC) construction, tourism, urban management, and other uses of the nation's land resources. More concretely, the current plan introduces environment-friendly development model and guidelines, as well as reasonable environmental review measures, while at the same time building an integrated national land and ecosystem network encompassing major mountain ranges, rivers and coastal areas. In particular, by introducing a strict zoning system that separates development and conservation zones, it is now possible to simultaneously pursue conservation with systematic and environmentally sound development in the ROK. Regarding housing policy, a greater emphasis is now placed on providing more amenable housing environments rather than just supplying an ever-greater number of dwellings. For this purpose, the MOCT is leading the way in improving the housing environment and in making relevant legal arrangements. In addition, in managing land resources and transportation systems, the government is endeavoring to minimize environmental pressure by adopting demand-side management policies. The new national land use plans will help realize sustainable development on a national scale by securing a healthy and pleasant environment through the efficient, sustainable use of Korea's land resources.

4)-1-2 National Land Use Zoning System

The ROK's population density is the third highest in the world, with mountainous areas comprising 65% of the total area. Therefore, the top national policy priority is the efficient use of available land. The zoning system is designed to guide efficient land use for sustainable development by providing clear-cut distinctions between development and conservation zones. In the zoning system, the entire national land area is classified into five usage zones: urban, semi-urban, semi-rural, rural, and conservation zones. This is anticipated to secure an excellent foundation for improved quality of life, by delineating clear boundaries between conserved/preserved areas and land approved for development activities. Urban zones, constituting 15% of the total area, are densely populated and are under strict control of the urban planning system, which includes use zones, infrastructure plans and estate plans. The urban planning system is applied to urban zones separate from the land use zoning system. Rural zones are designated in order to strictly protect and manage prime farmland and productive forests (as opposed to protected forests in conservation zones, etc.), which together comprised 51.3% of the total national land area as of January 2001.

Nature conservation zones are designated to thoroughly preserve areas with outstanding landscape or valuable ecosystems; these areas account for 7.1% of the total land as of January 2001. Semi-rural and semi-urban zones are essentially non-urban zones, accounting for 27% of the total national land. These areas are maintained as farms or forests but may be relatively easily converted to urban areas when necessary. Initially, a national land zoning system was introduced in 1972 in order to prevent reckless development and degradation of the natural environment brought on by rapid industrialization and urbanization. However, because of the rigidity of its implementation, the shortages in the land supply led to rising real estate prices and falling industrial productivity. In the early 1990s, the system was restructured to be more flexible, by introducing such new categories as the semi-rural zones. Although this change improved land supply, there was growing concern regarding reckless development with insufficient infrastructure and/or harm to the natural landscape and ecosystems. Thus regulations on construction activities in semi-rural zones were gradually strengthened. In 1995, regulations were tightened for restaurants and lodging facilities in non-urban zones. In 1997, regulations for development projects were likewise strengthened, including a reduction of floor area ratio from 250% to 100% for community dwelling houses like apartments in semi-rural zones.

Since June 1999, full-scale restructuring of the national land zoning system has been under way to make it more environmentally friendly and to improve the sustainability of land management. A key element in this restructuring is the principle known as Plan Prior to Development, which stipulates that no development of any plots of land shall be carried out unless planned in accordance with the regulations for urban development. It is to be completed in 2001 and enforced by 2002. In 2001, the Land Pertinence Assessment System was introduced in order to consider environmental, agricultural and urban relevance as well as the physical characteristics of the land in designating the five use zones and in evaluating the availability of land for specific uses.

4)-2 Agriculture and Rural Development

Agricultural activities can have diverse positive environmental effects such as flood prevention and water buffering capacity, land conservation, maintenance of outstanding natural landscapes, and preservation of biodiversity. To enhance this multifunctional character of agriculture, the ROK has promoted sustainable agriculture and rural development by making environmentally friendly agricultural policies and measures a priority. In this respect, the government is reducing production-linked agricultural support that has an adverse impact on the environment and is shifting to non-production-linked and environmentally friendly forms of support such as direct payments. The strategy for sustainable development in the agricultural sector and in rural communities can be summarized as follows: efficient use of product resources, agricultural technology development, sustainable production and resource use, promotion of environmentally friendly agriculture, and participation from community members. In particular, sustainable farming has been sought through the restoration of soil quality, enhancement of soil fertility, and integrated pest and nutrient management. The government has promoted comprehensive measures based on the results of the survey on restoration of impoverished land, efficient use of land resources, and enhancement of soil fertility. Concerning integrated pest management, the government promoted the development and dissemination of an integrated management technology by which the costs of pest control can be maintained at a minimum level while using a minimum quantity of insecticide and preventing the decrease in crop yields. Regarding integrated nutrient management, the government promoted policies to minimize the use of chemical fertilizers by developing technology that ensures adequate fertilization based on test results by soil type. Furthermore, the government continues to facilitate technological development to improve livestock breeds, automate facilities, and enable low-impact farming.

The consumption of fertilizer and pesticide, a major indicator of sustainable agriculture, has been declining since 1992, as shown in Table 2.

< Table 2> Annual Consumption of Fertilizer and Pesticide

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Pesticide (tons)	26,718	25,999	26,282	25,834	24,641	24,814	22,103	25,837	25,917
Fertilizer (1000 tons)	936	974	970	954	908	882	860	842	798

Source: Ministry of Agriculture and Forestry

The Ministry of Agriculture and Forestry is efficiently applying international trade standards and promoting the development of environmentally friendly agriculture. Its policies of coping with difficult issues such as food security have been viewed favorably as well.

4)-3 Forests

To promote afforestation and sustainable utilization and conservation of forest resources, the government formulates the Basic Forest Plan every 10 years for all forests across the nation. The plan's implementation and progress is evaluated every 5 years, in accordance with the Forest Act. This plan includes the National Forest Program, which is formulated based on forest management plans of private forest owners and regional forest management plans of local governments, mainly for afforestation and the use, protection and development of forest resources, forest lands, and forest ecosystems across the country. The government successfully implemented the First and Second Basic Forest Plans, which were mainly for afforestation and reforestation, and rehabilitated much of the tree cover affected with serious forest degradation in the first half of the 20th century during the Japanese colonization and the Korean War.

After the first two plans, the Third Basic Forest Plan (1988-1997) was undertaken to establish the foundation for forest resource development. Among the major achievements are: 1) by amending the Forest Law in 1996, the legal basis for sustainable forest management was provided, including 7 criteria for sustainable development of forest resources; 2) based on functions and purposes of forests, the classification scheme of forests was revised in 1997 for more efficient management of forest lands; 3) by formulating the Forestry Development and Promotion Law in 1997 and amending the forestry tax system, the institutional basis was provided to encourage more professional management practices in private forests; 4) during the implementation of the third plan, roughly 330,000 ha of commercial forests were established and silvicultural practices were applied to over 3 million ha of forests, resulting in a timber volume increase from 31 ・per ha in 1987 to 52 ・per ha in 1997; 5) about 110 forest recreational sites and facilities, including 70 Recreational Forests, were established to meet the ever increasing demand for forest recreation and tourism; and finally 6) by designating 372 wildlife sanctuaries, wildlife density in forest habitat increased from the wildlife population of 18.76 per 100 ha in 1987 to 21.3 per 100 ha in 1997.

The Fourth Basic Forest Plan (1998-2007) is now in effect. Its major goal is to improve and expand the infrastructure for sustainable forest management. Major achievements from 1998 to date include: 1) introduction of the Green Forest Lottery System in 1998 to secure investment funds for maximizing forest-generated public benefits; 2) formulation of the Basic Forest Law in 2001 to guide forest policy, focusing on sustainable forestry; 3) establishment of the National Arboretum in 1999 for systematic conservation and management of Korea’s flora and the formulation of the Arboretum Establishment and Promotion in 2001 for the conservation and utilization of the genetic material of plant resources; 4) innovative and/or experimental management of about 1.2 million ha of forests alongside 5 major rivers with a view to improving the water quality; and 5) introduction of forest tending projects to establish ecologically sound forests. From 1998-2001. about 0.4 million ha of forests were through investments of over 600 billion won. The public benefits and environmental values generated from all forests in Korea rose from 17.7 trillion won in 1987 to 50 trillion in 2000, an increase of 2.8 times over the 13 year span.

However, it is expected that a certain portion of forests will be converted to meet the demand for various uses, including housing development caused by continued urban migration, industrial sites due to diverse industry development, and non-forest leisure space for the public. To address these issues, the government is now considering the formulation of the Forest Land Control Act, which will include feasibility studies on forest development in an effort to administer more stringent conservation and management practices on Korea's remaining forests.

4)-4 Nature Conservation and Biodiversity

A major survey shows that as of 2000, there are 18,029 species of animals, 8,271 species of plants, 1,625 species of fungi, 736 species of protista, and 1,167 species of prokaryotes in the Republic of Korea; a total of almost 30,000 species. However, the extinction rate for many of these 22 species are being accelerated from extensive deforestation and development, urbanization, reckless hunting and excessive use of pesticides. Tigers, leopards, foxes and wolves are not reported recently in Korea. Gorals, musk deers and Asiatic black bears are on the verge of becoming endangered. For these reasons, the government has enacted and is enforcing the Natural Environment Conservation Act for the protection of endagered or protected wild fauna and flora, the Cultural Heritage Protection Act for the protection of natural monuments, and the Wildlife Protection and Hunting Act for the protection of wild mammals and birds. In 1997, the Natural Environment Protection Act was amended to include clauses for the protection of endangered species, which formed the basis for the government's designation of 43 wild fauna and flora as endangered species and 151 wild fauna and flora as protected species. Since 1992, the government has implemented the Basic Plan for Natural Environment Conservation, based on the Natural Environment Conservation Act. The government then formulated the Basic Directions for Natural Environment Conservation in 1998, and in May 1999 established a five-year action plan known as the National Natural Environment Conservation Plan.

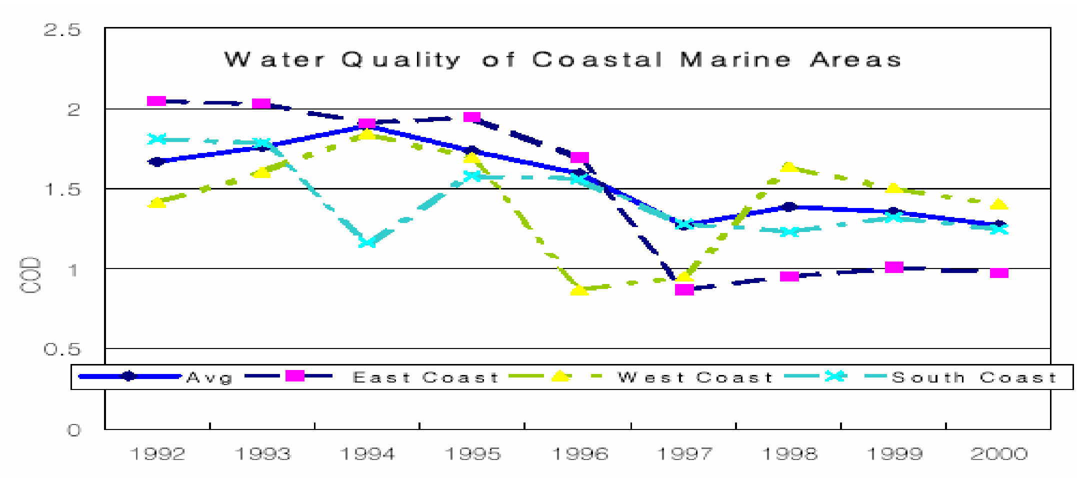
The government regularly conducts natural environment surveys, and designates and supervises so-called Ecosystem Conservation Areas. There are seven sites designated as National Ecosystem Conservation Areas, including migratory waterfowls habitats found at the Nakdong River estuary. Eight other areas have been designated as Provincial Ecosystem Conservation Areas, including rare plant growing areas of Mt. Baekwoon in Kwangyang County. Such strategies on nature and biodiversity preservation are being carried out in relation to Korea's responsibilities as a party to the Convention on Biological Diversity.

4)-5 Marine Environment

The creation of the Ministry of Maritime Affairs and Fisheries (MOMAF) in 1996 has enabled the government to implement integrated marine policy measures. The ROK has been pursuing various policies for the integrated management of coastal areas, establishing a basis for the systematic management of various marine pollution sources. In 1999, the government enacted the Coastal Zone Management Act and amended the Marine Pollution Prevention Act. Since 1995, the government has also been expanding basic environmental facilities in coastal zones. Most recently, policy measures have been introduced based on the Integrated Coastal Zone Management Plan, established in 2000. Since pollutants from 23 land affect a significant part of the marine environment, the government designated marine protection areas to facilitate the implementation of effective and integrated protection measures. To date, the government has designated nine marine areas totaling 4,791 km2 as “protected marine areas”. By doing so, the government has laid an institutional basis for introducing management policies based on complete prior reviews of environmental and socio-economic characteristics of designated marine areas. Furthermore, active participation from stakeholders, including local residents, is encouraged by a policy of support prior to regulation.

In 1998, the ROK established a management system for the sustainable utilization of fishery resources and adopted a total catch quota system to limit the size of catches. Fisheries may be closed on a rotating basis to prevent excessive contamination.

< Figure 1 > Water Quality of Coastal Marine Areas



Thanks to these marine environmental conservation strategies, marine water quality in coastal areas has improved since 1992 (See Table7). Since 1992, however, the incidence of red tides, an important indicator of marine pollution in coastal areas, has been increasing each year, only recently showing a reversal in this trend.

4)-6 Water Quality

Water quality management is one of the most important problems in the ROK. Since the supply of drinking water depends heavily on rivers, it is critical to preserve the quality of the water in rivers, as it is directly linked to human health and the quality of life. Since the sources of pollution are geographically dispersed and originate not only from industry and residential areas, but also from agriculture and livestock farming, water pollution is not easy to control. It is directly linked to the daily lives of inhabitants and the usage of land. As such, water quality management faces many difficulties including limitations to property rights.

Despite such difficulties, the water quality figures of the two largest major rivers, the Han and the Nakdong, have been maintained at the status quo (see Table 6). This is due to the establishment and implementation of comprehensive plans for water quality management for the major rivers used as primary sources of potable water.

< Table 3 > Changes in Water Quality: the Han and Nakdong Rivers

Unit: BOD (ppm)

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Han R. (Paldang)	1.1	1.2	1.2	1.3	1.4	1.5	1.5	1.5	1.4
Nakdong R. (Mulkeum)	3.3	3.4	4.6	5.1	4.8	4.2	3.0	2.8	2.7

Source: Ministry of Environment

In 1991, the government partitioned the national territory into four large zones and 11 medium-sized zones, based on the basins of the four largest rivers (Han, Nakdong, Keum, and Yeongsan Rivers) in order to effectively improve water quality.

The Comprehensive Measures for Clean Water Supply was launched in 1993 in order to promote integrated water management policy. Formulated as a five-year-plan with a budget of 15.9 trillion won, these measures concern water quality control, water resources management, and potable water supply. In 1996, these measures were succeeded by the Comprehensive Measures for Water Management, which constituted a long-term plan for water management with a 10-year program for water quality and a 15-year program for water resources.

In 1996, the Water Quality Improvement Task Force was founded by the Office of the Prime Minister to improve the water quality in the four major rivers. Its responsibilities include: integrating and coordinating water management policies; directing, supervising and coordinating related government agencies; devising policies to protect drinking water sources and improve water quality; addressing matters relating to the installation of basic environmental facilities; addressing and mediating conflicting interests while implementing measures for improving water quality; directing, supervising and coordinating the jurisdictions of the central government and local governments; and lastly, conducting performance reviews of the water quality measures. Despite the aggressive policies and investments following the Comprehensive Measures for Clean Water Supply, the ROK’s water quality improvements did not meet the expectations because of the large demand for economic development in the Suwon area. In 2000, the quality of the water in the Paldang, Taechung area, and the regional water supply was level 2, while the water quality in the lower part of the Nakdong River lingered at level 3, requiring intense purification during the dry season.

From 1998 onwards for three years, the local civil society, NGOs, and autonomous local bodies cooperated to establish the Special Comprehensive Program for Water Quality Improvement for each of the four major river systems. This program includes a new water use charging system, pollution quota system, and designation of waterside zones and forest buffer zones. For the Han River, a voluntary pollution quota system was in place since 1999, and for Nakdong, Keum, and Youngsan rivers, a mandatory pollution quota system will be enforced by late 2003. As a result of these and similar programs, the water quality in the major tributaries of the four largest rivers is gradually improving.

4)-7 Air Quality

The ROK's air pollution control policy includes institutional measures such as the introduction of ambient air quality standards, control of pollution sources, operation of the Air Quality Monitoring Network, and the designation of special air quality regulation zones. It also includes pollutant-specific measures to control sulfur dioxide (SO_2), particulate, odors, volatile organic compounds (VOC), and acid rain, as well as measures for reducing atmospheric pollution from motorized vehicles.

Thanks to the wide distribution of clean fuels, the air pollution in large cities has substantially declined in the last few years. The concentration of SO2 in some major cities, especially in Seoul and Ulsan, is decreasing year after year; the current level of annual average SO2 concentrations in the two cities are well below 0.02ppm, fully within the national ambient air quality standard. Air quality is improving considerably in terms of SO2 and total suspended particulates (TSP) concentrations.

< Table 4 > SO2 Concentrations in Seoul and Ulsan

(Unit: ppm)

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Seoul	0.035	0.023	0.019	0.017	0.013	0.011	0.008	0.007	0.006
Ulsan	0.031	0.032	0.03	0.028	0.022	0.019	0.015	0.017	0.013

Source: National Statistical Office

The transport sector has become one of the most troubling areas in the ROK, as it has an impact on the related issues of securing amenable housing, land-use, air quality management, energy consumption, and the efficiency of industrial activity. As the transport sector has continuously expanded since 1980, the size of the automobile fleet increased from 2 million in 1988 to 11 million by October 1999. Consequently, the partial improvement in air quality has been outpaced by the explosive jump in the automobile use and the subsequent air pollution. This causes health problems, air quality deterioration and traffic congestion.

The government's policies for mitigating environmental damage from the transport sector entail two approaches: reduction of auto emissions and demand- side management. The policy measures to reduce emissions include applying stricter auto emission and fuel quality standards and strengthening auto emission inspection. In addition, the government is replacing diesel-powered buses with CNG-powered ones in major cities by 2007, starting with the 2002 World Cup host cities.

The demand side policy includes encouraging public transportation use and infrastructure build-up (i.e., expansion of subways and the introduction of bus-only lanes), as well as economic instruments such as raising parking fees and fuel prices. By adopting a gasoline mileage charge (a high fuel price policy) in late 1996, Seoul's driving speed increased by 15.9% in downtown and by 26.7% in suburbs by January

1998, showing the remarkable effectiveness of economic incentives.

3. Korean Government’s Policies in Environmental Industry and Technology

1) Environmental Investments and Budget

The ROK has made a great advances since 1992 in environmental investments and budget as well as in strengthening legal and institutional capacity, especially in comparison to the statistics at the time of the 1992 Rio Summit. The overall environmental budget grew sharply from 352 billion won in 1992 to over 2.2 trillion won in 2000.

< Table 5 > Environmental Budgets

(Unit: 100 million won)

	1992	1993	1994	1995	1996	1997	1998	1999	2000
MOE Budget	1,396	1,887	4,716	6,729	8,851	10,802	11,131	11,536	13,023
Allowance for Water Quality Improvement	2,126	2,500	2,490	3,121	3,978	6,867	6,132	6,714	9,317
Total (Environmental Budget)	3,522	4,387	7,206	9,850	12,829	17,669	17,263	18,250	22,340

Source: MOE

Total environmental expenditures grew gradually from 1992 until the end of 1997, and decreased in 1998 (just after the financial crisis). However, as of 1999, expenditures reverted to 1.6% of the GDP (7.8 trillion). The government’s total environmental expenditure was hardly impacted by the economic crisis. As the economic situation worsened, private expenditures for the same period fell drastically in 1998, and showed no sign of quick recovery in 1999. Few improvements in private environmental investments are expected unless the economy stabilizes.

2) Policies for the Shift to Environmentally Friendly Industrial Structure

Based on the Act to Promote Shifting to an Environmentally Friendly Industrial Structure (enacted in 1995, revised in 1997 and 1999), the government plans to contribute to balanced economic development by shifting to an environmentally friendly industrial structure by actively promoting energy conservation and resource-saving industrial activities.

The act stipulates measures aimed at adopting an environmentally friendly industrial structure and the certification system for environmentally friendly enterprises. According to the act, comprehensive policy measures are to be established every five years to accelerate the restructuring. These policy measures include evaluating the current industrial structure and its outlook, setting targets, developing clean production technology and processes, support for environmental industry, and finally, promoting environment-oriented business administration.

The Clean Production Technology (CPT) project is designed to support the development and distribution of economically efficient and environmentally friendly technology that will enable companies to minimize environmental stress and reduce production costs. The project also promotes industrial development by helping to sharpen the competitive edge of Korean businesses in the global arena. In 1999, this project yielded 27 new patent registrations and 279 research papers.

The CPT has produced a number of achievements. They include the widespread diffusion of the clean production concept, voluntary participation by business enterprises, establishment of a basis for greening industry via technological improvements at individual firms and technology transfers, case studies of advanced clean technology, and development of appropriate technologies for small and medium enterprises.

The government had supported firms that manufacture or install environmental facilities or clean production facilities by providing special loans of 295 billion won 1995-2000. To help stimulate the demand for recycled products, the government extended a number of items applicable for recycling certification and expanded the standard rules. In 2000, the number of applicable items was 166, with 116 standards, ranking the ROK ninth in the world.

At the same time, the government has been encouraging enterprises to become qualified for ISO 14000; as of the year 2000 the number of enterprises so qualified has reached 544. Also, the government is encouraging the standardization of environmental management systems, including the development of environmental indicators for materials, manufacturing processes, and transportation.

3) Policies for the Development of Environmental Science and Technology

From 1992 to 2001, the government introduced a three-stage Environmental Engineering Technology Development Program to upgrade the ROK's environmental technology to the level of advanced G7 countries. Along with this, a joint program with public-private sectors has been implemented. From 1992 to 2000, 325 billion won was invested in 306 research projects, such as desulphurization and denitrification, of which 199 have been completed.

The program originally envisaged developing and applying advanced technologies by 1997, and developing purification, restoration, and recycling technology by 2001, with the goal of nurturing cutting-edge environmental industry. However, the project's status in 1998 showed that some of these objectives were not fully attained.

The government plans to set up a combined program for integrating and coordinating various programs individually planned by various ministries in order to enhance efficiency and avoid investment overlaps in the public and private sectors. For that purpose, in February 2000, the government amended the Act Concerning Development and Support for Environmental Technology.

In 1999, by amending the Special Act for National Science and Technology Innovation, the government established the National Committee for Science and Technology, which is mandated to examine and deliberate on the investment priorities in the field of science and technology, including environmental technology.

The demand side should be considered in designing policies to develop environmental technology, since the technologies may remain largely unused unless supported by relevant environmental policies. For this reason, 10 major objectives have been established for the distribution of environmental technology and products.

In February 2000, a national environmental technology assessment system was legislated to drive the development and distribution of new environmental technology, and in 2001, the government launched a program to develop cutting-edge environmental technology. Known as Eco-technopia, this program will invest 100 billion won during the decade (2001-2010) in 22 major projects in four areas: integrated environmental technologies, ecosystem conservation and rehabilitation, pollution prevention, and technologies for global challenges such like climate change. In particular, modifying and strengthening systems related to the environmental industry, including the improvement of bidding systems and the exemplification of pollution regulation standards, may contribute to its invigoration.

The government has launched the Eco-Dream Project to establish an environmental venture fund with 13 billion won, and second and third funds will be founded as the ventures develop. The number of environmental venture companies was about 280 in 2001, comprising 5% of the total of 5,400 venture companies, but recent interest has focused on venture capital for future-oriented industries and there is a strong sense of the potential for success in new and patented technologies owned by environmental venture companies.

In Korea, it is believed that “select and concentrate” policy is good for the efficient researches with limited professional manpower and financial resources. By the same token, a kind of “division of role” among the government and private sector is also considered desirable.

4. Current State and Prospect of the Environmental Industry of Korea

In Korea’s industrial classification (KSIC), industrial classification for the environmental industry is not integrated and scattered around related sectors and subsectors. Thus, statistical information on environmental industry is limited and incomplete. Accordingly, government policies for environmental industry lack sound basis.

Despite this limit, the Bank of Korea estimated that pollution abatement expenditure was 8,023.1 billion won 1999 and 7,969.0 billion won in 2000 (See Table 6). In 2000, the share of environmental expenditure in GDP was 1.54 %. It is reported that the size of total environmental expenditure decreased by 13.7% from the previous year. This is due to the financial crisis burst in late 1997. After 0.7 % of increase in 1999, the environmental increase again decreased in 2000 by 0.7%. By media, water quality takes 46.3%, solid waste 34.7%, air quality 15.8%, and others 32.%. By sector, government is 52.2%, business sector 43.6%, and household sector 4.2%.

Government’s environmental expenditure takes the role of meeting the ever-increasing demand for better quality of life. The growth rate of government expenditure is relatively high. In Korea, businesses’ environmental expenditure grows relatively slowly, since major large investment projects are already complete by major companies. These large investments are those in the areas of wastewater treatment facilities, dust collection equipments, or desulphurization equipments, mainly in responding to government’s tougher environmental regulations. By industry, environmental investments in machinery and primary metal products industries are rapidly increasing and those in refined petroleum products and transportation equipment industries are decreasing.

These figures, based on the data of the Bank of Korea, represent the demand side of the environmental industry which follows a narrow definition of the industry. A differently defined environmental industry’s market size and prospect are as shown in the following Table 8. Korea’s environmental market is expected to increase in terms of sales performance from 9 trillion won in 1999 to 19 trillion won in 2005, reaching 32 trillion won in 2010, and the growth rate is forecast to be 12% annually by 2010. Focusing on the market growth rate by period, it is expected to increase by 13.1% between 1999 and 2005 and by 11.1% between 2005 and 2010. Considering the fact that the long-term economic growth rate is under 5% annually, these numbers are very high. In particular, the increase in the utilization of the environmental resources sector will be higher than that of the environmental service and equipment sectors. In Table 8, the growth of Environmental Equipment, among three major sectors of the environmental industry, is projected to slow down in the period of 2005-2010. In Table 9, a more detailed, subsector-wise projection for the growth of environmental industry in Korea is provided for the period of 1999-2005. In terms of share, Solid/Hazardous Waste Management (Environmental Services) and Recycling of Resources (Utilization of Environmental Resources) are projected to maintain highest shares among subsectors. However, in terms of growth rate, Environmentally Fiendly Energy and Clean Production are expected to show highest growth rates among subsectors of environmental industry.

Within the Environmental Services sector, Water Treatment Services, Environmental Recovery and Creation, Environmental Consulting and Engineering are considered to have relatively brighter prospects. Solid and Hazardous Waste Management subsector is expected to grow with a rate lower than average. A large share of Solid and Hazardous

Waste Management is taken by the public sector and public enterprises. A small fraction of the Waste Management Service market is taken by small firms on exclusive bases, leaving potential new entrants little chance to get in the market. Environmental Experiment and Analysis Service is small in market size and has no great growth potential in the near future.

Utilization of Environmental Resource is considered to expand in market size, a speculation based on its position in product lifecycle. Recycling of Resources and Environmental Energy Resources are considered to be promising for its large market size and high growth potential respectively. Water Resource Utilization is a tough area for private businesses since the Water Resource Corporation, a government funded corporation, is exclusively operates in this area.

Environmental Equipment is considered to having entered maturity stage in its product lifecycle, showing slow growth. Regarding market size, Water Treatment Facilities, Air Pollution Prevention Equipment have good potentials, while Waste Management Facilities and Clean Productions are considered to be promising in terms of growth potentials. Environmental Energy Resources is expected to grow until the year of 2005 by an annual raet of 46.8%, the highest among sub-categories, followed by Clean Production (36.6% per annum) and Environmental Consulting and Engineering (15.5% per annum).

The potentiality of these prospects is partially based on a plan under which, in order to develop the environmental industry, eight governmental departments in the ROK will undertake a phased joint expansion in the scale of their investment in nurturing the environmental industry, from 509.1 billion won in 2001 to 1 trillion 462.9 billion won between 2002 and 2003, to be invested with an emphasis on five sectors.

Park and Kim (2001) enumerated several specific areas for future growth engine of environmental industry in the 21st century in Korea. They include Gasification Smelting Equipments, Biodegradable Plastic Manufacturing, Biological Water Treatment Facilities, Ultra Pure Water Treatment Facilities, Urban Sewage Treatment Services, Ecosystem Restoration, Environmental Diagnosis, Assessment, Monitoring Systems, Fuel Cell, and Home Appliance Recycling Business. These areas are of high growth potential and local technological capacities.

However, in more realistic estimates Park and Kim suggest areas with good market potentials including: Swage Treatment Facility Installation Business, Sewage Sludge Treatment Facility Installation Business, Flue Gas Desulfurization and Denitrification Equipment Installation Business, Incinerating and Smelting Equipment Installation Business, Food Waste Treatment Equipment Manufacturing, Environmental Restoration and Recreation Business, Management Services of Public Environmental Facilities, and so on. These areas are mostly existing businesses with steady demand or some new areas developed form such existing areas.

< Table 6 > Korea's Environmental Expenditure (Pollution Prevention and Treatment)

Unit: billion won

		1998	Share(%)	1999	Share(%)	2000(p)	Share(%)
Pollution Prevention Expenditure (% in GDP)		7,246.1 (1.63)	100.0	8,023.1 (1.66)	100.0	7,969.0 (1.54)	100.0
By Sector	Government	4,032.5	55.7	4,380.6	54.6	4,158.8	52.2
	Business	2,862.6	39.5	3,294.9	41.1	3,473.2	43.6
	Households	351.0	4.8	347.6	4.3	337.0	4.2
By Type of Expenditure	Capital Invst.	3,354.6	46.3	3,667.1	45.7	3,148.5	39.5
	Recurring	3,889.7	53.7	4,356.0	54.3	4,820.5	60.5
By Media of Pollution	Air	1,020.8	14.1	1,311.2	16.3	1,262.0	15.8
	Water/Soil	3,474.4	47.9	3,714.6	46.3	3,692.0	46.3
	Solid Wastes	2,526.7	34.9	2,749.6	34.3	2,766.9	34.7
	Others	224.2	3.1	247.7	3.1	248.1	3.2

Source: The Bank of Korea. "Estimates of Environmental Pollution Abatement Expenditure (in Korean)," November 7, 2001.

< Table 7 > Pollution Prevention and Treatment Expenditure by the Business Sector

Unit : billion won

			1998	1999	2000^p(share)
Total Expenditure by the Business			2,862.6	3,294.9	3,473.2(100.0%)
By Types of Expenditures	Capital Investment		1,025.3	1,138.9	930.4(26.8%)
		End-of-Pipe	937.3	1,003.1	776.0(20.3%)
		Preventive	88.0	135.8	154.4(4.4%)
	Recurrent		1,837.3	2,156.0	2,542.8(73.2%)
By Industries	Manufacturing		1,711.4	2,033.8	2,370.8(68.3%)
		Heavy&Chem	1,329.0	1,671.6	1,911.0(55.0%)
		Light Ind	382.4	416.2	459.8(13.2%)
	Non-manufacturing		1,152.2	1,261.1	1,102.4(31.7%)
		Agr/Fish/Min	84.2	94.2	106.6(3.1%)
		Utilities	377.7	481.1	209.1(6.0%)
		Construction	88.1	88.0	103.5(3.0%)
		Services	601.2	597.8	683.2(18.7%)

Source: The Bank of Korea. "Estimates of Environmental Pollution Abatement Expenditure (in Korean)," November 7, 2001.

< Table 8 > Prospects for the Environmental Industry of Korea (1999/2005/2010)

Unit: 100 million won

	1999	2005	2010	Annual Average Growth Rate (%)	
				1999-2005	2005-2010
Environmental Services	38,980	78,850	136,390	12.5	11.6
Environmental Resources	28,380	62,770	118,540	14.1	13.6
Environmental Equipment	22,610	46,350	62,620	12.7	6.2
Total	89,870	187,970	317,550	13.1	11.1

Source: Park, Jong Sik and Kim, Tae Yong. *Environmental Industry* (in Korean), *Samsung* Economic Research Institute, 2001

< Table 9 > Prospects for the Environmental Industry of Korea in Breakdown (1999/2005)

Unit: 100 million won

	1999	2005	Annual Growth Rate (%)
Environmental Services	38,980	78,850	12.5
Solid/Hazardous Waste management	22,060	42,930	11.5
Water Treatment Services	11,060	23,640	13.5
Environmental Recovery/Creation	4,320	9,480	14.0
Environ. Consulting/Engineering	740	1,760	15.5
Experiment and Analysis Services	800	1,580	12.0
Utilization of Environmental Resources	28,380	62,770	14.1
Recycling of Resources	26,730	57,150	13.5
Utilization of Water Resources	1,650	3,620	14.0
Environmentally Friendly Energy	200	2,000	46.8
Environmental Equipments and Facilities	22,610	46,350	12.7
Water Treatment Facilities	9,910	20,090	12.5
Air Pollution Prevention Equipments	9,500	18,060	11.3
Waste Management Facilities	2,710	6,270	15.0
Clean Productions	200	1,300	36.6
Measuring Equipment	290	630	13.8
Total	89.970	187,970	13.1

Source: Park, Jong Sik and Kim, Tae Yong. *Environmental Industry* (in Korean), *Samsung* Economic Research Institute, 2001

5. The Role of Foreign MNEs and NGOs on EI in ROK

1) MEAs and Pressures from the International Community

For Korea's environmental awareness to grow, major driving force was the grassroots environmental movement. However, environmental movement groups' activities were mainly targeted towards the domestic issues. Regarding international environmental issues, the international community's influence was significant. A few of the examples are the Montreal Protocol and the CITES. Montreal Protocol was a symbolic event by which Korean People became aware of the importance of international environmental problems. Since this protocol included trade restrictive clauses to prevent free riding problem by non-member countries, the impact was powerful and immediate. Korean people realized quickly that global environmental issues are a matter closely linked economic issues and there is no other option than actively participating in those global efforts. Despite Korea was developing country in all respects in 1991, Korea failed to obtain developing country status because per capita consumption of CFCs exceed the standard set by the protocol. Therefore, as known, the industrial impact of the Montreal Protocol was immediate and significant in Korea.

The CITES is also an important incident. For the enforcement of banning trade in endangered species and their products, environmental authority closely cooperated with Ministry of Health and Society, the Ministry of Justice and the Prosecutor's Office, etc. CITES was an example that international treaties brought significant changes in domestic law and its enforcement systems. In the course of this enforcement setting process in the early 1990s, there was international NGOs influence. WWF's TRAFFIC network continually warned cases of illegal trade in endangered species of which final destination of those products was Korea. International NGO's activity influenced Korea's oriental medicine market.

2) MNEs and the Environmental Industry

Since Korea is an export-oriented economy, environmental standard are, when related to the products, quickly caught up to meet the demands of markets in North America, Western Europe, and Japan. For standards of domestic environment (PPMs), Korean businesses are relatively quickly adapting to international standards, not because of foreign pressures or spillover effects from foreign business in Korea, but because of increasing needs for better environment. As a matter of fact, Korea is a country of potentially enormous environmental pressure, due to its extremely high population density and ever-growing industrial activities. Without appropriate action is taken, Korea will be unsuitable to live in. Aggressive environmental NGO's activities played key roles for this change.

However, foreign MNEs contributed to the development of environmental industries in Korea, indirectly through the pressure from the international market. Since Korea's manufacturers are fairly keen to the developments in the international market, they have been relatively successful in meeting international standard.

2)-1 Case: Semiconductor Industry

PFC (Perfluorocompounds) is one of the Greenhouse Gases and subject to the regulation of the Frame Convention on Climate Change and the Kyoto Protocol. The World Council of Semiconductor decided to build a cooperation system to reduce the emission of PFCs. In April 1999, semiconductor associations of USA, Japan, Europe and Korea decided to reduce the consumption of PFC by 2010. In 2000, Taiwan joined this group, although there remained some disagreements.

Although the agreement among the parties within the WSC took the form of voluntary agreement, it is apparent that major countries (USA, Japan, and Europe) took the leadership and others (Korea and Taiwan) reluctantly followed.

Reduction of PFC use in the semiconductor industry requires changes and improvements of material and equipments. In Korea, most technologies are dependent on foreign sources in semiconductor equipments, material and devices industries. PFC reduction agreement's effect on Korean semiconductor industry was creating a new market for "cleaner" materials and equipments for the foreign suppliers.

2)-2 Case: EU on Auto CO2 Emission Standards

To meet the commitment to reduce CO2 emission in EU until 2008-2012 by 8% from the level of 1990, EU is promoting a program to reduce CO2 emissions of passenger cars. This includes 1) inducing voluntary reduction of CO2 emissions based on voluntary agreements between the European Commission and the auto makers, and 2) providing consumers with information on the fuel economy and CO emission quantity of each passenger car model. By this program, European Commission already signed agreements with automobile industry associations of EU, Japan, and Korea. This agreements requires that auto makers shall reduce the Co2 emission to 140g/km until 2909(Japan and Korea) or until 2008(Europe). Korean automobile's emission ratio was 200g/km in 2000. If Korean auto makers fail to meet this requirement, the European Commission may hinder the import of Korean cars in the form of technical regulations. Alternatively, it may take a form of charge, a sort of Border Tax Adjustment. Europe's new tougher CO2 regulation on cars certainly encourages large R&D investment in Korean auto industry.

2)-3 Case: Effect of Foreign Customers/Suppliers: Daeduck GDS Co.'s Adoption of EMS[1]

Daeduck GDS Co., established in 1965, has been producing PCBs (printed circuit boards). With regard to environment, the company has been active in responding to national environmental concerns, government regulations, legal enforcements, and also demands from domestic and foreign customers and suppliers. Daeduck GDS Co. received awards for water quality in 1998 and air quality in 1999. Recently, the company introduced ISO14001 (EMS) certification. Daeduck GDS has four domestic and two overseas affiliates: two overseas affiliates are located in the Philippines (Daeduck Philippines) and U.S.A. (Fine Tech, Inc.).

For the company, the single most important environmental issue is water quality. Water supply is a key issue in the Banwal Industrial Comples, where the company is located, due to limited water resources. Sufficient water supply is essential in the washing process in manufacturing PCBs. This makes recycling of wastewater indispensable to Daeduck GDS Co. operations.

There were many reasons that led Daeduck GDS Co. to implement an EMS. The most important. The most important reasons were to build a sound company image and to make efficient use the limited municipal water supply of the region without affecting the

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[1] quoted from Korean Ministry of Environment/ World Bank, *Development of Environmental Management System for SMEs*, 2001

local environment. In terms of the supply chain, it became important to emphasize the environmental benefits of their product, as well as quality, to buyers, particularly foreign buyers. Changing market circumstances also made environmental management crucial to the company's management policy. Finally, an active response was necessary to meet continually tightening government environmental regulations.

The foreign companies that considered to have affected Daeduck GDS Co.'s environmental ,management system include: SONY, Siemens, Toshiba, Fujitsu, Philips, etc. as customes, and Matsushita, Fujikura, etc., as suppliers (see Tabel 10).

< Table 10 >: Table VIII-2-7. Environmental Management of Customers and Suppliers for Daeduck GDS Co.

	Customers		Suppliers	
	Company	Certification	Company	Certification
Domestic	Samsung Electronics	ISO-14001	Doosan Electronics	ISO-14001
	LG Electronics	ISO-14001	Shinsung Multiclad	ISO-14001
	Daewoo Electronics	ISO-14001	Dio Ink Korea	
	Sony Electronics Korea	ISO-14001	Unid	ISO-14001
	Hyundai Electronics	ISO-14001	Taekyung Chemical	ISO-14001
	Tae Kwang Industry	ISO-14001	Donghwa Damura	
Foreign	SONY	ISO-14001	Matsusida	ISO-14001
	SIEMENS	ISO-14001	Comboard	ISO-14001
	TOSHIBA	ISO-14001	Fujikura	ISO-14001
	SMK	ISO-14001		
	ALCATEC	ISO-14001		
	FUJITSU	ISO-14001		
	KENWOOD	ISO-14001		
	PHLIPS	ISO-14001		

Source: Korean Ministry of Environment/ World Bank, *Development of Environmental Management System for SMEs*, 2001

6. International Cooperation

1) Environmental Business Cooperative Group

In 2001, Korea's industry and government agencies formed a loose network to enhance cooperative projects between Korea and Asian and European countries to work together in the field of environmental industries.

It is composed of representatives of environmental businesses, Ministry of Environment, Korea Material Recycling Corporation, six related cooperatives, etc. Business and government agencies formed an Environmental Business Cooperative Group. This group toured to Indonesia, Singapore, France, and Japan. In Indonesia, Korean representatives agreed with Indonesian Chamber of Commerce to cooperate in environmental industry by 2002. In Singapore, France, and Japan, this group has performed active marketing and cooperation activities.

This group particularly focuses on the cooperation with Chinese partners. It runs an exhibition site for Korean environmental industries in Beijing. It works on active survey on cooperation opportunities throughout in China. To support this, Korean government will allocate EDCF fund. One of the cooperative projects is working on identification and promotion of environmental businesses of mutually beneficial interests to Korea and China altogether. It is promoted jointly by Korea's National Institute of Environmental Research and Chinese Academy of Environmental Sciences. It is identifying environmental technology items that are urgently needed for the improvement of environment of China.

Recently, the government established the "Permanent Exhibition Hall for the ROK's Environmental Industry and Technology" in China, as well as forming an "Environmental Industry Cooperative Export Group" as a joint effort between government and industry, in order to provide advice to small and medium companies regarding exports to the Southeast Asian market.

The Environmental Industry Cooperative Export Group was dispatched to Indonesia, Singapore, France, and Japan, resulting in establishing bilateral cooperation channels and many export deals amounting to 3,380,000 dollars. In Indonesia, this group agreed to promote to develop cooperation projects together with Indonesian Chamber of Commerce Environment Subcommittee by 2002.

2) International Cooperation in Environmental Technology with Japan and China

According to the data from Korea Institute for Industry and Trade (KIET), international trade of environmental industry and technology is largely mad up of environmental equipments, particularly waste treatment facilities.

Table 10 provides the information on the import of Japanese environmental technology into Korea. Most cases are technology transfer of incinerator technologies.

< Table 11 > Some Examples of Korea-Japan Environmental Technology Cooperation

Case 1: Samsung Heavy Industry – Mitsubishi Heavy Industry
Item: Incinerating facility Korean Partner: Samsung Heavy Industries Japanese Partner: Mitsubishi Heavy Industries Date: April 1994 Detail: Mitsubishi transfers technology to Samsung for plant technology for urban waste incineration. The duration of the contract is 10 years.
Case 2: Jindo Construction-NKK
Item: Incinerating facility Korean Partner: Jindo General Construction Japanese Partner: NKK Date: May 1995 Detail: NKK transferred Jindo Construction, Ltd. technologies for liquefied bed type waste incinerator and for the elimination of harmful exhausts. This was the first technology transfer case for NKK.
Case 3: Kolon Engineering-Sanki industry
Item: Incinerating facility Korean Partner: Kolon Engineering Japanese Partner: Sanki Engineering Date: January 1995 Detail: Technologies for stoker type incinerator and for large-scale waste treatment facilities were transferred form Sanki to Kolon.
Case 4: Ssang-Yong Engineering-Mitsui Shipbuilding
Item: Incinerator Korean Partner: Ssang-Yong Engineering Japanese Partner: Mitsui Shipbuilding Date: June 1995 Detail: Mitsui transferred Ssang-Yong technology for reducing ash from incinerators. The duration of the contract is 10 years.

Source: Korea-Japan Technology Cooperation Foundation/Korea Institute for Industrial Economics and Trade, 1996 (excerpt from Ministry of Environment, *The Ten-Year Comprehensive Development Plan for Next Generation's Core Environmental Technology* (in Korean), 2002, p404)

On the other hand, Korean firms have been active in investment, technology transfer, and businesses in Asian economies other than Japan, particularly China. Korean environmental companies' record of activities in China is as shown in Table 12. Cooperation between Korea and China did not start until mid 1990's since diplomatic tie was established in 1992 and the environmental cooperation treaty was signed in 1993.

< Table 12 > Some Cases of Korean Environmental Enterprises' Business Activities in China.

Firm	Details	Date
Seron Machine	Joint venture Dust Collector Plant in Shantung Province	Since 1993
Korea Cottrell	Built an electric dust collector in a cement factory in Shantung Province	1996-1998
Chung Engineering	Electronic Fluid Meter, COD Meter, Automatic Gas Measurement System	
LG Construction	Sewage Treatment Facility (Capacity 50,000 ton/day)	1996-1999
Kong-Young Engineering	Dust Collector in Tianjin	1996
Ja-Yun Engineering	Wastewater Treatment Facility in Tianjin	1996-1997
Tae-Woo Environmental Agriculture Technology Development	Built a plant producing fertilizer using livestock manure	1993
Korea District Heating Corporation	Established a Joint Venture for building and running a Combined Heat and Power Plant in Chinhuangdao in Hebei Province	1997-1999

Source: Ministry of Environment, *The Ten-Year Comprehensive Development Plan for Next Generation's Core Environmental Technology* (in Korean), 2002, p405.

3) Technological Impact of Import in Environmental Goods and Services

Assessments of the effects of allowing foreign-supplied environmental goods and services into Korea vary. According to Park and Kim (2001), imported environmental technologies have in general been absorbed into the country without too many problems. However, some imported technologies may have been introduced without due consideration being given to domestic circumstances or without undergoing sufficient prior testing. In some cases, infrastructure based on imported technologies has not been adequately maintained due to a lack of domestic technical experts. Moreover, because a majority (58%) of the domestic-foreign joint partnerships formed in this area have been technological alliances based on licensing agreements, rather than joint projects (22%) or joint ventures (4%), the transfer of technology to the domestic industry has been less than it might otherwise have been.

Imported technologies have nevertheless contributed to quality improvements in the domestic environmental industry. According to a survey carried out by KOTRA, most Korean environmental firms acquired their technological expertise by importing technologies (21%) or by imitating existing foreign or domestic technologies (31%). However, a good number of companies (42%) have developed technological expertise through their own efforts (KOTRA, 1996). Among the environmental products and facilities that the Korean environmental industry produces, the imported content is reported to be considerably less than 50%, and for more than half the companies the proportion is less than 10%. In some sub-sectors, such as water and wastewater, Korean technologies have been gradually replacing imported ones.

The import of foreign environmental/process control equipment is as shown in Table 13. In the years of 1997and 1998 Korea imported environmental/process control equipment as much as US$ 587,563 and US$ 409,820 respectively.[2] In the import market of this sector in Korea, United States, Japan, and Germany takes 38%, 30%, and 17% in 1997, and 38%, 26%, and 16% in 1998, respectively. Three countries combined comprise more than 80% of this market.

In Korea, water treatment facility is the most promising subsector among the environmental equipment sector. For local and foreign businesses, Korean government's investment plan for water treatment facilities would be useful information. In Table 14, information for Korean government's public sewage treatment projects are provided. More specifically, data for import market for water filtration equipment is shown in Table15. These import is considered to contribute to the upgrade of technology level of Korea's water treatment technology.

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[2] The drop in the value of import in 1998 is due to the severe financial and economic condition brought by the financial crisis started in December 1997.

<Table 13> Imported Environmental/Process Control Equipment Market Share by Country of Origin 1997-1998

Country	Total Exports 1997	Market Share 1997	Total Exports 1998	Market Share 1998
USA	$221 357	38%	$155 976	38%
Japan	$177 768	30%	$104 597	26%
Germany	$101 898	17%	$64 693	16%
France	$10 756	2%	$20 776	5%
Switzerland	$8 898	2%	$19 871	5%
England	$23 783	4%	$10 084	2%
Belgium	$14 325	2%	$7 123	2%
Netherlands	$6 151	1%	$5 555	1%
China	$4 120	1%	$4 037	1%
Norway	$1 593	0%	$3 892	1%
Denmark	$1 325	0%	$3 371	1%
Italy	$6 881	1%	$3 206	1%
Singapore	$1 710	0%	$3 046	1%
Canada	$2 080	0%	$2 285	1%
Sweden	$4 883	1%	$1 186	0%
Australia	$23	0%	$79	0%
Philippines	$0	0%	$25	0%
Austria	$12	0%	$20	0%
Total	$587 563	100%	$409 820	100%

Source: Korea External Trade Center of Seoul, January 1999, and Thomas Associates, San Diego, California (excerpt from Jintaek Whang and Jae-Hyup Lee, Complementary Measures to Ensure the 'Win-Win' Potential Accompanying Liberalization of Trade in Environmental Goods and Services: A National Case Study of Korea, unpublished mimeo, 2003)

< Table 14 > Upcoming Public Sewage Treatment Projects, 2000-2005

	2000	2001	2002	2003	2004	2005
Capacity	1,834	861	1,564	886	1,827	5,833
(in thousands of tons per day)	36	30	33	18	18	65
Number of plants (projects)	1,497	1,464	1,540	1,625	1,722	1,975
Planned investment (billions of won)	1,361	1,331	1,400	1,447	1,565	1,795
Planned investment* (billions of U.S. dollars)	1.24	1.21	1.27	1.31	1.42	1.63

Average exchange rate projection for 2000 through 2005: US$1 = 1,100 won.

Source: Environmental Management Research Center, *Environmental Industry Yearbook* 2000, Seoul, 1999. (excerpt from Jintaek Whang and Jae-Hyup Lee, Complementary Measures to Ensure the 'Win-Win' Potential Accompanying Liberalization of Trade in Environmental Goods and Services: A National Case Study of Korea, unpublished mimeo, 2003).

< Table 15 > Imported Water Filtration Equipment Markets 1997-1998

Country	Total Imports 1997	Market Share 1997	Total Imports 1998	Market Share 1998
USA	$10,777	31%	$5,143	36%
Japan	$10,290	29%	$4,193	30%
Germany	$7,262	21%	$1,518	11%
Denmark	$805	2%	$1,126	8%
Norway	$3	0%	$766	5%
France	$693	2%	$493	3%
England	$1,034	3%	$455	3%
Switzerland	$1,234	4%	$262	2%
Sweden	$2,882	8%	$236	2%
Total	$34,980		$14,191	
Segment Growth			-5.9%	

Source: Korea External Trade Center of Seoul, January 1999 and Thomas Associates, San Diego,CA (Excerpt from Jintaek Whang and Jae-Hyup Lee, Complementary Measures to Ensure the 'Win-Win' Potential Accompanying Liberalization of Trade in Environmental Goods and Services: A National Case Study of Korea, unpublished mimeo, 2003)

4) Joint Ventures

It seems that there are quite a few joint venture cases in environmental industry. Several cases are reported in the following Tabel 16. Most of the cases are small in terms of firm size.

< Table 16 > Joint Ventures in Environmental Industry

Case 1: Hasu, Ltd.
Area: Water treatment Korean Partner: Hansu, Ltd. Foreign Partner: Kurita Industry (Japan)
Case 2: KC Ueda Co., Ltd
Area: Ecological Services Korean Partner: KC Rivertech Foreign Partner: UES(Ueda Environment Solutions, Japan) Date: September 2001
Case 3: Kumho Polychem
Area: Chemical Korean Partner: Kumho Group Foreign Partner: Exxon Chemecial (U.S.A.) Date: n.a. Detail: Exchange of environmental and energy technology
Case 4: A Korea-China Environmental Joint Venture
Area: Night-soil treatment Korean Partner: Dae-Kyung Entech (subsidiary of Dae-Kyung Machinery Technology) Foreign Partner: Beijing Tungingzun Environmental Protection, Ltd. (China) Date: n.a. Detail: a joint venture for night-soil treatment using newly developed microbiological technology. Aims to perform waterless, non-polluting treatment of night-soil from public lavatories in Beijing, China
Case 5: GGBC (Green Gold Biosystem Co.)
Area: Development and Distribution of Eco-functional Plants Korean Partner: Microplants Foreign Partner: Nishoku and others (Japan) Date: may 2001 Detail: located in Okayama, Japan. Plants will be developed by the Japanese side and propagated and distributed by the Korean side.

Note: Company names may be incorrect because they are translated from Korea sources.
Source: Collected from various websites.

7. Observations and Conclusions

Korea's environmental industry market has a high potential. Since Korea's environmental pressure is already high and expected to be higher in the future and Korean economy is expected to grow steadily, the demand for environmental goods and services is certainly to increase sharply. This is an attractive market for EI businesses both in and out of Korea. For Korean government, environmental industry seems to be an attractive area of interest because it seems to be a good means to catch two birds with one stone: environmental protection and industrial interest.

There are several problems faced by the environmental industry in the ROK. First of all, many of the companies active in the environmental industry are small in size and backward in technical level. In terms of market sales figures, average annual sales amount only to 2.4 billion won per company in environmental business entities (based on companies specializing in prevention facilities) in the ROK, while it amounts to 1.6 trillion won for the world's 50 biggest environmental production business entities (Han Kiju, 2001). Secondly, Korean firms still lag far behind those of major countries in the important fields of clean production, marine conservation, waste recycling and global environmental conservation. Thirdly, Korean firms' investment in genuine novel technology is low. Fourthly, the size of domestic market is small for the EI businesses to get enough economies of scale.

Korean businesses are complaining that Korean government is not working appropriately to help Korean firms to penetrate into foreign markets. They consider the activities of the US, Japanese and European governments or government related agencies as model cases.

The fact that the scale of the domestic environmental market is expected to quadruple by 2010 is also an important factor. It is also important that the environmental technology level in the ROK is improving remarkably. In the case of technology related to air, water quality and waste, including such follow-up treatment as highly effective filtering, flue-gas desulphurization or denitrification, and clean production, the speed of technical development is fast. Moreover, non-polluting technology, including unmanned remote supervisory control and waste reuse technologies, is at the stage of practical application.

Korea's environmental industry's growth is indebted to foreign influences of international NGOs and MEAs. Influences from MNEs operating in and/or out of Korea are very significant in supply side, particularly technology aspects. However, in the demand side, no meaningful evidence is found yet. An important foreign element in driving forces for Korea's environmental industry is the discipline from the export markets. In particular, semiconductor and automobile industry are prominent examples.

The prospect for the environmental industry in Korea is promising. It is not surprising because Korea is a relatively high income country whilst environmental endowment is extremely adverse, as manifested by the low rank in the ESI index. The strong grassroots environmental groups also contributed to the demand side of the industry. In some cases, Korea's environmental standards are even more stringent than the world standard. In diesel automobiles, the emission standards for NOx and particles are higher than the European ones. Therefore, excluding advanced level technologies for export sectors, ordinary demand for environmental goods and services are driven by domestic factors in Korea. To the author's opinion, businesses who consider participation in the Korean market may get some benefit by analyzing the Korean NGOs' activities and government plans, rather than focusing on the direct foreign influences. For instance, NGOs' campaign against the land reclamation project of Saemankeum would result in huge investment to maintain the water quality in the rivers flowing into that water area.

In Korea, air quality improvement in the Seoul-Kyunggi Metropolitan Area, water quality improvement in the four major watersheds, and the reduction and recycling of wastes are the three most compelling tasks in the upcoming several years. Therefore, low emission motor vehicles and emission reduction technologies in industrial plants, water treatment facilities and water treatment services, waste treatment and recycling technology deserve special attention for businesses seeking opportunity in Korea's environmental market.

Recently, finding land for filling site for radioactive waste from nuclear power plants became a major source of social conflict. Although the risk of radioactive waste is exaggerated, it became a political reality that nuclear power is becoming very costly. Given another constraint from the Kyoto Protocol, market potential for environmentally friendly energy sources seem brighter than before.

Several points can be raised as policy recommendations to the government of ROK. First, for appropriate policies to be established and implemented, it is a prerequisite to have correct and relevant information on the environmental industry. In ROK, statistics for the environmental industry is not yet available. Main problem is the lack of classification that allows the environmental industry as a separate item in industry and trade statistics. Earlier adoption of new statistical classification system is urged.

Second, for the domestic market for the environmental industry, a combination of more stringent environmental regulation (it means bigger market size) plus better facilitative policies to encourage more investment in technology and capital equipments is recommended, rather than a combination of loose environmental regulation (it means smaller market size) plus some subsidizing policies for technologies with vague strategic concepts. In this case of stringent regulation and facilitative policies, some part of the domestic market might be taken by foreign firms because of low competitiveness of domestic firms in terms of technology and financial capacity. However, this loss would be compensated by dynamic beneficial effects from technology spillover and competitive learning effects. Government may impose some guidelines to encourage joint ventures and/or technology cooperation between Korean and foreign advanced firms to induce technological improvement in the environmental industry of ROK. Another concern may be raised on the validity of “more stringent environmental regulation” as an economically feasible policy option. However, more stringent environmental regulation may be implemented in the form of environmental tax, with gradual and appropriate fiscal adjustments to secure fiscal neutrality.

Third, some elements of government procurement procedure need amendments. There are two categories in bidding procedure for the public sector environmental infrastructure facilities: Prequalification (PQ) projects and non-PQ projects. For the PQ projects, the screening procedure needs to be modified so the environmental industry-specific characteristics can be appropriately considered. Under current screening system, firms’ experiences in environmental projects are not differently treated from the experiences in general construction projects, so environmental businesses have serious disadvantage in competing with large general construction firms in getting the public sector bids. This system is considered as one of the major hindrances for the specialization and technological accumulation of environmental businesses in ROK. For the non-PQ projects also, some improvements are necessary to rightfully consider the applying firms’ technical capacity. In addition, some business experts are recommending the bidding agency for the environmental projects should be independent from the general procurement office to appropriately incorporate specialized expertise in environmental industry.

Fourth, frequently mentioned policy measures such as financial assistance to environmental SMEs, assistance to environmental R&Ds, encouraging joint ventures with foreign firms, government's facilitative activities for the promotion of exports, etc. are be still valid as far as they do not violate international economic norms such as WTO rules.

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Chapter V

Small and Medium-Sized Enterprises (SMEs) for Sustainable Development

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Summary and Recommendations

Small and Medium-Sized Enterprises (SMEs) is a crucial group of society. Including unregistered enterprises, SMEs is believed to account for more than 80% of companies in Asia, which implies diversity of the products and large supply of the workforce. At the same time, environmental impacts resulted from their brisk economic activities are remarkable and become increasingly serious, thus sustainability of SMEs is a pressing issue nowadays. Besides the socio-economic and environmental impacts, bringing SMEs to be sustainable has reasonable understanding: percolating the concept of sustainable development through their strong cohesion with local communities, avoiding economic disorder from bankruptcy of too many SMEs due to tighter regulations, securing their competitiveness in the international market; maintaining balance between economic development and conservation; expecting substantial environmental improvement as a whole. Unfortunately, however, the progress which has been made so far is still below expectation. This paper identifies problems challenging SMEs as well as measures initiated by leading international organizations and national governments, then offers recommendation on sustainable industries by SMEs, paying special attention to China, India, Indonesia, and Korea.

In order to assist SMEs, national governments and the international community have been taking steps with different means. Cleaner Production (CP) is one of the primary initiatives adopted by many countries which has proved a large cost saving. Asian and Pacific Centre for Transfer of Technology (APCTT) is the organization which offers assistance of environmentally sound technologies (ESTs), setting its primary target on SMEs. National governments provide services for environmental improvement through

their specialized agencies for SMEs' development, as well as financial assistance through national banks.

It is recognized that improving companies' environmental performance would induce and assist the development of environmental industry in which SMEs are also able to make significant contributions. Indeed, SMEs occupies quite high percentage of environmental industry from recycle material processing to air filters productions, and the environmental industry shows rapid growth, suggesting the expansion of the SMEs' business opportunities and operations.

Some obstacles, however, prevent SMEs to pursue environmental performance, resulting in the adverse impacts on the development of environmental industry. Financial constraints impose SMEs difficulties to install ESTs. Lack of information access causes failures of meeting qualifications for loans available for SMEs. In addition to these typical obstacles that SMEs confront, weakness of business/productivity management, insufficient supports from government, lack of enforcement of environmental regulations, and weak interactions between government and the private sectors are identified as the barriers in promoting environmental management for SMEs.

Although SMEs are struggling with these obstacles, they will still be a key actor in the development of environmental industry: That is because 1) SMEs has been already a primary group active in the operations of environmental industry 2) Strong demand of cleaner production under stricter international standards pushes SMEs to adopt ESTs 3) Their entrepreneurship and specialized skills are suitable to operate in the newly emerged entity 4) Increased attention to SMEs development is the robust support for SMEs' operations in environmental industry.

Despite of the fact that roles played by SMEs contain a great potential for sustainable industries, actions which have been taken for SMEs are considered as modest. The question is that in what way SMEs can be brought into sustainable industries.

Involvement of governments is indispensable for the development of environmental industry. As goods and services for the environment available in developing countries are less competitive than the ones in industrialized countries, governments of developing countries may want to concentrate their limited human and financial resources on creating and stabilizing domestic market for environmental industries such as eco-products and services through the means to increasing domestic demand, rather than competing in the high competitive international market.

Governments would have to provide incentives to SMEs in order to stimulate the domestic market in a view of both demand and supply. As the demand side of the government involvement, regulatory instruments would be some push to increase popularity of environmental goods and services, while appropriate financial assistance is to be provided accordingly as the supply side of the government involvement. Financial assistance is required not only for the increased demand, but also to assist activities such as capacity building and training. In any case, what is important for governments is to set a priority in selecting what to do and not to do through their policy making in order to maximize effectiveness of the performance with limited resources.

Together with governments, industry associations could take crucial part for SMEs in sustainable industries. As a business oriented group, an industry association would be able to seek an optimal balance between economic interests and environmental concern of SMEs, which is quite important for the private sector in their operations. Several activities can be expected to industry associations in assisting SMEs: organizing workshops for capacity building, coordinating communication with Multi-National Corporations for know-how transfer, developing database for technical advice and information, assisting interactions with governments.

It is understood that SMEs have a great potential in contributing to sustainable industries. Yet, required conditions are not in place, and governments as well as other stakeholders are to adopt further steps to make it happen.

1. Introduction

It has been for a while since “Business and the Environment” was brought into the spotlight of public attention as one of the pressing issues of environmental protection. Industries, mostly Multi-National Corporations (MNCs) have actively adopted substantial steps to cope with environmental problems in a number of ways and continuously make progress having social responsibility in mind. Yet, it requires a significant amount of time and tremendous efforts for Small and Medium-Sized

Enterprises (SMEs) to become mature in their sustainable performance due to the financial and technical constraints as well as improper information access.

In industrialized countries like Japan, a number of assistance programs by governmental agencies from loans to consultation with experts to review companies' environmental performance are available. Such supporting mechanism, however, is quite limited in developing countries and SMEs in those countries are virtually struggling against the compliance with environmental regulations which become stricter as well as the pressure from local communities on the liability of pollution.

In this paper, significance of SMEs in socio-economy is reviewed with special attention paid to China, India, Indonesia, and Korea, followed by endeavors undertaken by international organizations and national governments to assist SMEs for the improvement of their environmental performance, which is considered to accommodate the needed conditions for the development of environmental industry. Then, SMEs' involvements in environment industry in selected countries are delineated. Coupled with the examination of the obstacles SMEs face and future prospect, the paper offers a direction for policy making in sustainable industry for SMEs.

2. SMEs in socio-economics and the environment

All over the world, SMEs vigorously play critical roles in socio-economy, and their activities are predicted to become even more remarkable than before along with the dynamics of the world economy. Small and medium, often including miciro firms provide a large number of jobs and their operations are often, if not always, closely connected to local communities. In Taipei China, 97.76% of the firms was categorized as SMEs in 1998 under the "Guidelines for Identifying Small and Medium-Sized Enterprises" issued by the Ministry of Economic Affairs, counting 7.265 million jobs which is equivalent to 69.19% (Cheng 2001). In Indonesia, 80% of the workforce is employed by 37 million SMEs, accounting for 54.59% of the national Gross Domestic Production (GDP) in 2001 (Guerin 2002). These SMEs also occupy important portion in the industrial structure and are backbone of manufacturing in supplying parts and semi-finished products to large firms, operating their business for years and years in their own communities. Because of their wide range of activities and the large share in manufacturing industries, environmental impacts that SMEs directly and indirectly cause are considered to be enormous. In India, “there are more than 3 million registered SMEs in the country and they are found over a large geographical area. They manufacture about 7,500 products, accounting for 45% of exports. At the same time, SMEs contribute to approximately 65% of total industrial pollution,” (Kittappa 2000, 21) while only 25 SMEs are certified for ISO 14001 as of July 1999 (Maithel 2002). In China, 31860,000 tons of industrial solid wastes were produced, and small scaled companies which even the government can hardly control on are responsible of 67% in 2000 (Tagome 2001).

Because of the critical roles in socio-economy and huge impacts on the environment, it is recognized that environmental performance of SMEs is one of the pressing issues that countries and the international community are to take serious steps forward. Not only because of that, but also there are even more persuasive reasons to motivate SMEs to be green.

1) Due to their business diversity, contribution to national productivity, the size of employment, and cohesion to communities, commitment to environmental improvement by SMEs will send a powerful message to the society and gear up the attention to sustainability within a country.

2) Along with the global pressure for environmental improvement, enforcement of environmental regulations at national level becomes strict. Under such circumstance, SMEs have difficulties to catch up with those tighter regulations and in the worst cases factories are closed down. Closing down of too many SMEs could lead to disordering economic activities.
3) It is expected that companies in developing countries will face, in the near future, with the strong demand of meeting international standards for environmental safety on their export products in accordance with WTO discussion. In order not to lose their market share and to weaken their competitiveness in international market, precautionary strategies are necessary.
4) A number of programs for SMEs’ business development are currently carried out by nations and international development agencies. Along with the business expansion of SMEs, environmental performance has to be incorporated into business management simultaneously to maintain a balance between economic development and conservation for sustainability at an optimal point.
5) Many Multi-National Corporations (MNCs) and/or large companies already manage

their operations in environmental friendly ways from employees' training to environmental accounting, while it is said that more than 50% of the industrial pollution in the region is the responsibility of SMEs (UNEP 2000). Thus, the society may not be able to expect dramatic improvement from MNCs any further, instead improvement of SMEs' performance for environment may be more promising, bringing a leap on environmental protection as a whole.

Improving environmental performance of companies guarantees predominant influence over the development of environmental industries. It prepares the foundation/infrastructure for environmental industries to grow such as an increase of environmental consciousness among individuals, thus creating substantive support from governments and consumers towards development of environmental industries. Furthermore, technologies and information transferred from other countries in the purpose of improving environmental performance can be well adopted for their own initiatives in the development of environmental industries in developing countries. Cleaner Production explained below can be a showcase in this context

3. Initiatives and measures

It is rarely self-commitment and spontaneous actions, but most of the actions undertaken for SMEs to improve their environmental performance come into practice with the assistance through international organizations and bilateral donors as well as government assistance. In this section, some selected actions are discussed.

1) Cleaner Production

The Term of cleaner production (CP) becomes increasing common as environmental impacts of production process are broadly realized, and the concept of CP is regarded as one of substantial approaches to cope with the issues existing between manufacturing industries and their environmental improvement. It was the establishment of the United Nations Environmental Programme (UNEP) Cleaner Production Program in 1989 that the term of cleaner production has started being popular. Currently, different organizations use different terms, such as greener productivity by Asian Productivity Organization (APO) and Eco-efficiency by World Business Council on Sustainable Development, but the concept they conceive is essentially the same that is :to minimize energy and resource use (inputs) and to reduce waste and discharges (outputs) in the production process.

Regardless the size of operation, primary interest of the private sector is to maximize the net profits. Thus, majority of them have some hesitation to take the first or further steps for environmental performance because of the concerns of “additional or unnecessary” costs for them to burden, and that concern is implicitly strong especially among SMEs in developing countries. It is often too costly for SMEs to invest for installation of energy efficient and/or less-polluting facilities, although they might be aware of the advantages to do so in a long run. In its “Pollution Prevention and Abatement Handbook,” however, World Bank Group argues the point. “As a rough guide, 20-30% reductions in pollution can often be achieved with no capital investment required, and a further 20% or more reduction can be obtained with investments that have a payback time of only months.” (World Bank Group 1998) A case from India below demonstrates economical attraction of CP.

In 1993, a CP demonstration project targeting SMEs was initiated by United Nations Industrial Development Organization (UNIDO), in cooperation with the Indian National Productivity Council and other industry associations. The DESIRE (DEmonstration in Small Industries for Reducing wastE) project focused on three sectors: agro-based pulp and paper, textile dying and printing, and pesticides formulation. Results for one of the pulp and paper plants prove the types of savings possible. In a plant producing 36 tons of paper per day, a combination of process and equipment modifications and some new technology was identified that improved the product and the operating conditions for a capital investment of US$25,000, with a payback period of less than three months. (World Bank Group 1998)

Compared to the investments for end-of-pipe measures, CP shows greater potential of saving by reducing energy and material use as well as costs of pollutants and wastes in mid- and long perspectives. In the case of Solasia Energy Development Co., Ltd. (ten employees and annual revenue of approximately NT$34 million) in Taipei, China, APO demonstration project of the Green Productivity (GP) Program successfully saved nickel material, and reduced treatment cost and sludge volume by reducing the amount of Ni discharge. Measures used by the GP program are mainly installation of facilities, such as multi-stage countercurrent rinse system and an advanced ion exchange system. The action of the reduction of Ni discharge itself resulted in the saving of NT$238,200/year with the investment cost NT$2,000/year, being added NT$2,000,000/year by recycling of degreasing liquor, and NT$69,300/year by recycling of rinsing water (Cheng 2001). In other words, total NT$2,307,500/year was saved with the investment costs only NT$611,000 by implementing the GP program.

While economic benefits become a strong incentive for companies to adopt CP, a government policy may be even more effective driving forces to shift obsolete polluting technologies to advanced environmentally sound technologies, especially in countries where advantages of CP are hardly reached to a right place. In December 1996, the Indian Supreme Court made the decree of banning the use of coal and switching over to natural gas to industrial units located in Taj Trapezium Zone (TTZ), an area of 10,400 sq. km in where the famous Taji Mahal is located. Within the TTZ, small scale glass industries are operating in the Firozabad glass cluster, where 70% of the total glass production is made. With financial assistance from Swiss Agency for Development and Cooperation (SDC), small scale glass industries in the Firozabad were able to install gas-fired furnaces replacing conventional goal-fired furnaces. As results, there is a clear improvement of air quality by reducing emissions of particles and carbon monoxide in neighboring areas and of living conditions in the cluster, coupled with energy saving. This Supreme Court ruling was made possible because of public interest litigation to protect the World Heritage site from pollution. Thus, this case demonstrates that the transition to cleaner technologies was made not solely from a government policy but public concerns against pollution acted as the push behind the policy.

Another example of CP that was taken in response to a government policy is Industrial Efficiency and Pollution Control (IEPE) in Indonesia. Ministry of Environment of Indonesia, together with Ministry of Finance, Government of Germany as well as banks, has been carrying out IEPC project since 1997, and Revolving Fund System for Environmental Management in Indonesia under the IEPC is to provide environmental investment loans to SMEs. The grant of DM 15.6 million from the Government of Germany is used for:

(1) Investments in production facilities for pollution reduction and/or natural resource saving
(2) Investments in machinery and equipment for recycle, reuse, and recover waste

materials

(3) Investments in waste treatment for neutralization of industrial wasts and pollution

Almost 60% of the loan has been allocated for category (1), 22% for (2), and 17% for (3) respectively. So far, twenty two SMEs applied for the loan in recycling and reusing wastes (ESCAP 2002).

In order to bring the concept of CP down to the implementation by enterprises in developing countries, UNIDO started been setting up National Cleaner Production Centres (NCPCs) since 1994, and UNEP provides strategic advice from its expert points of views. The services NCPCs offer are: 1) Technical Assistance and In-plant Assessments, 2) Training, 3) CP Technology and Investment promotion, 4) Information dissemination, 5) CP Policy advice, and UNIDO identifies SMEs as the primary focus of the NCPCs' services. Until today, twenty two NCPCs have been established in countries including China, India, and Korea. Furthermore 24 Cleaner Production Centres (CPCs) have been established in China and 4 CPCs in India under their NCPCs to deliver CP programs applicable to local conditions. In collaboration with the NCPCs, UNIDO carried out demonstration projects of CP in China and India, the targeted sectors of which were SMEs in paper and pulp, metal finishing, leather manufacturing, and textiles industries.

Though the concept itself is regarded as a win-win approach: environmental friendly conditions enable to be created along economic benefits through less spending on raw materials and energy as well as waste treatments, CP leaves yet unsolved issues in its implementation. Due to the high costs on initial investment and weak funding support mechanisms for SMEs, CP investments are challenged by being applied in broader use. In economic point of views, CP could be even less attractive in countries where: Lax environmental regulations are applied, Enforcement of regulations is hardly ensured, Natural resources are under-priced or even free, Consumers are less interested in products that are produced in a more environmentally responsible manner (UNEP 2000). These facors suggest the importance of awareness raising accompanied with CP implementation.

There are a great number of cases that SMEs are simply not aware of CP program itself and/or available financial assistance. In addition, as they are tied up with their day-to-day operation, owners and/or managers of SMEs hardly envisage their management plan in mid- and long run, resulting in the indifference to CP programs which could yield long term benefits. Dody Bastaman, senior official at the Environment Agency in Tangerang Municipality in Indonesia, introduced in the Jakarta Post that only 10 of 720 companies in his area have participated in CP program. Deputy Assistant for Standardization and Technology at the Ministry of Environment of Indonesia, Sabar Ginting, mentioned in this regard that “many firms don’t believe that clean production can minimize operating costs” (Jakarta Post 2002). Their words imply the needs of education programs for SMEs to be acquired relevant information and boost their understanding about CP.

2) Asian and Pacific Centre for Transfer of Technology (APCTT)

United Nations Asian and Pacific Centre for Transfer of Technology (APCTT) of the Economic and Social Commission for Asia and The Pacific located in New Delhi, India provides assistance of environmentally sound technologies (ESTs) ranging from waste management to energy efficiency in the region, setting the primary target group on SMEs. More than US$60 million in total value was facilitated by APCTT for technology transfer contracts among SMEs in 1996 (APCTT 2002). The activities include organizing training programs, networking, and match-making between buyers and sellers of technologies. Through these endeavors, APCTT successfully facilitates more than 250 technology transfer negotiations per month.

The services APCTT offers have been carried out through its strong partnership with a number of industrial associations, consultants, as well as governmental agencies. With their technical inputs, APCTT promotes ESTs transfer by dissemination of information, identification of appropriate technology, and adoption of technology to match local conditions. The partners include China Science and Technology Exchange Centre, Consultancy Development Centre, Korea Institute of Industry and Technology Information, and Rajasthan State Industrial Development & Investment Corporation Ltd., (India).

Another significance of APCTT is International Network for Transfer of Environmentally Sound Technologies (INTET). INTET AISA was established in 1994 in India with the intention of APCTT to develop network among SMEs and intermediaries (business consultants, technology brokers, information and technology development organizations) and to provide appropriate information for ESTs transfer. The members spread not only in Asia, but also European countries such as Netherlands, and United Kingdom. With the growth of the global membership and its high demand, APCTT embarked extending the national network, setting up INTET Pakistan and Russia. Furthermore, it is currently in process to develop web-based services, so that necessary information can be reached to more SMEs with less cost.

3) Institutional arrangement of national government

In recognition of SMEs' substantial performance in national economy, specialized agencies are arranged within the governments to assist SMEs development. In India, Small Industries Development Organization (SIDO) was set up to assist Ministry of Small Scale Industries and Agro and Rural Industries of India in implementation of policies and programs for the development of small scale sectors, as well as providing technology support services. Energy conservation is one of the areas covered by Technology Management Division which was established in January 1997 within the SIDO. Being concerned with high energy consumption in certain sectors, the division of SIDO takes a lead in increasing awareness about the advantages of new techniques of energy conservation. From 1998 through 1999, Rs.20 lakhs (Rs. 2million) has been allocated for awareness programs, preparation of video etc. (Ministry of SSI & ARI2002).

4) Financial assistance

In general, financial institutes have a hesitation to accommodate loans to SMEs due to the risks of payback. Even if financial institutes offer loans to SMEs, the interest rates imposed to them are less favorable compared to the ones for larger companies. Because of that, SMEs' access to financial sources is explicitly below the demand, though some financial institutions indeed provide assistance for SMEs' environmental performance.

Small Industries Development Bank of India (SIDBI) -India was established in April 1990 under the Act of Indian Parliament, being a wholly-owned subsidiary of Industrial Development Bank of India. Under its Promotional and Development activities, SIDBI launched the environment management initiative, the objectives of which are to increase awareness of environmental issues and regulations among Small Scale Industries (SSIs) and to assist them in finding solutions toward pollution prevention through demonstration projects. The bank supports the awareness programs by covering participations fees, and subsidies of consultation fees and the cost of equipments for demonstration projects.

National Environment Engineering Research Institute (NEERI), Environmental Protection Training and Research Institute, Centre for Environmental Educations are engaged to execute the bank's awareness programs. For instance, a satellite interactive network for the message of "Green Profits" stationed in New Delhi was carried out with over 200 participants from SSI units in 13 cities all over the country. The bank also supports demonstration projects for cupola based foundries, induction furnaces, electroplating units, dyeing unites, and cost effective technology has been demonstrated with the payback period of less than one month. The program is extended to more industry sub-sectors and more diverse geographical areas. (SIDBI 2002)

4. SMEs in Environmental Industry

While improvement of their environmental performance is a critical assignment for sustainable economic growth in society, development of environmental industry would offer comprehensive opportunities to SMEs in their business and environmental improvements in mid- and long run.

In a study of environmental industry in China reported by the State Environmental Protection Agency in 1993, the number of the corporations categorized in environmental industry accounted for 8,651 with 1.882 million employees, and their productivity was equivalent to 31.148 trillion Yuan and the benefit was calculated 4.091 trillion Yuan per year. Among the total number of corporations in environmental industry in China, companies which produced eco-products account for 3,158 and the production value of each company was 3.29 million Yuan on average per year. Environmental industry is not an exception for SMEs to play an important role in China. Small scale corporations occupy 82% of the total environmental industry. In Jiangsuis Province, 87.8% of the total number of corporations is SMEs: 92.6% for Zhejiang Province; 89.6% for Shanghai respectively (GISPRI 1998).

The growth of Chinese environmental industry is dynamic. The number of companies in environmental industry jumped to 18,144 in 2000, and the productivity is from 31.2

trillion Yuan in 1994 to 168.99 trillion Yuan in 2000 (Zhang and Yu 2002). Coupled with government policies of foreign investment and tax exemption on environmental industry, the trend will continue, and environmental industry, virtually SMEs is and will be growing further.

Like other countries majority of companies in Korea is categorized as SMEs, accounting for 99% of the total number. The high percentage of SMEs suggests that SMEs is a dominant in environmental industry. Indeed, recycled material processing is monopolized by 180 SMEs as of 1995 (JSBRI 1998). Besides that, there are the SMEs the operations of which contribute to environmental improvement in Korea. For example, Miracle Co., Ltd., with 12 employees and its annual sales revenue of US$ 300,000 produces air filters for automobiles and has acquired Environmental Label (KELA) in 2001 (Miracle 2003). MEITEC (Marine Environmental & Industrial Technology CO., Ltd.), which holds 19 employees and the capital of 150,000,000 Won, conducts scientific investigations on impacts of oil pollution and a project of aquaculture purification management (MEITEC 2003).

The substantial involvement of SMEs in environmental industry is an encouraging factor for the development of the industry, being considered its socio-economic impacts as mentioned earlier. Nevertheless, the challenges with which SMEs face such as technology adaptation and their vulnerabilities of financial situation leave the positive expectation uncertainty.

5. Challenges against SMEs

Generally speaking, SMEs fall in the constraints of lack of financial resources, poor information access, and less skilled personnel. A survey conducted by Asia Foundation shows that only 17 % of SMEs had ever received a bank loan in Indonesia due to lack of information access to the loan and failure to meet qualification for the loan (Guerin 2002). Obsolete technologies that SMEs typically use are usually more polluting, and lack of awareness about adverse environmental impacts caused by their day to day operations results in underestimation of the importance of environmental measures in the view of social responsibility. These all constraints induce problems for environmental improvement by SMEs. Furthermore, the fact that companies fail to adopt appropriate measures suggests them some risks of paying for fines and closing their factories down for the worst case.

A study conducted by Japan International Cooperation Agency (JICA) identified four obstacles in promoting the activities of environmental management including Cleaner Production (CP), and the above mentioned three constraints are closely related to the obstacles.

(1) Weakness of business/productivity management. Environmental management can be successfully incorporated in well-established business management. Thus, weak business management does not direct an appropriate framework for environmental performance. For example, when the owner/manager of a company does not grasp the clear vision on the operation costs and profits of the company, economic benefits created by CP in mid- to long run are not correctly calculated, resulting in the fact that CP cannot be fairly appraised.

(2) Insufficient supports from government. Policies and measures are hardly favorable of companies nor do respond it to needs of companies. As the access to loans and/or financial support plan are not in place, companies especially SMEs are not able to make an investment to CP and other environmental measures.

(3) Lack of enforcement of environmental regulations. When the enforcement of regulations is not ensured, companies especially in developing countries which receive less consumer pressures hardly have incentives to improve their environmental performance unless they have a strong self-commitment to environmental protection. In this circumstance, environmental management and CP are not attractive for them, but rather considered burdensome.

(4) Weak interactions between government and the private sectors. As is widely recognized, sustainability of the society can be realized only when governments, the private sectors, and citizens are fully involved, and cope with each other. The success of such a collective actions largely depends on understanding among stakeholders through communication. Then, lack of the interactions is critical in pursuing sustainability.

6. Future Prospect

Despite of the difficulties they have to cope with, it is expected that SMEs would continue to be a key in the development of environmental industry. Followings are some factors to support this prospect.

First, SMEs have already occupied a large portion of environmental industries in China and Korea, and that state would be so unless industrial structure in these countries is changed drastically. Indeed, Chinese environmental industry presently shows a rapid growth as was discussed earlier.

Second, without exception, SMEs in the four countries will be exposed to strong requirement of stricter international standards in their production process due to increased access to the global market. Thus, they will be obliged, no matter they want or not want, to apply environmental sound technology to stay in business.

Third, compared to other industries, in which certain companies historically have established their jurisdiction of business, environmental industry is a newly emerged business entity, thus it contains more oportunities for SMEs to penetrate into the market. With their entrepreneurships and specialized skills as well as the simple decision making – usually what an owner says will be the corporate decision, SMEs is more flexible than larger companies to offer goods and services to the market demand of environmental industry in a timely manner.

Fourth, a number of nations and organizations have conceived the significance of supporting SMEs business operations, and the topic has been discussed at the national, regional, and international levels. Recent example of the Asia Pacific Economic Cooperation (APEC) Small and Medium Enterprise Ministerial Meeting I August 2003 draw special attention on financial access and capacity building, as well as addressing the obstacles of export for SMEs. Such kind of conference by policy makers would certainly make things work faster, and the development of environmental industry undertaken by SMEs should be benefited from these initiatives.

7. Recommendations

As was seen, SMEs is a critical group of actors in socio-economy and sustainability. This recognition of their significance is reflected in the initiatives by international organizations and national governments. Nevertheless, the obstacles that SMEs face are yet unsolved, and further actions are called for in order the above mentioned prospects to be ensure.

1) Develop appropriate government policies

Exchange of goods and services across the borders is expected to become more active, following the World Trade Organization's scheme of trade liberalization. Like other products, it is obvious that industrialized countries are far more advanced in the areas of environmental industries and environmental management than developing countries. Thus, the level of technology as well as quality of eco-products and services offered in developing countries are not yet strong enough to compete with the ones by industrialized countries at the competitive international market. In recognition of the comparative advantage, policy makers of developing countries may not want to use their moderate resources both human and financial to aggressively penetrate into the international market, but rather focus on facilitating domestic market to increase the demand of eco products and services.

Regulatory instrument

Tighter regulations and environmental standards would be one of the instruments for governments to stimulate the domestic market of environmental goods and services. For SMEs which run their business on day to day bases, voluntary actions for social responsibility are not in their serious consideration unless they could visualize explicit economic benefits by doing so. The fact implies some kind of statute for environmental improvement would induce them to invest in pollution control and waste management. Tightness/degree of regulations, however, has to be carefully set. Otherwise, strict regulations would be simply ignored under weak enforcement or some SMEs would be out of business due to their incapability to catch up with the renewed regulations, which leads to adverse impacts on the country's economy mentioned earlier.

Financial assistance

In ways to guide the society to be sustainable, governments are to not only impose regulations but also to offer supports to meet the regulations. Installation of a pollution control machinery is always too costly for vulnerable SMEs. Thus, funding arrangement accompanied with the introduced regulations are necessary.

Strong financial mechanism is required not only to meet regulations, but also to assist SMEs' overall positive activities in the area from environmental management to capacity building. Although SMEs have already contributed to major parts of environmental industry in many countries, their roles would become even more active in the near future with their entrepreneur spirit, specialized technologies as well as flexible mobility. Then, problems they currently face should be taken care without delay, especially the financial constraint. Generally speaking, financial mechanism is quite weak in developing countries, and funding for SMEs is even poorer. As is widely recognized, governments need to develop appropriate financial assistance for SMEs.

As the result of rapid industrialization, Japan suffered from heavy industrial pollution, and measures for the mitigation were urgently needed. The governments responded to the issue by introducing public funding systems, such as Japan Finance Corporation for Small Business and Japan Environment Corporation, for pollution abatement and many of them were to assist financially vulnerable SMEs. At that time, it was perceived that the investment in pollution control machineries did not bring the increase of productivity, thus private financial institutions were reluctant to invest in pollution abatement. Consequently, companies had to depend on the public financial institutions. Indeed, reliance on public funding for pollution abatement had been much higher than the one for other use. Furthermore, the introduction of public funding systems induced private funding for pollution abatement machineries (GISPRI 1999).

In any case, for both regulations and financial assistance it should be secured that governments set a priority in their policy making. Obviously, with limited human and financial resources governments are not able to handle all issues the society faces, and that requires policy makers to choose what to do and what not to do. For instance, India may put a priority on waste management at tanneries over paper recycling. Based on the agenda setting, regulations should be targeting to waste quality improvement along with appropriate financial assistance for that target. Prioritizations of issues is the fundamental task in policy planning for effective resource use.

It is also important for each country to carefully examine and make priorities on what to take and not to take from outside of their countries. It would be indispensable for developing countries to adopt the advanced technology and knowledge from industrialized countries like Japan, the United States and the European Union countries in the development of environmental industry and enhancement of environmental management in order to satisfy the demands of the domestic market of environmental industry. Again, implementation of a policy requires huge resources from finance to human power. With that limited resources, a government is unable to afford anything which looks good. Instead, policy makers have to examine what is most needed for their countries, knowing the maturity of environmental industry and management of their own countries. For instance, China may need consulting service for air quality improvement, but may less need eco-products because of yet weak consumer demand, while consumers in Korea may be ready to buy eco-products which is relatively expensive compared with regular products and they are aware of the importance of consumer demand for sustainability.

2) Encourage the involvement of other stakeholders

Governments are not the only one actor for environmental performance and development of environmental industry, but other stakeholders are to take part of the policy implementation. Because of the unique roles and the position, industry associations can be catalysis in development of sustainable industries for SMEs. As is recognized, environmental measures should be accompanied with economic benefits to win the interest of companies. Setting the objectives in enhancing business development through technical training, information sharing, and consultancy, the involvement of associations could be convincing and appealing in promoting environmental performance to business sectors, even if companies might still feel skeptical towards environmental improvement. In other words, industrial associations are in the ideal position to motivate companies to integrate environmental concerns into their business management, transmitting a message that the environment is not costs, rather it is benefits for business operations as well as foreseen business opportunities. Possible functions that industry associations can take are as follows:

Organizing a workshop/meeting for capacity building

Making a maximum use of their network, associations will be able to support a workshop/seminar in the purpose of training for SMEs. For instance, Chamber of Commerce and Industry in Vietnam provided an occasion for managers of SMEs to learn about the application of CP in wastewater treatment, to be introduced about financial assistance of Japan Bank for International Cooperation (JBIC), and to interact with local government officers by hosting a seminar named "Diminishing the environment pollution in industries of Danang City and environment restoring policies" in close collaboration with industry associations. The participants were invited through the network of the associations in relevant sector. Participated by approximately 60 persons, the seminar was very informative and active discussions were taken place. The participants expressed in the feedback that the seminar was useful and should be continued.

Coordinating in establishment of the relationship with Multi-National Corporations (MNCs)

Large companies, especially MNCs, are sensitive to the issues of social responsibility and consumer pressure, thus their commitment to environmental performance has been embodied in comprehensive like technological development, recycling programs, environmental education for employees, environmental accounting, and so forth. Although their environmental performance has achieved at a sophisticated level, and SMEs may not be able to adopt the same environmental performance as MNCs do because of the size of financial resources and skilled personnel. Yet, there should be the know-how that can be applicable and useful to SMEs, and associations can play a role of a mediator in bridging SMEs and MNCs. Confederation of Indian Industry (CII), a large non-governmental business association, develops "Small, Medium and Large Industry Partnership, in intention of the promotion of closer relationship and mentoring services for SMEs. At present, the partnership may only focus on business development, but could be extended on environmental management. Through the new partnership, new business opportunities can be also expected.

Developing database and provide technical advice and information

SMEs in developing countries chronically fall into the difficulties in collecting necessary information and/or often they do not even know the availability of information. In addition, the information is sometimes available only in foreign language or through

Internet. Under such circumstances, industry associations can develop database and provide appropriate information as necessary to SMEs. In that way, SMEs do not need to spend extra time on asking around for information. At the same time, Internet access and translation service can be also considered as further assistance. For the example of technical advice, CII offers professional services about environmental management and energy conservation to SMEs. The services in environmental management include advice on environmental policy, in-company and inter-company training programs. Because of the success, these services are extended to other regional and state offices. Thus, this kind of attempt should be replicated in other areas and countries.

Promoting interactions between governments and SMEs

Sustainable development can be attained with the optimal balance of three pillars, namely social, economic, and environmental aspects in society, suggesting cooperation among all stakeholders is mandate. In reality, however, there are hardly occasions for governments and SMEs to communicate each other, thus governments may not know the needs of SMEs while SMEs hardly have a way to be informed about new regulations and assistance announced by governments. In this regards, associations can coordinate the dialogue among stakeholders and facilitate interactions between governments and SMEs.

8. Conclusion

SMEs is a group of stakeholders who literally support socio-economic activities of countries and are responsible of adverse environmental impacts in large parts. Moreover, they are the vehicle of eco business in many countries. These features suggest promising leverage in achieving sustainability: That is to incorporate SMEs' commitment to sustainability into their business strategies, enhancing their environmental management as well as involvement in environmental industry. Despite of this understanding, all stakeholders including national governments, the private sectors, as well as the international community have not yet done enough, and the development of the policies which respond to the needs has been delayed.

Technology solution has received a special attention, and demonstration programs are carried out in collaboration with foreign and international donors. However, issues of finance and lack of effective policies, coupled with poor access to appropriate information, leave insecurity toward the expected outcomes. What is needed for sure is to bringe all stakeholders from governments and financial institutes to industrial associations and companies, regardless the size of operation, into the development of sustainable industries played by SMEs and to develop appropriate policies with clear targets in order not to have the promising leverage fading away.

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Appendix: Comparison of Definitions of SMEs in the Selected Countries

Country	Definition	
China[1]	1) Manufacturing, construction, mining	paid-in capital of less than NT$60 million or fewer than 200 regular employees
	2) Forestry, agriculture, fishing, electrical, gas and fuel oil, commerce, transportation, warehouse, courier, finance, insurance, industrial and commercial service	sales of less than NT$80 million for the previous year or fewer than 50 regular employees.
India[2]	1) Small Scale Industrial Undertakings	An industrial undertaking in which the investment in fixed assets in plant and machinery whether held on ownership terms on lease or on hire purchase does not exceed Rs 10 million
	2) Tiny Enterprises	Investment limit in plant and machinery in respect of tiny enterprises is Rs 2.5 million irrespective of location of the unit.
	3) Small Scale Service & Business (Industry related) Enterprises (SSSBEs)	SSSBEs industry related service/ business enterprises with investment upto Rs 500,000 in fixed assets, excluding land and building, but This limit has been raised to Rs.1 million
Indonesia[3]	According to Undang-Undang (Regulation) No 9 Tabun (year) 1995, small businesses have a maximum net worth (excluding land and building) Rupiahs 200 million or maximum sales of Rupiahs 1 billion, are owned by Indonesian citizens and are independent i.e. not a subsidiary of , or owned by, or affiliated directly or indirectly with, medium size or big enterprises	

1 "Guidelines for Identifying Small and Medium-Sized Enterprises" by the Ministry of Economic Affairs in 1995

2 Small Industry Development Organization Online available at http://www.smallindustryindia.com/ssiindia/definition.htm

3 http://www.tradenetsl.lk/sme/definition.htm

<table>
<tr><td rowspan="3">Korea[4]</td><td colspan="2">SMEs is generally defined as a company which employs fewer than 300 persons or whose paid-in-capital amounts to below 8 billion won</td></tr>
<tr><td>1) Manufacturing</td><td>The number of employees or paid-in-capital
- Fewer than 300 employees or less than US$ 6.7 million in paid in capital</td></tr>
<tr><td>2) Service</td><td>Standards based on the number of employee or sales
- fewer than 300 employees or less than US$ 25 million in sales-information processing, etc.(9 categories)
- fewer than 200 employees or less than US$ 16 million in sales-communication, etc(43 categories)
- fewer than 100 employees or less than US$ 8 million in sales-communication sales, etc.(84 categories)
- fewer than 50 employees or less than US$ 4 million in sales
- wholesale, etc.(14 categories)
- fewer than 30 employees or less than US$ 1.6 million in sales
- retail, etc.(224 categories)</td></tr>
</table>

4 The Framework Act on Small and Medium Enterprises

Part Three: Role of External Factors in Environmental Industry Development

Chapter VI

The Major Contributions of Japan's ODA and Japanese Multinational Corporations to Environmental Industry Development

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Summary and Recommendations

1) The contribution of Japan's ODA
Japan started economic cooperation for developing countries by joining the Colombo Plan in 1954. In 1989, Japan became the world's top donor among the 21 DAC member countries. Japan's cooperation in the environmental field are categorized following 5 sectors; 1) residential infrastructure, 2) forest preservation, 3) antipollution measures, 4) disaster prevention, and 5) other sectors (nature conservation, environmental administration, seawater contamination, global warming).

The Japanese government adopted Japan's Official Development Assistance Charter (ODA Charter) as basic philosophies of Japan's ODA in 1992. In the ODA Charter, the environmental consideration is considered as the most important matters. In 1997, then-prime minister Hashimoto announced the "Initiatives for Sustainable Development Toward the 21st Century" (ISD) as the Japanese basic philosophy on environmental cooperation. Philosophy of ISD is that Japan's environmental cooperation will be extended in accordance with the following ideas; i) global human security, ii) ownership, iii) sustainable development, and following five areas are listed as the action program; i) air pollution (acid rain), water pollution, and waste disposal, ii) global warming, iii) nature conservation, iv) water issues, v) development of public and government awareness. At the 2002 Johannesburg summit, five years latter of announcement of ISD, Japan is issuing its Environmental Conservation Initiative for Sustainable Development (EcoISD), replacing the current ISD.

Nowadays, environmental problems are recognized globally and diversified from natural degradation to global environmental problems. That is, adding to the environmental problems of the degradation of renewable natural resources, deteriorating urban environments by rapid industrialization and health problems by pollution, global environmental problems such as global warming, desertification, and the reduction in biodiversity are recognized as significant problems.

In order to provide cooperation for tackling with these problems, it is important for ODA to introduce optimum policies and technologies for environment issues to recipient countries. Japan has obtained plenty of know-how through overcoming industrial pollution problems. These Japanese experiences will contribute antipollution measures in industrialization of developing countries. Japan will transfer Japanese appropriate technology and know-how to assist the environment conservation of developing countries under the ISD plan.

It is important to enact proper environmental laws and regulations and make circumstances to enforce these laws and regulations in developing countries. This will encourage by development assistance for environmental policy support for government in developing countries. Many developing countries do not have the proper technologies for environmental monitoring to check the present environmental problems. It is essential to strengthen technologies of scientific analysis for inspecting environmental problems.

Japanese assistance by the project-type technical cooperation will provide the measures of these purposes. The cooperation will transfer the technologies and skills necessary for environmental monitoring to developing countries. And also, the cooperation will support to develop capability of policy-making for environment, promoting environmental standards, strengthening environmental organization. This will provide fundamentals to develop the environmental industry in developing countries. Japan has provided the project-type technical cooperation to six countries; Thailand, Indonesia, China, Chile, Mexico, and Egypt.

In the case of China, the Japan-China Friendship Environmental Protection Center, as a project-type technical cooperation, opened in 1996, and had preferable effects to China’s environmental issues. And also under the agreement on "Japan-China Environmental Cooperation toward the 21st Century", the establishment of Environmental Information Network, and the creation of environmental model cities are implementing. The Environmental Information Network plans to make a nationwide environmental information network with the Japan-China Friendship Environmental Conservation Center as the core.

The China-Japan-Korea Tripartite Environment Ministers Meeting (TEMM) has learned annually since 1999. Cooperation in environmental industry was selected one priority areas in environmental cooperation. At the 2nd Tripartite Roundtable Meeting in Awaji, Japan in 2002, Chairperson points out in his summarization of the meeting as follows; 1) It is recognized that government policies have long served as effective incentives for the development of environmental industry. 2) Environmental industry will be one of the most important industries in the future in China, Korea and Japan.

2) The contribution of Japanese MNC

Many companies pay attention to the environmental consideration in their corporate activities including the production process in domestic and abroad. Production activities of multinational companies in developing countries have a possibility to improve environmental consciousness of the people and society of developing countries.

Japan has experienced the industrial pollution problems in 1960s and 1970s and some companies found this for business chance to utilize the technology and know-how obtained through overcoming industrial pollution. In the forecast of market size and employment in Japanese environmental industry, the market size in 2020 will increase to 2 times of 2000 and the employment will increase to 1.6 times of 2000. The export of environmental equipment is not a big scale yet.

Foreign direct investment (FDI) of Japanese companies increased greatly in 1970s. In the operation of Japanese manufacturing companies in foreign countries, especially in developing countries, it often discusses about insufficiency of the environmental consideration in production, and inability of implementation of regulation and rules by local government.

Nowadays, many Japanese companies take into consideration for environment issues in their foreign investment as a same in domestic activities. Japanese companies tried to develop their environmental mind in their foreign manufacturing activities by the leadership of Keidanren in 90s. Although the defects of environmental laws and regulations are indicated, Japanese companies made positively environmental measures and environmental assessments in the process of FDI, and also many Japanese companies had their own environmental management policy.

Japanese companies are trying to provide environmental technical support and environmental information to the joint venture companies in developing countries. Technology transfers of advanced environmental technology form multinational enterprises are expected in developing countries. Multinational companies, which have much capital sources and technological capabilities, should take leadership to cope with environmental problems.

There still remain problems in the field of environmental infrastructure in developing countries. For instance, many companies have worries the treatment of industrial waste. The development of environmental infrastructure is anticipated the support of ODA.

3) Recommendations for Future Development of The Environmental Industry

Japan's ODA has been providing the assistance for developing countries in the area of 1) equipments to reduce environmental burdens, 2) services for environment protection, and 3) assistance for building social environmental infrastructure. In the technical cooperation for developing countries, Japan is cooperating to reinforce environmental institution building of the government in the form of dispatching Japanese experts, accepting trainees from developing countries and providing of environmental equipments.

The effective regulation for environment and its proper implementation is the priming water of development of environmental industry. At this sense, ODA contribute the development environmental industry in-direct way. The development of government attitude for environment will educate the company's environmental mind. ODA will contribute construction for good infrastructure for environment and environmental mind of the government in developing countries.

Corporate activities will contribute more directly to reduce the environmental problems. It will be a role of multinational companies to lead their related local companies to the operation for environment friendly in developing countries. Many Japanese companies are operating with environmental measures in Asian countries. These corporate attitudes will help to develop environmental minds in local companies. The corporate behaviors also improve subcontractors' attitude for environment. It seems that consciousness for the environment leads to set up the environmental industry market in developing countries.

The environmental consideration of Japanese multinational companies in developing countries will raise the environmental consciousness of local companies. Moreover, local companies will be able to develop their technology for the environment in their subcontract work of Japanese multinational companies. Japan's ODA offers the basic technology for the environment protection and raises the consciousness for environment in developing countries.

And governments of developing countries will get the hands to secure the implementation of environmental restriction. And engineering companies will offer practical technology to protect environment issues. The combination of three actors will lead the development of environmental industry.

Section I:
Japan's ODA and its Effects on Environmental Industry Development in Selected Asian Development Countries

1. Japan's Official Development Assistance (ODA) in Environment

1) Outline of Japan's Environmental Cooperation: Bilateral and Multilateral

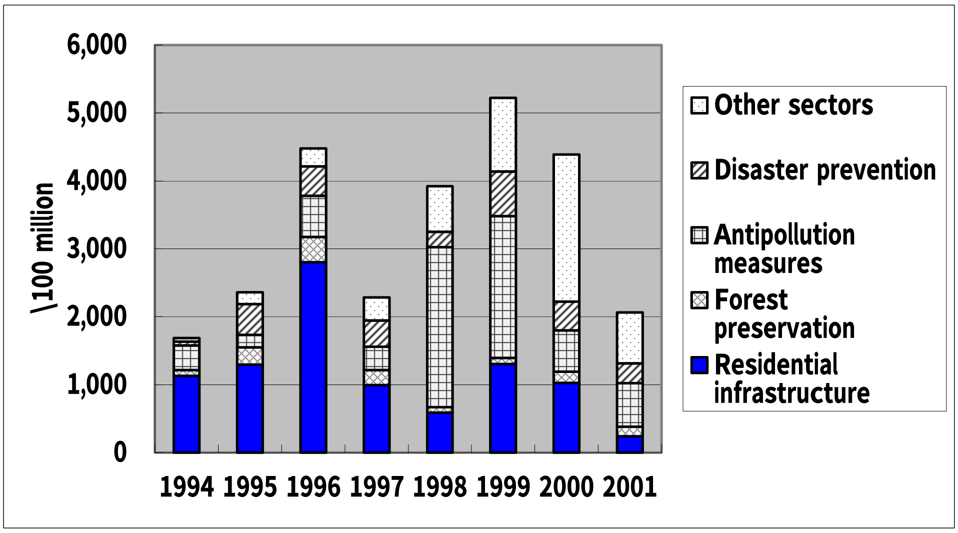
Japan started government-to-government technical cooperation for developing countries by joining the Colombo Plan in 1954. And also, Japan extended yen loan to India at the first time of this type of cooperation in 1958. In 1989, 35 years after when Japan started official development assistance for the developing countries, Japan became the world's top donor among the 21 DAC member countries. Then Japan is contributing to the development of developing countries in many fields until today.

Japan began environmental cooperation in the early 90s. Then Japan's ODA puts priority in the field of environment. Japan's cooperation in the environmental field are categorized following 5 sectors; 1) residential infrastructure, 2) forest preservation, 3) antipollution measures, 4) disaster prevention, and 5) other sectors (nature conservation, environmental administration, seawater contamination, global warming).

The theme of this project is to study the situation and possibility of development of environmental industry in the Asian developing countries, especially China, India, Indonesia and Korea. Japan's ODA has the possibility to contribute development of environmental industry in Asian in the following manner. The first is cooperation for environmental institution building of government. These are cooperation for formulation of environmental policy and regulation, and technical cooperation to raise the measurement ability of pollution problems. The second is direct cooperation for pollution prevention by providing pollution control equipments by grant aid and yen loan. These cooperation will also assist the technology transfer of manufacturing technology for antipollution equipment and operating technology for antipollution equipment. In this context, Japan's ODA will have the possibility to bring up the environmental industry in developing countries.

Above mentioned areas are categorized antipollution measures and other sectors (environmental administration) in Japan's ODA. I would like to introduce Japan's environmental cooperation in the following chapter and possibility to the development of environmental industry in Asian developing countries.

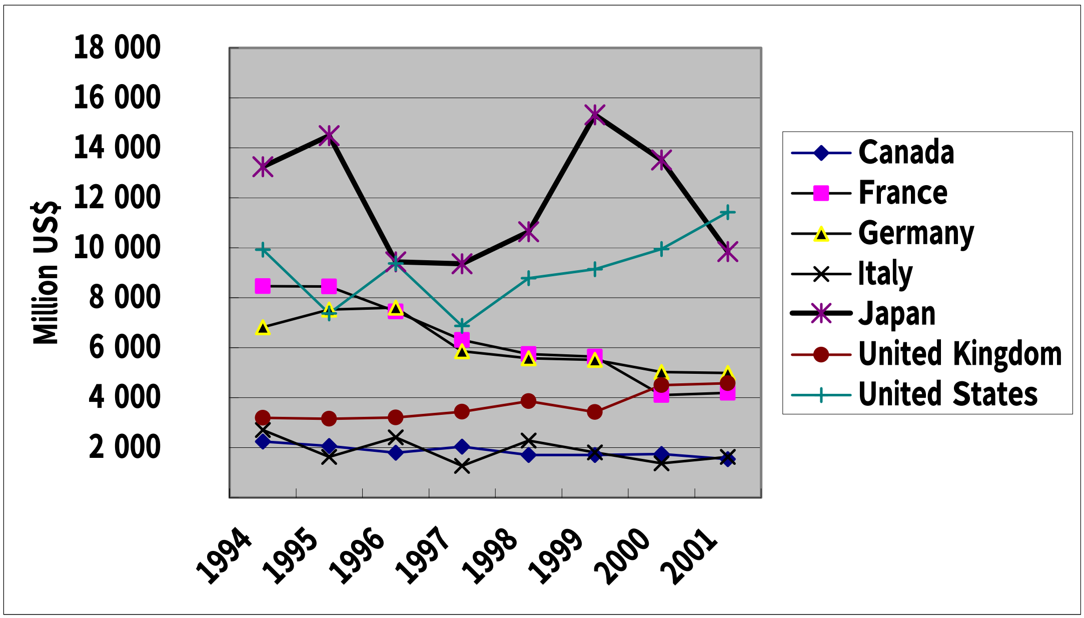
Figure1 Environmental ODA Results



Source: Ministry of Foreign Affairs of Japan

Japan's environmental cooperation has been expanding, and it reaches 452.5 billion yen in FY2000, an amount equivalent to about 31% of the total in committed that year (1.456 trillion yen). Assistance for residential infrastructure of environmental ODA increased up to 1996. After 1996, assistance for antipollution measures became main field of Japan's environmental ODA. The share is 61% in 1998, 40% in 1999, and 14% in 2000. In FY2000, other sectors of environmental ODA are expanding the share in environmental ODA and it shares 50% of environmental ODA. Other sectors include nature conservation, environmental administration, seawater contamination and global warming.

Figure2 Trends in Major DAC Countries' ODA (net disbursement basis)



Source: Ministry of Foreign Affairs of Japan

Note: Excluding aid to Eastern Europe

2) Policy Development in Environmental Cooperation

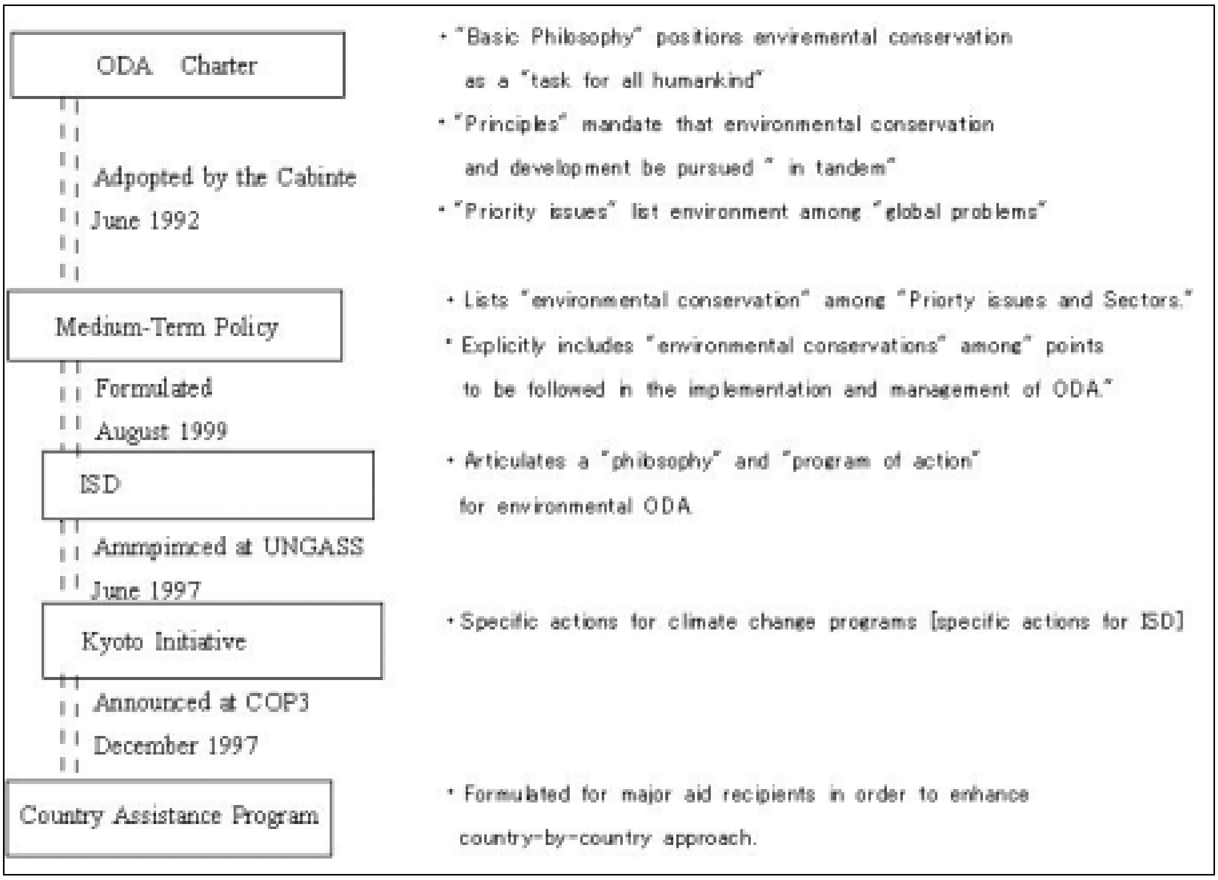
Japan became the largest donor country in the world in 1989. Then-prime minister Uno announced, at the Arche Summit in 1989, the Japanese government pledges to expand its environmental ODA up to 300 billion yen from FY1989 to FY1991. After this, Japan expanded environmental ODA consciously.

In order to clear Japanese philosophies and objectives for ODA, the Japanese government announced 4 ODA guidelines of its economic assistance to developing countries in 1991. The government will pay full attention to the following four points in implementing its economic aid:

1) the trends of the military expenditures of recipient countries,
2) the trends of their development and production of mass destruction weapons and missiles,
3) their export and import of arms, and
4) their efforts for promoting democratization and introduction of market-oriented

economy, and the situation regarding the securing of basic human rights and freedoms.

Figure3 Environmental Conservation within the Japanese ODA Framework



Source: Ministry of Foreign Affairs of Japan

In response to above-mentioned 4 ODA guidelines, the Cabinet adopted in 1992, Japan's Official Development Assistance Charter (ODA Charter) as basic philosophies of Japan's ODA. The ODA Charter lists (1) humanitarian considerations, (2) recognition of interdependence among nations of the international community, (3) environmental consideration, and (4) support for self-help efforts of recipient countries. The Japanese government is trying to faithfully follow these principles as the conduct of Japan's foreign assistance. Especially the environmental consideration is considered as the most important matters.[1]

At the 1992 UN Conference on Environment and Development (the UNCED), Japan pledged to disburse between 900 billion and 1 trillion yen in environmental ODA over the ensuing five years. At the end of 1996, it had already disbursed 1.44 trillion yen, more than 40 percent over the pledged amount.

This led to the announcement by then-prime minister Hashimoto, in Special Session of the United Nations General Assembly on Environment and Development in 1997, Japan's comprehensive medium- and long-term plan for environmental cooperation, called the "Initiatives for Sustainable Development Toward the 21st Century" (ISD). ISD present Japanese basic philosophy on environmental cooperation, and constitute an action plan.

Philosophy of ISD is that Japan’s environmental cooperation will be extended in accordance with the following ideas; i) global human security, ii) ownership, iii) sustainable development, and following five areas are listed as the action program; i) air pollution (acid rain), water pollution, and waste disposal, ii) global warming, iii) nature conservation, iv) water issues, v) development of public and government awareness.

As the program for global warming, Japan presents "the Kyoto Initiative," in the policy framework of the ISD at the 3rd Conference of Parties to the United Nations Framework Convention on Climate Change (COP3) in Kyoto in 1997. The three pillars are summarized as follows;

i) Cooperation in capacity development

In the five years beginning in FY1998, Japan will train 3000 people in developing countries in the following fields: a) air pollution, b) waste disposal, c) energy saving technologies, d) forest conservation and afforestation.

ii) Official development assistance loans on the most concessional conditions

Japan will grant ODA loans with the most concessional terms available internationally (0.75% interest rate, 40 year repayment period) to actively promote cooperation in the following fields: a) energy saving technologies, b) new and renewable energy sources, c)

[1] ODA Charter is in the process of review in 2003, but the policy for emphasizing environmental cooperation will not change.

forest conservation and afforestation.

iii) Exploitation and transfer of Japanese technology and know-how

Using technology and know-how acquired in the process of combating its own pollution and energy problems, Japan will a) send teams to diagnose global warming prevention measures in manufacturing plants, b) set up information networks related to global warming prevention technology, c) develop and transfer technology suited to developing countries' needs, and d) hold workshops on global warming prevention.

At the 2002 Johannesburg summit, five years latter of announcement of ISD, Japan is issuing its Environmental Conservation Initiative for Sustainable Development (EcoISD), replacing the current ISD. Under the new concept of EcoISD, Japan will continue to extend environmental cooperation, mainly through its ODA, to support environment protection of developing countries. EcoISD is summarized as follows

1. Philosophy of EcoISD

1) Human Security
2) Ownership & Partnership
3) Pursuit of Environmental Conservation & Development

2. Principles of Environmental Cooperation

1) Capacity development in environment
2) Active integration of environmental considerations
3) Japan's leading role
4) Cooperation under a broad and comprehensive framework
5) Application of Japanese experience and scientific knowledge.

3. Action Plans

Japan will promote actions in the following four priority areas.

1) Efforts to Address Global Warming

   To raise awareness that global warming threatens to spoil sustainable development, to transfer to and spread over developing countries appropriate technologies as countermeasures against this problem, and to enhance capacity to address this issue from scientific, social and systemic perspectives.

2) Pollution Control

To provide support focusing on measures to control pollution and improve living standards (air & water pollution and waste management) in urban areas, mainly in the Asian regions in which economies are rapidly growing.

3) Fresh Water Issues

To support the implementation of both water supply and sewage systems, taking into account the characteristics of the target country's urban and rural areas, as well as to promote "soft" cooperation for water resource management and water quality control.

4) Conservation of Natural Environment

To support developing countries in the areas of the management of nature reserves, forest-related issues, prevention of desertification, and natural resources management, taking into consideration the efforts for eradicating poverty of local people.

4. New Efforts by Japan

Japan will undertake the following new efforts.

1) Human resources development totaling 5,000 in the environmental field over a five-year period from FY 2002.
2) Provision of yen loans with the most concessional terms for projects in environmental fields in order to give incentives to developing countries to resolve global environmental issues.
3) Enhancement of Japan's grant aid for global environment to promote cooperation for resolving the issue.
4) Promotion of wide-ranging collaboration with international organizations.
5) Further improvement of evaluation methods in order to make the ex-post evaluation of Japan's environmental ODA more effective.

2. Major Achievements and Issues in Japan’s ODA in Environment

1) Learning Lessons form Japanese Experiences in Air, Water and Urban Pollution

ODA has possibilities to improve environmental issues in the developing countries by transfer of experiences in industrialized countries. Many industrialized countries have experiences of pollution, for instance, air pollution due to Sox, water pollution due to pollutant discharge, and complaints due to noise, vibration. Japan also has experienced industrial pollution and urban pollution.

Japan has obtained plenty of know how through overcoming industrial pollution problems in 1960s and urban pollution problems in 1970s. These Japanese experiences will contribute antipollution measures in industrialization of developing countries. For instance, technologies for air pollution, water pollution and waste disposal are listed as antipollution measures.

Adding these industrial pollution problems, natural environmental issues and global environmental problems are listed environmental issues. Japan’s energy saving technologies, new and renewable energy sources and forest conservation and afforestation will be useful technology for developing countries. These technologies will contribute natural preservation and global environmental problems (i.e. global warming) .

Japan has assigned high priority to ODA projects in the environment field. From 1995, Japan reduce 0.2% of the interest of yen loan for environmental projects in order to promote environmental measures in developing countries. Japan began offering yen loans for environmental projects at special concessional terms (0.75 %, with a repayment period of 40 years) in 1997. Yen loan for environmental projects at special concessional terms will help the access to yen loan from developing countries.

Total amount of Japan’s ODA in FY 2001 is 1.203 trillion yen, the amount decreases by around 17.8% form the previous year. In Japan’s ODA of FY2001, yen loan for environment purpose is 22.8% of total yen loan. And also grant aid for environment is 22.6% of total Japan’s grant aid. Technical cooperation for environment is 20.3% of total technical cooperation.

Statistical trend of Japan’s ODA is shown in the following tables. In the environmental cooperation, grant aid peaked in 1997, loan assistance peaked in 1999, and technical cooperation peaked in 2001. From the view point of environmental field, antipollution measures, nature conservation, environmental administration, and seawater contamination are main cooperation fields in 2001. These are reflecting the international trends for environmental cooperation. Various environmental problems acknowledged widely, for instance, the degradation of renewable natural resources, deterioration of urban environments due to rapid urbanization, pollution by industrialization and global environment issues.

Table1 Japanese Economic Cooperation in the Environmental Field

Table 1.1 Commitments by aid type

(Unit: ¥100 million)

FY	Grant aid	Loan assistance	Technical cooperation	Multilateral assistance	Total
1994	414.3 (33.6)	1,054.9 (12.4)	218.7 (15.9)	253.3 (6.5)	1,941 (14.1)
1995	428.2 (33.5)	1,708.2 (15.3)	222.9 (15.8)	400.3 (10.2)	2,760 (19.9)
1996	360.7 (27.8)	3,864.7 (29.7)	253.4 (16.9)	153.8 (11.3)	4,632 (27.0)
1997	364.6 (27.7)	1,623.4 (15.3)	300.7 (19.2)	158.1 (4.6)	2,447 (14.5)
1998	289.9 (25.9)	3,280.9 (30.2)	304.2 (19.6)	263.1 (10.2)	4,138 (25.7)
1999	293.7 (25.2)	4,644.5 (44.9)	282.5 (19.0)	136.0 (4.5)	5,357 (33.5)
2000	244.2 (22.5)	3,860.6 (44.5)	284.3 (18.2)	136.1 (4.7)	4,525 (31.8)
2001	242.0 (22.6)	1,498.1 (22.8)	324.4 (20.3)	157.7 (5.5)	2,222 (18.9)

Note:

1. arenthetical figures other than those in the "Total" column represent the share (%) of each type of aid in that particular year. "Grant aid"refers to the percentage of general grant aid extended that year. (It does not include grant aid for debt relief, non-project grant aid for structural adjustments, or grant aid for grassroots projects.) "Loan assistance"represents the percentage of the total (excluding loan assistance for debt relief) in project and non-project loan assistance, e.g., commodity loan assistance and structural adjustments lending.
2. The parenthetical figures in the "Total" column represent the share of total ODA committed that year.
3. Amounts for grant aid and loan assistance were calculated on a commitment (Exchange of Notes) basis; technical cooperation on a JICA disbursements basis; and multilateral assistance on a budget basis for contributions to multilateral institutions.

Table1.2 Bilateral technical cooperation

(1) (Actual JICA disbursements, including aid to Eastern Europe)

FY	Project-type technical cooperation			No. of development surveys	No. of independent supply projects
	No. of projects	Trainees accepted	Experts dispatched		
1994	48	143	457	79	18
1995	58	176	585	90	10

1996	74	160	545	98	10
1997	80	156	562	115	31
1998	81	170	593	120	19
1999	73	168	610	115	14
2000	47	132	449	110	8
2001	87	172	599	115	13

Note:

1. Project and personnel totals include figures for new as well as for ongoing programs. Instances of project-type technical cooperation include post-project follow-up cooperation.
2. Project-type technical cooperation is a type of technical cooperation which bundles expert assignments, trainee programs in Japan, and the provision of equipment.

(2) (Actual JICA disbursements, including aid to Eastern Europe)

FY	Trainees accepted		Experts dispatched		JOCV	
	No. of trainees	Share (%)	No. of experts	Share (%)	No. of experts	Share (%)
1994	1,192	12.7	325	10.9	116	10.3
1995	1,418	14.3	355	17.2	92	2.7
1996	1,559	14.5	284	9.4	116	11.7
1997	1,572	13.8	309	17.0	85	2.4
1998	1,758	8.9	279	13.6	102	2.9
1999	1,880	10.5	435	17.3	116	3.2
2000	2,277	13.0	505	14.9	132	8.0
2001	2,672	12.7	467	21.4	219	5.0

Note:

1. The annual personnel totals represent newly accepted trainees as well as new and continuing assignments for experts and JOCV staff.
2. Percentages represent the share of all personnel in a category in that year.

Table1.3 Statistics for bilateral assistance by environmental field

(Including aid to Eastern Europe; unit: ¥100 million)

FY	Residential infrastructure	Forest preservation	Antipollution measures	Disaster prevention	Other sectors
1994	1,128 (66.9)	87 (5.2)	362 (21.5)	58 (3.4)	52 (3.1)
1995	1,296 (54.9)	252 (10.7)	183 (7.7)	453 (19.2)	176 (7.5)
1996	2,803 (62.6)	372 (8.3)	609 (13.6)	429 (9.6)	266 (5.9)
1997	993 (43.3)	223 (9.8)	345 (15.1)	384 (16.8)	341 (14.9)
1998	538 (13.9)	82 (2.1)	2,353 (60.7)	226 (5.8)	676 (17.4)
1999	1,303 (25.0)	89 (1.7)	2,090 (40.0)	656 (12.6)	1,083 (20.7)
2000	1,025 (23.4)	168 (3.8)	608 (13.9)	421 (9.8)	2,167 (49.5)

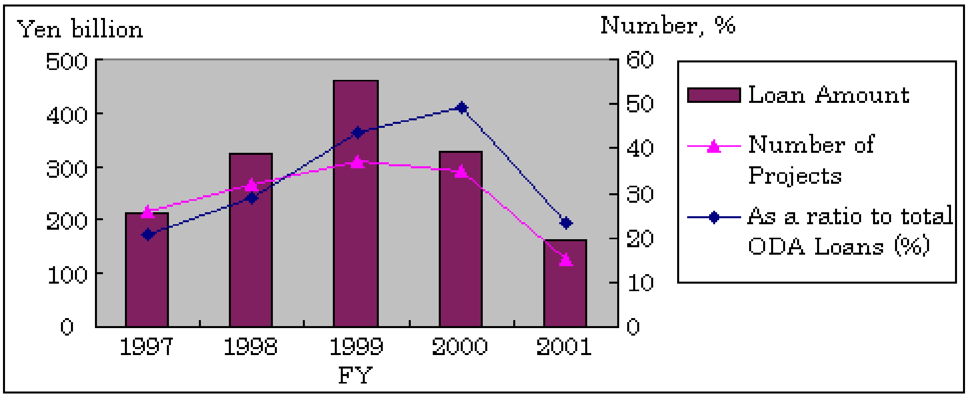
2001	238 (11.5)	143 (6.9)	640 (31.0)	295 (14.3)	748 (36.2)

Note:

1. Figures are totals for loan assistance, grant aid, and technical cooperation. Multilateral assistance is not included.
2. Percentages in parentheses represent the share of total ODA in the environmental field that year.
3. "Other sectors" include nature conservation, environmental administration, and seawater contamination.

Source: Ministry of Foreign Affairs of Japan

Figure4 Commitments by Yen Loan to Environmental Projects 1997-2001 (L/A basis)



Source: JBIC Internet Home Page

Note: The major reasons for a significant decline in commitments to environmental projects in fiscal 2001 are as follows:

1) The aggregate amount of commitments to China, which accounted for a large portion of the overall commitments to environmental projects in the several years up to fiscal 2000, declined in fiscal 2001. On top of that, initiating support for human resources development projects decreased the relative share of environmental projects.

2) Unlike the three years from fiscal 1998 through 2000, there was no commitment in fiscal 2001 to mass transit projects (such as an urban rail system to mitigate traffic congestion), which had taken up a large share of the overall commitments with their relatively huge funding requirements.

Recent Japan's environmental ODA is conducting under ISD (Initiatives for Sustainable Development toward the 21st century. The ISD plan comprises comprehensive package of Japanese guidelines ODA-led environmental policy and program. In the ISD plan, Japan will transfer Japanese appropriate technology and know-how to assist the environment conservation of developing countries. The programs and projects are classified 1) air pollution, Water Pollution, and Waste Disposal, 2)Global Warming (The Kyoto Initiative), 3)Nature Conservation, 4)"Water" Issues, and 5)Development of Public and Government Awareness. The main programs and projects are as follows;

1. Air Pollution (Acid Rain), Water Pollution, and Waste Disposal

i) **Acid Deposition Monitoring Network in East Asia**

- Monitoring of acid rain and development of technology (training courses)

ii) **Cooperation through Environmental Centers**

- Indonesia, China, Chile, Mexico and Egypt (P)

iii) **Financial and Technical Cooperation**

- China: Liuzhou Environmental Improvement Project III (O)
- China: Benxi Environmental Improvement Project II (O)
- Philippines: Local Government Units Support Credit Program (Two-Step Loan) (O)
- Philippines: Metro Manila Air Quality Sector Development Project (O)
- Sri Lanka: Environmentally Friendly Solution Fund (Two-Step Loan) (O)
- Indonesia: Plan for Training in Industrial Pollution Prevention Technology (O)
- Thailand: Automotive Fuel Research Project For Environmental Improvement (P)

2. Global Warming (The Kyoto Initiative)

i) **Cooperation for Human Resources Development**

- Course on Global Warming (training course)
- Professional Energy Conservation Centers (China, Turkey, Argentina and Bulgaria) (P)

ii) **Most Concessional ODA Loans**

- Thailand: MRTA System Project (Blue Line) (O)
- Malaysia: Port Dickson (Tuanku Jaafar) Power Rehabilitation Project (O)
- Viet Nam: Da Nhim Hydroelectric Powerplant Construction Project (O)

iii) **Other Projects (countermeasures for rising sea levels)**

- Maldives: Project for Seawall Construction on Male's Island III (G)

3. Nature Conservation

i) **Biodiversity Conservation**

- Indonesia: Biodiversity Conservation Project (P)
- "Parks in Peril" Program (Grant aid for a grassroots project)

ii) **Coral Reef Conservation Network**

- Project for the Establishment of the Palau Coral Reef Conservation Center (G)

iii) **Promotion of Sustainable Forest Management and Strengthening of Cooperation against Desertification**

- Laos: Project for Construction of Afforestation Center (G)
- Indonesia: The Forest Fire Prevention Management Project in the Republic of Indonesia (P)
- Malaysia: The Effective Wood Utilization Research Project in Sarawak in Malaysia (P)
- Thailand: Reforestation and Extension Project (P)
- Kenya: The Social Forestry Extension Model Development Project for Semi-Arid Areas in Kenya (P)

4. "Water" Issues

- Cambodia: Project for Improvement of Water Supply Facilities in Phnom Penh II (G)
- Niger: Plan for Clean Water Supply for Eradication of Guinea Worm (G)
- Mauritius: Sewage Treatment Facility Improvement Project (O)
- China: Shandong Yantai Water Supply and Water-Induced Disaster Management Project (O)
- Thailand: Technical Training Center for Sewage Works Project (P)
- Egypt: The Water Supply Training Improvement Project (P)

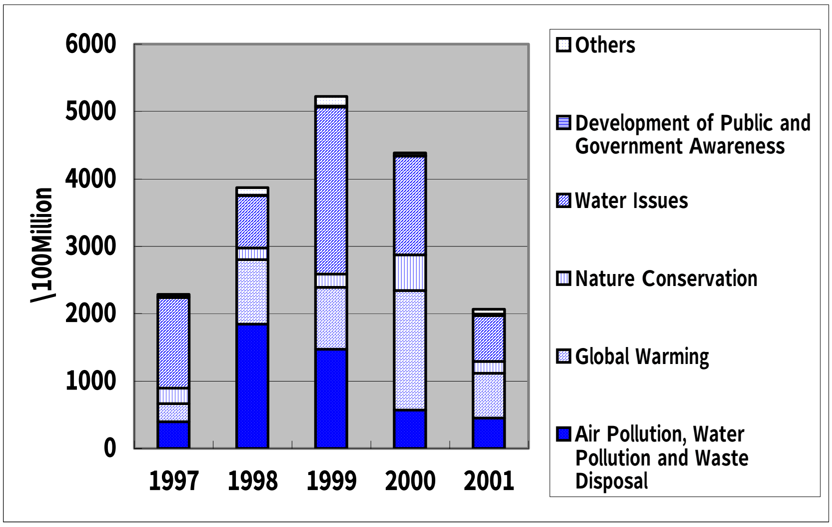
5. Development of Public and Government Awareness

- Active implementation of dialogue on policies for environmental cooperation
- Support for local conservation activities through the provision of grassroots grant aid

(G): Grant aid, (O): ODA loans, (P): Project-type technical cooperation

Source: Japan's ODA Annual Report 1999

Figure5 ISD Results 1997-2001



Source: Japan's Development Assistance White Paper 2002

2) Use of Environmental Guidelines for Mainstreaming Environmental Concerns into All ODA Programmes and Projects

Japan has been strengthening environmental programmes and projects in ODA from the end of 80s. But in the mainstreams of ODA projects, for instance, economic development projects like construction of road, hydroelectricity station and others, environmental considerations in the project development become the most serious matters through the 80s. In some cases, Japan's ODA projects criticized as causes of deteriorations of the environment in the recipient countries. These environmental negative effects are not considered in the project design stages.

In 1988, Aid Study Committee on Environment was established by JICA to discuss Japan's ODA for the field of environment. In this committee, the environmental considerations that should be taken in the implementation of ODA were discussed as main issues.

Upon the recommendation of the committee, OECF (predecessor of JBIC) and JICA had guidelines on the consideration of environmental problems for the implementation of environmental impact assessment in ODA programs.

From 1990 through 1992, JICA formulated and implemented guidelines covering twenty sectors, for examples, guidelines for the investigation of environmental impacts concerning dam construction plans and guidelines for the investigation of environmental impacts concerning socioeconomic infrastructure improvements. JICA is reviewing these guidelines to give further consideration to the environment.

In 1989, JBIC formulated and implemented OECF guidelines for environmental considerations and revised the guidelines in 1995 for more environmental considerations. Also JBIC established "Japan Bank for International Cooperation Guidelines for Confirmation of Environmental and Social Considerations" as unified guidelines for international financial operations and overseas economic cooperation operations in 2002.

The new guidelines adopt the common approaches of OECD, placing importance on dialogue with local residents, host countries and borrowers and promoting information disclosure. The checklist for the project approval included social considerations pertaining to resettlement, indigenous people and women. The following items are stipulated in the guidelines:

1. Classification of projects into three categories (A, B and C)[2] and criteria for

[2] 1. Category A: projects corresponding to at least one of the following items
(1) Large projects (both new and rehabilitation) of the following kinds:

classification
2. For Category A projects, submission of the Environment Impact Assessment Report to JBIC is required.
3. Basic rules for environmental considerations

3) Issues in Planning and Implementation: Limitations of Technical Cooperation in Environmental Policy Planning and Implementation

The technology transfer of environmental conservation to technicians was emphasized in the Japanese technical cooperation for developing countries. There are not so much cases the cooperation to environmental policy support for government of developing

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1) Road and railroad, 2) Airports, 3) Ports and harbours, 4) Electric power generation, 5) Industry in general, 6) Mining development, 7) Forestry, 8)Irrigation, 9) Waste disposal, 10) Development necessitating submergence of large areas, 11) River basin development, 12) Development involving the manufacture or use of a large amount of hazardous and/or toxic materials or pesticides, and 13) Development involving reclamation affecting bodies of water.
(2)Projects implemented in, or which may affect, such areas as the following:
1) Areas where there is the danger of salt accumulation or soil erosion, 2) Semi-arid areas, 3) Natural forests in tropical areas, 4) Water sources, 5) Habitats of value to protection and conservation and/or sustainable use of fish and wildlife resources (including coral reef or mangrove ecosystems), 6) Areas of unique interest (historical, cultural or scientific), 7) Areas of concentrations of population or industrial activities, and 8) Areas of particular social interest to specific vulnerable population groups(nomadic people, etc., with traditional lifestyle)
(3)Projects with such characteristics as the following:
1) Projects expected to have a wide, diverse and irreversible environmental impact, 2) Projects affecting a large number of inhabitants (other than impacts resulting from involuntary resettlement), 3) Projects consuming a large amount of non-renewable natural resources, 4) Projects resulting in the occurrence of significant change in land use or the social, physical and/or ecological environment, and 5) Projects causing the generation or involving the disposal of a large amount of hazardous and/or toxic wastes.

2. Category B:
(1) Projects belonging to the following sectors and not belonging to Category A:
1) Road and Railroad, 2) Airports, 3) Ports and harbours, 4) Water supply, 5) Sewerage, 6) Electric power generation, 7) Electric power transmission, 8) Industry in general, 9) Mining development, 10) Oil and gas pipelines, 11) Diversion channels, 12) Forestry, 13) Irrigation, and 14) Waste disposal.
(2)Projects other than (1) and with a less remarkable environmental impact than a Category A project
(3)Engineering Service Loans provided for projects belonging to Category A.

3. Category C
(1)Projects not normally expected to have an environmental impact
(2)Certain telecommunication, education, human resource development projects, etc., may in certain cases, fall within this category.

countries.

Nowadays, environmental problems are recognized globally and diversified from natural degradation to global environmental problems. That is, adding to the environmental problems of the degradation of renewable natural resources, deteriorating urban environments by rapid industrialization and health problems by pollution, global environmental problems such as global warming, desertification, and the reduction in biodiversity are recognized as significant problems.

Under diversification of environment problems, the importance for the cooperation to environmental policy support was realized by Japanese environmental cooperation. Followings are recommended by 1st JICA's aid study committee on environment and realized as the important fields for environmental cooperation for policy support, 1) to develop appropriate human resources in developing countries, 2) to establish institutional frameworks for environmental management, 3) to prepare basic environmental conservation plans, 4) to find ways of identifying environmental problems, and 5) to systematically gather and compile environmental-related information.

Technical cooperation for environment must cope with above mentioned problems. In order to provide cooperation for tackling with these problems, it is important for ODA to introduce optimum policies and technologies for environment issues to recipient countries.

If ODA project implements without proper plan under proper research of the actual economic situation of recipient countries, there is a possibility to disturb the implementation of the project. In some cases, the recipient countries can not continue the project for the lack of the cost of management and maintenance for the project, and the lack of the cost to manage and maintain facilities and equipment.

Environmental problems are closely related other sectors, i.e. agricultural sector, industrial sector and infrastructure development. Main actors of these areas are the private sector. So ODA projects are needed to have cooperative relationships with the private sectors.

In some cases, private sectors are causes of environmental problems by their activities in developing countries. To cope with these issues, it is important to enact proper environmental laws and regulations and make circumstances to enforce these laws and regulations in developing countries. This will encourage by development assistance for environmental policy support for government in developing countries. And also environmental equipment supplied by ODA and trained human resources will provide the measures to enforce the environmental laws and regulations. It will need broad and comprehensive environmental cooperation to cope with environmental problems in developing countries.

As a specific case in the target countries of this study project, the following chapter introduces Japan's assistances for China. Project-type technical cooperation, namely The Japan-China Friendship Environmental Protection Center, is introduced as a cooperation to make effective impacts for environment and environmental industry in China.

In the project-type technical cooperation, JICA provides the team of experts to provide necessary support for recipient center, the provision of the necessary facilities, equipment and materials, and preliminary training for counterpart personnel.

Many developing countries do not have the proper technologies for environmental monitoring to check the present environmental problems. It is essential to strengthen technologies of scientific analysis for inspecting environmental problems. This is also essential to ensure the enforcement of environmental standards in developing countries. Japanese assistance by the project-type technical cooperation will provide the measures of these purposes. This type of cooperation will transfer the technologies and skills necessary for environmental monitoring to developing countries. And also, the cooperation will support to develop capability of policy-making for environment, promoting environmental standards, strengthening environmental organization. This will provide fundamentals to develop the environmental industry in developing countries.

3. Japan's Environmental Cooperation in Asia: Case in China

China is a country on special focus for Japanese ODA. China ranked third in terms of Japanese bilateral ODA in FY2000. From 1995 to 1998, China ranked first in bilateral ODA. Japan is China’s largest donor country. Japanese ODA to China, mainly through yen loan, has contributed to the alleviation of infrastructure bottlenecks. China ranked first in terms of yen loan of Japanese ODA. The grant aid technical cooperation has contributed mainly to projects related to basic human needs as well as environment conservation and human resources development.

Japan focuses on the priority for the issues of environment in Japan’s economic cooperation guideline for China. Japan's ODA to China places more emphasis on the areas such as the conservation of environments and eco-systems. The serious pollution is observed in China with rapid economic development. Chinese government strengthens their efforts to protect their environment. But they have not much financial resources and technology prevent the pollution. Japan provides yen loan for resolving environmental and other global issues.

By FY1999, environmental projects by yen loan are 14 projects of 19 projects. Also by FY2000, environmental projects are 20 of 23. These projects are water supply project, water works supply project, water pollution control project, sewage treatment project, environment model city project, environmental improvement project, and thermal power plant construction project.

A Japanese high-level mission on economic cooperation visited china in 1992, and both governments agreed that environment project will be made one of the future ODA priorities.

In 1995, Japan sent a joint public-private survey team to China in order to collaborate environmental issues between Japan and China. To foster a heightened exchange of views and opinions on themes in environmental cooperation, in 1996, Japan and China held the Japan-China Comprehensive Forum on Environmental Co-operation with participation by Japanese and Chinese government agencies, local municipalities, NGOs, and specialists.

In 1996, The Japan-China Friendship Environmental Protection Center opened by the

Japan's ODA. The establishment of this center was decided to commemorate the anniversary of the Japan-China Peace Treaty. Japan extended grant aid for the construction of the building as well as provided research equipment. It has also been implementing technical cooperation, including the dispatch of experts in wide-ranging fields.

The cooperation by environmental center approach is to encourage assuming the initiative to formulate environmental programs by developing countries. This type of cooperation will be effective for capacity enhancements and reinforce the environment-related administrative capabilities of developing countries. Japan has provided this kind of assistance to six countries; Thailand, Indonesia (see annex1), China, Chile, Mexico, and Egypt.

Now, the Japan-China Friendship Environmental Protection Center receives assistance form several other donors, including the U.S., Germany, Belgium, and the World Bank. It is expected that the desulfurization equipment which developed in this center will industrialize in near future.

China: The Japan-China Friendship Environmental Protection Center Project

Duration of technical cooperation (project-type)	1 September 1992~31 August 1995 (Phase I) 1 February 1996~31 January 2001 (Phase II)
Counterpart institution	National Environmental Protection Agency
Cooperation objectives	Phase I: The collection and analysis of environmental monitoring data, the study of pollution control technology, and the training of staff in environmental protection fields, to provide Chinese counterpart personnel to become staff of the Center with the necessary technical transference for the smooth opening of the Center in 1995. Phase II: The Center plays a leading role in the field of environmental research, training, and monitoring.
Project content	1. Environmental monitoring technology 2. Pollution control technology 3. Environmental information 4. Environmental strategy/policy research 5. Environmental education/public awareness 6. Human resources development for researchers

<table>
<tr><td rowspan="6">Cooperation</td><td colspan="3">Grant aid: Around ¥10.5 billion in total
Technical cooperation (up to FY1998 for Phase II)</td></tr>
<tr><td></td><td>Phase I</td><td>Phase II</td></tr>
<tr><td>Long-term experts dispatched:</td><td>11 persons</td><td>16 persons</td></tr>
<tr><td>Short-term experts dispatched:</td><td>12 persons</td><td>24 persons</td></tr>
<tr><td>Trainees accepted:</td><td>24 persons</td><td>18 persons</td></tr>
<tr><td>Provision of equipment:</td><td>¥93 mil.</td><td>¥94 mil.</td></tr>
<tr><td>Counterpart country arrangements</td><td colspan="3">Center staff: 282 persons
(full quota 410)
Center budget (FY1998): 16 million yuan</td></tr>
<tr><td>No. of trainees during cooperation period</td><td colspan="3">1,800 persons (44 times)
(As of the end of October 1998)</td></tr>
</table>

At 1997 Japan-China summit meeting, Japan's and China's leaders reached an agreement on "Japan-China Environmental Cooperation toward the 21st Century." This agreement has two ideas for cooperation, i) the establishment of Environmental Information Network, and ii) the creation of environmental model cities.

The Environmental Information Network plans to make a nationwide environmental information network with the Japan-China Friendship Environmental Conservation Center as the core. For this purpose, computers will be installed to process environmental information in 100 major cities in China. In addition to installing computers, Japan cooperates in training human resources for the environmental information network.

The plan of environmental model cities is to select several cities and have them serve as models of efficient environmental planning for other cities. In the plan, Japan's assistance including ODA loans with most preferential terms for environmental projects, and technical assistance are intensively applied. These environmental measures, directed at reducing air pollution and acid rain, are aimed at generating successes that will encourage extension of conservation efforts in other cities and wider adoption of environmental policies throughout China. Chongging, Dalian, and Guiyang are selected as the model cities:

- Implement measures against air pollution on a prioritized, intensive basis.
- Initiate water quality programs where conditions for implementation are met.
- Strive to cultivate recycling-oriented industries and social systems that are explicitly designed to utilize gypsum, fertilizer, and other by-products of emission-desulfurization processes.
- Implement measures against global warming that are geared to aid for programs of energy conservation.

Japan-China Environmental Model City Plan: Recommendations by Expert Committees (Overview)

1. Basic policy
   (1) Measures to combat sulfur dioxide and soot, acid deposition control
   (2) Formation of recycling-oriented industries and social systems
   (3) Measures to combat global warming
   In the above areas, air pollution prevention projects will be implemented on a prioritized, intensive basis, while appropriate consideration will also be given to projects to combat water pollution where conditions for implementation are met and to build environment management capacity.

2. Requests to governments and other related institutions
   (1) Utilize schemes as diverse as possible in line with the nature of the project
   (2) Emphasize human resources development and other "soft" aspects in tandem with development of "hard" aspects
   (3) Consider the introduction of effective "cleaner production"
   Full consideration should be given to the above points, and efforts made to ensure that concept objectives are met.

3. Follow-up arrangements
   The Japanese and Chinese expert committees will review the overall progress of the concept and make recommendations to their respective government as the occasion demands.

Project lists for each model city

Chongqing City	Guiyang City	Dalian City
Recommended projects 1. Fuel Conversion Project for Small and Medium-size Boilers and Household Burning Facilities 2. The West Plant Flue Gas Desulfurization Engineering of Chongqing Power Plant 3. Desulfurization Project of Coke Oven Gas in Chongqing Iron and Steel (Group)	Recommended projects 1. Expansion of Coke Oven Gas Making Plant 2. Air Pollution Prevention at Guiyang Steel and Iron Plant 3. Flue Gas Desulfurization Engineering of Guiyang Power Plant 4. Automatic Monitoring on Major Emission Sources and	Recommended projects 1. Dalian Iron and Steel (Group) Company Electric Furnace Air Pollution Prevention Project 2. Dalian Pharmaceutical Plant Air Pollution Prevention Project Phase 1 3. Dalian Cement (Group) Company Dust Prevention Project

Company 4. Automatic Monitoring on Major Emission Sources in Chongqing 5. Production of Potassium Sulfate from Desulfurized Gypsum Collected from Power Plants 6. Chongqing Compressed Natural Gas Auto Engineering Project	the Ambient Environment in Guiyang 5. Guizho Cement Plant Dust Prevention Project 6. Lindong Clean Coal Project 7. Guizho Organo Chemical Plant Project	4. Yandao Chemical Industrial Estate Thermoelectric Project 5. Chunhai Thermoelectric Project Phase 2 6. Automatic Monitoring on Major Emission Sources and the Ambient Environment in Dalian
Projects to be Considered · Bio-Briquette Plant Construction Project · Coal Preparation Plant Construction Project · The East Plant Retrofit and Flue Gas Desulfurization Engineering Project of Chongqing Power Plant	**Projects to be Considered** · Guiyang Cement Plant Relocation and Air Pollution Prevention Project · Guiyang Hongyan Chemical Plant Relocation and Air Pollution Prevention Project · Flue Gas Desulfurization Engineering of Qingzhen Power Plant	**Projects to be Considered** · Flue Gas Desulfurization Engineering of Hua Neng Power Plant · Water Supply and Drainage Facility Construction in Lushun City · Water Supply and Drainage Facility Construction in Zhuanghe City · Water Resources Project in Wafangdian City
Estimated effect SO_2 122,000 tonne reduction (44 percent of total emissions) NOx 7,000 tonne reduction (12 percent of total emissions) Soot 15,000 tonne reduction CO_2 670,000 tonne reduction	**Estimated effect** SO_2 139,000 tonne reduction (68.5 percent of total emissions) Soot 51,000 tonne reduction (58.6 percent of total emissions) CO_2 618,000 tonne reduction * In the case that flue gas desulfurization engineering at Guiyang Power Plant is implemented on a reduced scale: SO_2 91,000 tonne reduction (44.8 percent of total emissions) Soot 33,000 tonne reduction (38.4 percent of total emissions)	**Estimated effect** SO_2 9,000 tonne reduction (5.6 percent of total emissions) Soot 36,000 tonne reduction CO_2 618,000 tonnes reduction

Nature of project lists

- Project lists are "long lists", and there is no obligation to implement all projects within a given time-frame.
- Implementation priority will be given to those projects on the lists which meet implementation conditions, bearing in mind the effect of the concept as a whole.
- The amount of investment in each project will not be taken into consideration in project selection.
- The Japanese expert committee has not prioritized the various projects. Lists are in the order provided

by the Chinese side.

Source: Ministry of Foreign Affairs of Japan

Above these Japanese cooperation, Green Aid Plan (GAP) is conducting as the environmental cooperation for industry. GAP launched by the Ministry of Economy, Trade and Industry since 1992.Japan currently implements Model Projects with China, Indonesia, Thailand, and Vietnam, to transfer technologies for environment protection and efficient use of energy.

The China-Japan-Korea Tripartite Environment Ministers Meeting(TEMM) has learned annually since 1999. The environment minister of three countries met in soul in 1999 and agreed to held TEMM for closer cooperation among three nations for sustainable development in Northeast Asia.

At the 1st TEMM, 6 priority areas in environmental cooperation were selected by the tree nations.

1) Improvement of awareness in "environmental community",
2) Vitalization of information exchange,
3) Cooperation in environmental research,
4) Cooperation in environmental industries and technologies,
5) Pursuing measures to prevent air pollution and to protect the marine environment,
6) Addressing global environmental issues.

At the 2nd TEMM, 5 prioritized areas of mutual cooperation among three countries were set.

1) Raising consciousness of the environmental Community,
2) Fresh water(lake) pollution prevention,
3) Land-based marine pollution prevention,
4) Cooperation in the environmental industry,
5) Environmental conservation in Northwest China.

As to the environmental industry, the 1st Roundtable Meeting on Environmental Industry was held in soul in 2001 and discussed the definition and scope of environment industry in each country. The 2nd Roundtable Meeting on Environmental Industry was held in Awaji, Japan in 2002. Chairperson summarizes the result of discussion in the 2nd Roundtable Meeting on Environmental Industry as follows;

1) It is recognized that environmental industry has been rapidly expanding in recent years and that it will be one of the most important industries in the future in China, Korea and Japan.
2) It is acknowledged that the corporate approach to environmental protection is changing from “end-of-pipe” measures to cleaner production and, furthermore, to environmental products and services.
3) It is recognized that government policies have long served as effective incentives for the development of environmental industry. The role of industries themselves is, however, likely to become increasingly important, and further corporate voluntary initiatives and responses to interest from the public are required. Environmental industry will be further developed if industries adapt to social changes in a proactive way and view environmental issues as new business opportunities.
4) It is becoming clear that each country faces different gaps and barriers according to its stage of development. China ’s problems relate to technology diffusion, Korea needs more incentives to induce environmental investment, and Japan needs to improve the cost performance of environmental industry.
5) Consideration should be given to the following three points in entering other countries’ environmental markets:
    i. Putting priority on technology transfer
    ii. Building a good, cooperative partnership with the host country
    iii. Having a long-term perspective

Japan’s environmental ODA is providing cooperation for many environmental areas, as mentioned, technology to prevent pollution, institution building for government, human resource development, providing monitoring equipment. And today, the cooperation was enlarged the stage to discuss the environment industry in the Roundtable Meeting on Environmental Industry. Japan’s ODA will provide the fundamentals of development of environmental industry in future.

4. Possible Impat of Japan’s ODA on Environmental Industry

With rapid industrial development in developing countries, emission of sulfur oxides, nitrogen oxides and carbon dioxide have increased. These emissions causes an acid rain problem and acid rain problems go over the border for a wide area.

The problems of air pollution and water pollution were the problems that Japan faced in the past. Japan's past experiences and know-how in overcoming environment problems will be useful to resolve environmental problems in developing countries. Local governments and private companies in Japan have accumulated know-how. To utilize these experiences, positively, Japan has to provide know-how to developing countries. So Japan's environmental ODA has much priority to the cooperation to industrial pollution control.

Environmental issues in developing countries cannot resolve solely. But most important matter in developing countries is to tackle environmental issues on their own initiative. It is most important that developing countries have self-help efforts to the environmental issues.

Technology transfer of pollution control to developing countries is help their self-help efforts to the environmental issues, and it will support the development of environmental industry in developing countries. Japan's environmental ODA puts priority to combine effective enforcement on regulation and technological and financial cooperation.

In the developing countries, the pollution by private companies is most serious problems. But ODA is a scheme for cooperation government-to-government basis, so it is impossible to assist private companies directly by ODA. The two-step-loan, a modality of Japanese ODA, is available for private companies in developing countries. It will help the development of environmental industry, if private companies be able to get the financial resources by Japan's ODA to buy antipollution equipments. This assistance will bring up the market of environmental industry.

Green Aid Plan (GAP) is also useful cooperation to promote technology and know-how for environment problems in developing countries.   GAP is cooperation in the field of environment and energy, which develop and transfer low-cost and easy handle technologies appropriate to developing countries.

Cleaner production (CP) is listed as useful cooperation for environment issues. CP has been adopted by many donors as environmental management programs in developing countries as a Win-Win approach to industrial environmental management. CP realizes the enhancement of plant production performance and the reduction of environmental loads.

In Japan, JICA is studying the potential problems in CP-related cooperation as follows;

1) Enterprises in developing countries are reluctant to make an investment in pollution control, and also less conscious of production control and environmental management.
2) There are only a limited number of governments and private organizations that provide effective consultation services for industrial environmental management, including enhancement of production performance.
3) Environmental regulations are ineffective to motive enterprises to introduce an environmental management system.
4) Donors are also groping for any effective approaches (including prevention of global warming) other than strengthening of regulations.

The mechanism to promote the CP is not developed yet in developing countries. The biggest problems to promote CP production are the difficulty of communicating information and lack of human resources in developing countries.

JICA proposes following strategic approaches for future cooperation;

- Strategy 1: Changing priority from a regulation- and EOP-oriented approach to a market mechanism- and CP-oriented approach
- Strategy 2: Development of CP promotion policies with emphasis on private sector activities
- Strategy 3: Development of promotion measures interrelated to SME promotion policies
- Strategy 4: Organizing Japanese experiences

Japan’s environmental ODA is contributing environmental issues in many fields in developing countries. These cooperation will provide the fundamentals of development of environment industry in-direct way.

ODA's most important contribution to environment issues is cooperation for human resource development. This will help self-help efforts of developing countries to the environmental issues. By this, the government of developing country is able to develop institution building to tackle with environmental issues and to make effective enforcement of regulation for environment issues. In the case of China, this was done through the cooperation of the Japan-China friendship environmental protection center. Japan-China environmental model city is another way of cooperation. This plan is directly tackle the environmental problems. The combination of two types of cooperation gives positive effects to China.

The effective regulation for environment and its proper implementation is the priming water of development of environmental industry. At this sense, ODA contribute the development environmental industry in directly. If government of developing country earnestly tackles with environment issues under their environment regulation, it will attract foreign companies which has many effective technologies for environmental matters.

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Annex 1

Japan's cooperation by environmental center approach in Asian countries

	Indonesia: The Environmental Management Center (EMC)
Duration of technical cooperation (project-type)	1 January 1993~31 December 1997 1 January 1998~31 March 2000 (extension)
Counterpart institution	Environmental Impact Management Agency
Cooperation objectives	To strengthen capacity of environmental management through environmental research and monitoring activities and information systems in the fields of water pollution, toxic substances and other environmental subjects, and

	environmental training for human resources development in the primarily government organizations concerned, and to improve the quality of environment in the Republic of Indonesia.
Project content	1. Water pollution 2. Air pollution 3. Toxic substances 4. Noise and vibration 5. Information systems 6. Environmental engineering 7. Environmental impact assessment 8. Environmental biology 9. Other environmental subjects (1~3: main fields, 4~9: when required)
Cooperation	Grant aid: Around 2.7 billion in total Technical cooperation (up to FY1998) Long-term experts dispatched: 17 persons Short-term experts dispatched: 40 persons Trainees accepted: 35 persons Provision of equipment: Around ¥320 million
Counterpart country arrangements	Center staff: 94 persons (52 engineers) Center budget (FY1998): 370 million rupiah FY1993-98 cumulative total: Around 4.8 billion rupiah
No. of trainees during cooperation period	303 persons (13 times) (As of the end of August 1999)

	Thailand: The Environmental Research and Training Center (ERTC) Project
Duration of technical cooperation (project-type)	1 April 1990~31 March 1995 1 April 1990~31 March 1997 (extension) Cooperation already completed.
Counterpart institution	Ministry of Science, Technology & Environment (MOSTE) Environmental Research and Training Center (ERTC)
Cooperation objectives	To promote and strengthen research training and monitoring activities in the fields of water pollution, air pollution, noise and vibration, solid waste, toxic substances and so forth in ERTC, and thus to improve the quality of the environment in the Kingdom of Thailand.
Project content	Technology transfer related to research, training and monitoring in the following areas: 1. Water pollution

	2. Air pollution 3. Noise and vibrations 4. Solid waste 5. Toxic substances 6. Environmental administration 7. Environmental impact assessment 8. Environmental data processing 9. Environmental education
Cooperation	Grant aid: Around ¥2.3 billion in total Technical cooperation Long-term expert dispatch: 41 persons Trainees accepted: 33 persons Provision of equipment: Around ¥200 million
Counterpart country arrangements	(As at project completion date) Center staff: Around 70 persons Center budget: 61.50 million bahts
No. of trainees during cooperation period	ERTC trainees: 956 persons Local trainees: 890 persons Training guidance training: Around 150 persons

Section II:
Major Contributions of Japanese Multinational Corporations to Environmental Industry Development in Developing Asian Countries

Introduction

The environmental industry usually means the industry, which contributes to decrease the environmental load by the production of pollution control equipment. But nowadays many companies pay attention to the environmental consideration in their corporate activities including the production process in domestic and abroad. Environmental considerations of Japanese multinational companies in the target countries of this project, China, India, Indonesia and Republic of Korea, are focused as main themes in this part.

Production activities of multinational companies in developing countries have a possibility to improve environmental consciousness of the people and society of developing countries. This will lead same goal for environmental problems as done by the production of pollution control equipment. Also it increases the demands of pollution control equipment. Under this process, the market for the environmental industry will be developed in the developing countries.

1. The development of environmental industry in Japan

Japan has experienced the industrial pollution problems in 1960s, and many Japanese companies were insisted to set up pollution control equipment. In the middle of 1970s, urban pollution problems have emerged, and some companies found this for business chance to utilize the technology and know-how obtained through overcoming industrial pollution, such as waste water management. This is the start point of environmental industry in Japan. In the middle of 1980s, it became to focus on global environmental problems, particularly global warming, and environmental industry experienced new development as the field of efficient use of energy and promotion of recycling business, and so on.

The total amount of environmental equipment production in Japan is 1,690 billion yen in 2001. Water pollution control equipment and waste treatment equipment occupy a major part of the production. The export amount of environmental equipment is 41 billion yen. It is only 2.4% of the total, so the activities of the industry in overseas are not a big scale yet. The East Asia is the biggest export area. Japan exports 200.2 billion yen (49.2% of the export of environmental equipment) in FY 2001. Major export countries are Taiwan (9.8 billion yen, 23.9% of the export), China (5.1 billion yen, 12.4%), USA (2.5 billion yen, 6.0%). Licensing of environmental technology for abroad in FY2001 is 20 cases. It increased 4 cases compared to FY2000. The major licensed countries are Korea (10 cases) and China (5 cases).

The forecast of market size and employment in Japanese environmental industry by the Ministry of Environment is shown in the table 3. The market size of environmental industry in 2020 will increase to 58.4 trillion yen, 2 times of 2000. The employment of environmental industry will increase to 1.2 million people, 1.6 times of 2000. In the trend of strengthening the regulations for solid waste management, the statistic estimates the growth of solid waste management service in the market size and employment. In the case of air pollution control and waste water management, the growth for production of equipments are estimated highly. These are reflecting that some environmental issues needs for development of production of equipments, and others are needed provisions of services. No. 15 of table 3, analytical services, data collection, analysis and assessment, will mean environmental monitoring and analysis. This service estimated steady growth in response to the development of environmental industry.

Table 1: Production of environmental equipment in Japan

(Unit: 100 million yen)

	1980	1985	1990	1995	2000	2001
Air pollution control equipment	1,601	1,477	1,542	3,220	2,612	2,122
Water pollution control equip.	3,521	3,225	3,921	6,140	7,712	6,283
Waste treatment equipment	1,364	1,789	2,322	6,770	6,029	8,389
Noise and vibration control equipment	65	38	65	97	80	103
Total	6,551	6,528	7,850	16,226	16,432	16,897

Source: The Japan Society of Industrial Machinery Manufacturers

Table 2: Export of Environmental Equipment from Japan

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Table 3: Forecast of environmental industry in Japan

	Market size(100 mil.Yen)			Employment (person)		
	2000	2010	2020	2000	2010	2020
Pollution management	95,936	179,432	237,064	296,570	460,479	522,201
Production of equipment, etc.	20,030	54,606	73,168	27,785	61,501	68,684
1.Air pollution control	5,798	31,660	51,694	8,154	39,306	53,579
2.Wastewater management	7,297	14,627	14,728	9,607	13,562	9,696
3.Solid waste management	6,514	7,037	5,329	8,751	6,676	3,646
4.Remediation and clean-up of soil, surface water and groundwater	95	855	855	124	785	551
5.Noise and vibration abatement	94	100	100	168	122	88
6.Environmental monitoring, analysis and assessment	232	327	462	981	1,050	1,124
7.Other	-	-	-	-	-	-
Provision of service	39,513	87,841	126,911	238,989	374,439	433,406
8.Air pollution control	-	-	-	-	-	-
9.Wastewater management	6,792	7,747	7,747	21,970	25,059	25,059
10.Solid waste management	29,134	69,981	105,586	202,607	323,059	374,186
11.Remediation and clean-up of soil, surface water and groundwater	753	4,973	5,918	1,856	4,218	4,169
12.Noise and vibration abatement	-	-	-	-	-	-
13.Environmental R&D	-	-	-	-	-	-
14.Environmental contracting and engineering	-	-	-	-	-	-
15.Analytical services, data collection, analysis and assessment	2,566	3,280	4,371	10,960	14,068	17,617
16.Education, training, information	218	1,341	2,303	1,264	5,548	8,894
17 .Other	50	519	987	332	2,487	3,481
Construction& installation	36,393	36,985	36,985	29,796	24,539	20,111
18.Air pollution control	625	0	0	817	0	0
19.Wastewater management	34,093	35,837	35,837	27,522	23,732	19,469
20.Solid waste management	490	340	340	501	271	203
21.Remediation and clean-up of soil, surface water and groundwater	-	-	-	-	-	-
22.Noise and vibration abatement	1,185	809	809	956	536	439
23.Environmental monitoring, analysis and assessment	-	-	-	-	-	-
24.Othter	-	-	-	-	-	-

Cleaner technology& products	1,742	4,530	6,085	3,108	10,821	13,340
1.Cleaner/resource-efficient technologies and processes	83	1,380	2,677	552	6,762	9,667
2.Cleaner/resouece-efficient products	1,659	3,150	3,408	2,556	4,059	3,673
Resource management	201,765	288,304	340,613	468,917	648,043	700,898
1.Indoor air pollution control	5,665	4,600	4,600	28,890	23,461	23,461
2.Water supply	475	945	1,250	1,040	2,329	2,439
3.Recycled materials	78,778	87,437	94,039	201,691	211,939	219,061
4.Renewable energy plant	1,634	9,293	9,293	5,799	30,449	28,581
5.Heat/energy saving and management	7,274	48,829	78,684	13,061	160,806	231,701
6.Sustainable agriculture and fisheries	-	-	-	-	-	-
7.Sustainable forestry	-	-	-	-	-	-
8.Natural risk management	-	-	-	-	-	-
9.Eco-tourism	-	-	-	-	-	-
10.Other	107,940	137,201	152,747	218,436	219,059	195,655
Total	299,444	472,266	583,762	768,595	1,119,343	1,236,439

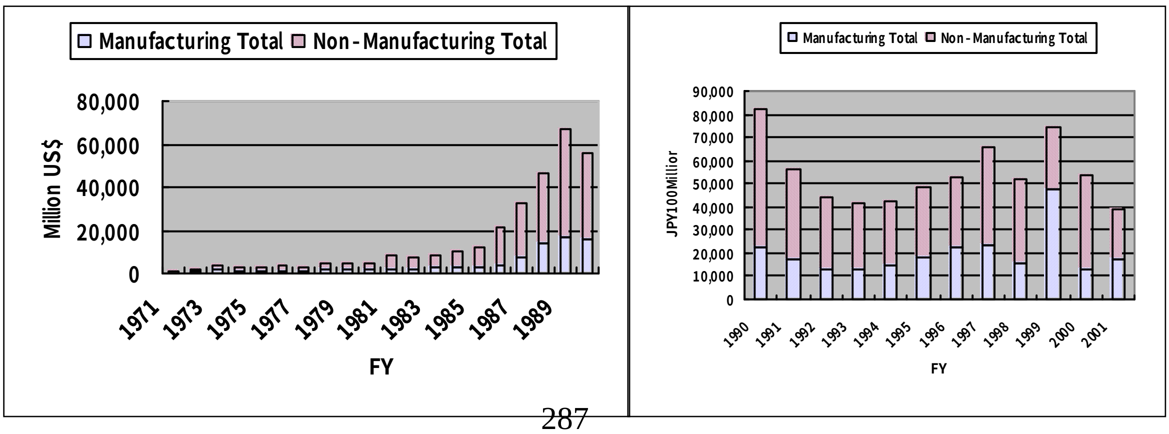
Source: Ministry of Environment, May 29, 2003. Estimation by OECD classification

2. Environmental considerations of Japanese companies in Asian countries and Impact for environmental industry

1) Foreign Direct Investment of Japanese companies

Foreign direct investment (FDI) of Japanese companies increased greatly in 1970s. Many Japanese companies established factories in abroad, especially in the Southeast Asian countries, to keep their international competitiveness under the high appreciation of the yen after Nixon shock in 1971. At that time, there are a few cases which criticism was taken for Japanese companies from the local society because of insufficient environmental consideration in the operation.

Figure 1 Japanese Foreign Direct Investment



Japanese companies' foreign direct investment has been increasing up to now. Especially after Plaza agreement in 1985, the amount and cases of Japanese companies' foreign direct investment increased dramatically and the region also expanded form the Southeast Asian countries to all over the world, especially North America. But Southeast Asian countries still remained major investment area of Japanese manufacturing companies.

Indonesia was the country that was invested the biggest amount of FDI from Japan until the beginning of 1990s. At the beginning of 1990s, China appeared as a main investment country from Japan with her development of market economy. By the statistical data of Japanese foreign direct investment in 2001, 20% of Japanese FDI was directed to Asia (for 33% of Europe and for 20% of North America). For the target countries of this study project, China shares 23% of total Japanese Asian investment, Republic of Korea is 9%, Indonesia is 7%, and India is 2%.

In the operation of Japanese manufacturing companies in foreign countries, especially in developing countries, it often discusses about insufficiency of the environmental consideration in production, and inability of implementation of regulation and rules by local government. If multinational companies make appropriate environmental production system in developing countries under proper environmental administration of local government, environmental consciousness in local society will increase and the opportunity to market formation of environmental industry will be increased. Also local companies have the chance to learn the environmental technology from multinational companies.

2) Japanese companies' environmental consideration in Asian countries

According to "the research report of environmental management of Japanese multinational companies in ASEAN 5 countries (Indonesia, Malaysia, the Philippines, Singapore and Thailand) in 1990" and "the research report of environmental management of multinational companies in ASEAN 5 countries in 1991" published by Japan Overseas Enterprises Association, the following points are listed as the environmental issues of the corporate activities in ASEAN countries (In the survey of 1990, 107 Japanese companies responded for distributed 342 questionnaires. The survey of 1991 was conducted by on-site interviews for 53 companies which are non Japanese multinational companies and local companies.);

The results of 1990 survey (for Japanese companies)

1) Environmental measures: 3/4 of answered companies are conducting environmental measures. In the case of small capital companies fewer than 1 billion yen, there are many cases which are not conducting environmental measures.
2) Main environmental measures; Air pollution control and water pollution control are emphasized. And tree planting around factory and industrial waste disposal are also emphasized. In the Thailand, Indonesia and Singapore, companies are insisted to take measures water pollution control.
3) Main reasons for environmental measures: Companies are conducting environmental measures to cope with environmental laws and regulations and government guidance. Environmental measure is one of the requirements for the approval of foreign investment in Indonesia and Thailand.
4) Environmental standards: many companies answered that they were using the Japanese environmental standards or more strict standards. In Indonesia, many companies are usually using local environmental standards.
5) Problems of environmental measures: The answers indicated the defect of environmental laws and regulations and shortage of local environmental experts.

The results of 1991 survey (for non-Japanese multinational and local companies)

1) Environmental measures: Air pollution control, water pollution control and industrial waste disposal are emphasized in this order.
2) Main reasons for environmental measures: Companies are conducting environmental measures to cope with environmental laws and regulations and requests by inhabitants. Foreign based multinational companies are conducting environmental measures autonomously compared to local companies.
3) Environmental standards: Local companies are using local environmental standards. Multinational companies are using several standards by their own policy, i.e. local environmental standard, the environmental standard of head office and own environmental standard by location. The reason of using own environmental standards in each subsidiary is that the environmental standards of head office is too strict to use in the local production.
4) Problems of environmental measures: The answers indicated the defect of environmental laws and regulations, shortage of local environmental experts and lack of environmental industry.

The indications of 2 years study are as follows;

1) There are not specific differences for environmental measures between Japanese multinational companies and other multinational companies.
2) Environmental legal system and regulatory standards are not sufficient for environmental protection in ASEAN countries. This cause to make light of environmental measures of companies and to increase the investment of "the pollution enterprise" from the foreign countries.
3) Even if the legal system and regulation is well prepared, it is not yet implemented as effectively as desired. The implementation of the laws and regulations may be done arbitrarily in some country; this will reduce the mind of environment measures.
4) The expert of the environmental area is insufficient. A company must expenditure more cost for sufficient environment measures. For instance, implementation system of the industrial waste does not develop to fit the requirements of companies.
5) In the case of above-mentioned 2), many multinational companies use a local environmental standard in their factory, which is looser than their host country.

The environmental measures do not develop well in both area of software (i.e. government administrative system for environment and education system of environmental specialist) and hardware (i.e. pollution control equipment) in the ASEAN countries. Although the environmental measures are needed in the ASEAN countries, it is in the condition that the environmental efforts can’t catch up with the speed of industrialization. Government of ASEAN countries has to do in proceeding with the environmental infrastructure and environmental related law.

Otherwise the next points are being raised as the subjects which enterprises are asked for in the operation in these countries.

1) Foreign multinational enterprises aren't almost using leading environmental technology corresponding to the severe standard of home country in the operation of developing countries. Technology transfers of advanced environmental technology form multinational enterprises are expected in developing countries. But those expectations are not fully done. Multinational companies, which have much capital sources and technological capabilities, should take leadership to cope

with environmental problems.

2) There are differences by the enterprise for their environmental measures. It concerned with "corporate philosophy". Multinational companies are requested their environmental friendly behavior based on the lessons from history of corporate activities.

In the above-mentioned research in 1991, following points are listed as Indonesian findings, the target country of this study project (Research samples are; 3 cases of non-Japanese multinational enterprises and 6 cases of local companies). These findings are pointed out same tendency of the research results of other ASEAN 4 countries.

After the enactment of the environmental management act in 1982, environmental regulations on business operations are strengthening. Foreign companies must to present “company’s policy document for environmental pollution control” with the approval process for foreign direct investment to Indonesia. And also, government of Indonesia requires environmental impact assessment for the project, which has possibility to affect serious impact for the environment.

1) The environmental measures, which has been emphasized: Air pollution control, water pollution control, industrial waste disposal and tree planting around factory.
2) The main reasons for environmental measures: to cope with environmental laws and regulations and government guidance. It is appeared that many companies are tackling with environmental issues in order to meet government request.
3) The problems for environmental measures: The defect of environmental laws and regulations, the difference of environmental standard in the central government, the local government and each ministry and shortage of local environmental experts.
4) Environmental standards: Each company has taken each environmental standard in each country, i.e. local environmental standard, the environmental standard of head office and own environmental standard by location. The reason of using own environmental standard in each subsidiaries is that the environmental standard of head office is too strict to use in the local production.
5) Environment public relations for the local community: Public relations activities are done for the government rather than the local society and people. Local companies are more active for the public relations activities to the government such as “to explain business activities to make good understand for the persons

concerned in government” and “to invite government environmental specialist for seminar in the factory.”

In 1966, 5 years after of the above-mentioned research, Global Environmental Forum published, “Research Report on Trends in Environmental Considerations related to Overseas Activities of Japanese Companies”. The survey by a questionnaire and on-site interviews was conducted in 1965 for the Japanese companies engaged in business in four Asian countries; the Philippines, Thailand, Indonesia and Malaysia. 425 Japanese companies responded for distributed 2,070 questionnaires (the return rate was 20.5%). For the survey in Indonesia, one of the targets countries of this project, the questionnaire was sent to 316 companies, of which 96 responded (30.4% by those in manufacturing).

The main findings of the survey in Indonesia are as follows (the figures in the parentheses show the average of the three Asian countries, the Philippines, Thailand and Malaysia.);

1) Environmental measures before establishing business overseas; the companies legally obliged to carry out environmental assessments accounted for 32.3% (27.7%). But a far larger percentage of 45.8% (46.2%) of all companies responded actually conducted environmental assessments.
2) Environment management policy; the companies have their own environment management policy accounted for 36.5%(32.5%). Half of the response is interesting to set up own corporate environment management policy.
3) Attitudes of companies toward environmental issues; Regarding the expenditures or investments for environmental conservation, 63.6% (77.2%) of those responded was willing to do more than the minimum requirements to satisfy the current regulations. 19.8% (20.7%) of these were willing to bear the necessary cost regardless of the company's business performance.
4) Environmental issues in the operations; 25.0% (27.7%) of companies was to be regulated by local governmental bodies in terms of air and water pollution, etc. 21.9% (21.3%) of companies reported the results of measurements of air and water pollution to the local authorities. 18.8% (19.7%) of the companies have encountered some environmental problems in the operation, including minor ones such as no significant effects outside the company premises. Among the environmental problems encountered, the issue related to discharge of pollutants into water was the highest, accounting for 48.0% (48.6%), followed by issues

related to vibration and noise accounting for 20.0% (10.8%), odors 16.0% (18.9%), and the treatment and disposal of solid waste 12.0% (20.3%). Some companies revealed that they are unable to find proper disposal sites, and kept the solid waste within the premises. In the future, 24.0% (24.3%) of the companies anticipate the possibility of some environmental problems arising. Among the issues anticipated, the issues related to discharge of water pollutants was the highest, accounting for 52.2%(37.5%), followed by treatment and disposal of solid waste 43.5%(56.3%), emission of air pollutants 26.1%(26.3%) and vibration and noise 21.7%(30.0%).

In the findings of survey, Japanese companies are tackling with environmental issues in positive way, although the legal system and regulation for the environment and its implementation system are not sufficient in ASEAN countries. Half of the response conducted environmental assessments and set up their own corporate environment management policy. 75% of the response is willing to invest for environmental conservation more than the minimum requirements to satisfy the current regulations. But many Japanese companies express concern to the environmental problems for issues related to discharge of water pollutants and treatment and disposal of solid waste and emission.

3) Positive step of Japanese industries for environment issues

Nowadays, many Japanese companies take into consideration for environment issues in their foreign investment as a same in domestic activities. As the background of this, it is important following efforts by Japanese companies in the long run.

In 1991, Keidanren (Japan Federation of Economic Organizations) instituted the Keidanren global environment charter. In the charter, Keidanren appealed that "Japan must not rest content with its good record in pollution control thus far. The business world, academic circles, and government must pool their resources to create innovative technologies for preserving the environment, conserving energy, and cutting back on resource consumption. While drawing on the Japanese experience in reconciling economic development with environmental protection, we must actively participate in international environmental undertakings. Concerning such problems as global warming, we should support the efforts on more scientific research into their causes and effects and also begin work immediately on the feasible countermeasures. "

And in the charter, companies operating overseas shall observe the Ten-Points-Environmental Guidelines for the Japanese Enterprises Operating Abroad in Keidanren's Basic Views of the global environment problems(April 1990).

Ten-Points-Environmental Guidelines are as follows;

1) Establish a constructive attitude toward environmental protection and try to raise complete awareness of the issues among those concerned.
2) Make environmental protection a priority at overseas sites and, as a minimum requirement, abide by the environmental standards of the host country. Apply Japanese standards concerning the management of harmful substances.
3) Conduct a full environmental assessment before starting overseas business operations. After the start of activities, try to collect data, and, if necessary, conduct an assessment.
4) Confer fully with the parties concerned at the operational site and cooperate with them in the transfer and local application of environment-related Japanese technologies and know-how.
5) Establish an environmental management system, including the appointment of staff responsible for environmental control. Also, try to improve qualifications for the necessary personnel.
6) Provide the local community with information on environmental measures on a regular basis.
7) Be sure that when environment-related issues arise, efforts are made to prevent them from developing into social and cultural frictions. Deal with them through scientific and rational discussions.
8) Cooperate in the promotion of the host country's scientific and rational environmental measures.
9) Actively publicize, both at home and abroad, the activities of overseas businesses that reflect our activities on the environmental consideration.
10) Ensure that the home offices of the corporations operating overseas understand the importance of the measures for dealing with environmental issues, as they effect their overseas affiliates. The head office must try to establish a support system that can, for instance, send specialists abroad whenever the need arises.

Also, Keidanren declared Keidanren Appeal on Environment, "Declaration on Voluntary Action of Japanese Industry Directed at Conservation of Global Environment in the 21st Century" in 1996. In 1997, following up on this appeal, Keidanren produced the “Keidanren Voluntary Action Plan on the Environment,” a program in which 50 industries currently participate and deal vigorously not only with the problem of global warming but also with waste-related issues. The results of 5th follow-up indicated that CO2 emissions in fiscal 2001 were 483.70 million t-CO2, a 2.9% decrease compared to fiscal 1999 and a 3.2% decrease compared to fiscal 1990.

4) Recent survey results of Japanese companies’ environmental consideration

As for the recent environment behavior of the Japanese enterprise in the foreign countries, ministry of the environment carries out a questionnaire survey regularly.

In "the survey on environment friendly corporate activities in 2001",1,291 listed companies and 2,898 non-listed companies answered for questionnaire. Main findings from questionnaire are as follows (The figures in the parentheses show the answer of the non-listed Japanese companies.);

1) Environmental measures of business activities in developing countries; i) Japanese head quarter is providing environment-related information and environment technological support 39.4%(24.8%), ii) There are not special environment measures in business activities in developing countries 30.6%(39.5%), iii) There is a written corporate management policy or corporate environmental policy for environmental measures in foreign operation 26.1%(18.4%).
2) Disclosure of environmental measures in foreign operation in developing countries; 64.7% of listed Japanese companies answered “no disclosure of their environmental measures."(Non-listed Japanese companies are 74.8%. The figures in the parentheses hereafter show the answer of the non-listed Japanese companies.) 12.0 %(8.2%) of listed Japanese companies answered, " disclosure by the request." Only 15.4 %(4.4%) of listed Japanese companies answered they describe their environmental measures in the environment report. This figure shows that there is a tendency to disclose the environmental measures in foreign activities in their environment report in comparison with 2000 survey result. While Japanese companies’ activities become more global, the company has to disclose environmental measures in foreign operation as well as in Japan.
3) Environmental standards; 74.4 %(61.2%) of listed Japanese companies answered that they has taken local environmental standards. 7.1 %(3.4%) of Japanese

companies have taken environmental standard in Japan. Japanese standard is usually stricter than local standard.

4) The initiative for the environmental matters in the overseas operation (Items only indicated in the 2000 survey): 58.8 %(45.2%) of the answer shows that "the joint venture companies have the initiative of environmental matters." 32.3 %(38.6%) is replied that Japanese head quarter has initiatives for environmental matters. This answer shows that it is in the trend that environment consideration can be enforced in the local judgment.
5) Environmental problems in the operation (2000 survey); 82.9 %(88.8%) of listed Japanese companies answered that they have not experienced environmental problems in their operation. 11.5 %(7.5%) of companies have experienced minor environmental problems.
6) Environmental problems (2000 survey); water pollution issues is the highest for 58.3 %(45.5%), followed by disposal for 27.8 % (18.2 %).

Japanese companies became to put more consciousness for the environment measures in FDI in this decade. In the 1990s, the environmental laws and regulations are not so well arranged in developing countries, and also, the implementation of the laws and regulations are done arbitrarily. These situations reduced the mind for environment measures of multinational companies.

In the middle of 1990s, Japanese companies tried to develop their environmental mind in their foreign manufacturing activities by the leadership of Keidanren. Although the defects of environmental laws and regulations are indicated, Japanese companies made positively environmental measures and environmental assessments in the process of FDI, and also many Japanese companies had their own environmental management policy.

There still remain problems in the field of environmental infrastructure in developing countries. For instance, many companies have worries the treatment of industrial waste. The development of environmental infrastructure is anticipated the support of ODA.

In the 2000s, many Japanese companies are trying to provide environmental technical support and environmental information to the joint venture companies in developing countries. Nowadays, many Japanese companies specify their environmental management policy in the company philosophy.

3. Recent corporate activities' Impacts for environmental industry

Environment industry is a broad meaning and there are various definitions in it. In Japan, environmental Industries are defined as industrial sectors with a potential to help reduce environmental burdens.

In other words, it is the industry to offer following four areas services, 1) equipments to reduce environmental burdens, 2) environment friendly products, 3) services for environment protections, and 4) social environmental infrastructure.

Japan's ODA has been providing the assistance for developing countries in the area of 1) equipments to reduce environmental burdens, 2) services for environment protection, and 3) assistance for building social environmental infrastructure. And in the technical cooperation for developing countries, Japan is cooperating to reinforce environmental institution building of the government in the form of dispatching Japanese experts, accepting trainees from developing countries and providing of environmental equipments. These cooperation means that Japan has provided the equipments for environment preservation and techniques for operation of the equipments.

ODA is the cooperation for government to government, so it does not directly intend to develop private environmental industry. But the establishment of environmental policy and rules of the government in developing country is the key to develop the environmental mind and the environmental industry. The development of government attitude for environment will educate the company's environmental mind.

ODA will contribute construction for good infrastructure for environment and environmental mind of the government in developing countries.

Corporate activities will contribute more directly to reduce the environmental problems. It will be a role of multinational companies to lead their related local companies to the operation for environment friendly in developing countries. Nowadays, many Japanese companies are operating with environmental measures in Asian countries. These corporate attitudes will help to develop environmental minds in local companies.

Although many Japanese companies publish environmental report in these days, there are very few to describe environmental matters in their foreign operation. In the survey in FY2001 of the ministry of environment, the companies which reported their environmental measures in overseas operations in environmental report don't pass 12%. But it increases the tendencies to report the situation of acquisition of ISO14001 at overseas office. In the time of globalization of corporate activities, the company has to disclose their environmental matters of overseas activities in the same way in the domestic.

The companies, which are more sensitive to the environmental matters, have a tendency to act positively to environmental matters in overseas operation and also report their environmental activities in the environmental report.

Following examples are introduction of recent corporate behavior of Japanese companies for environmental issues.

1) Toyota introduced "consolidated environmental management" at all consolidated subsidiaries in Japan and overseas, major production companies, and overseas distributors in FY2000. Consolidated environmental management covers a total of 600 companies. Toyota thus responds to environmental issues on a global scale by enhancing its environmental management system.
2) Honda disclosed data of energy consumption, CO2 emission and waste in Japan and overseas factories in environmental report.
3) NEC has been transferring production technology and know-how related environmental matters to overseas EMS (Electronic Manufacturing Services).
4) Sony introduced the green partner system to promote environmental considerations from the materials procurement stage in 2001. The Green Partner System involves coordinating Sony's efforts with those of business partners who supply components, devices and materials. The Green Partner Standards were established with the aim of taking green procurement to a higher level whereby the demand-side, the Sony Group, and the supply-side, the green partners, work in unison to preserve the environment. This system intends to introduce overseas Sony group.
5) Matsushita Electric group announced new idea for environment protection, namely "greening lighting service". Until now, manufacturers produces and sales their products, and consumer buy and dump out the products after used. In this idea, Matsushita retains the ownership of fluorescent lamps under contract with corporate user, and users buy the only usefulness of fluorescent lamps. So

Matsushita is responsible for collection of the products after the use for the global environment.

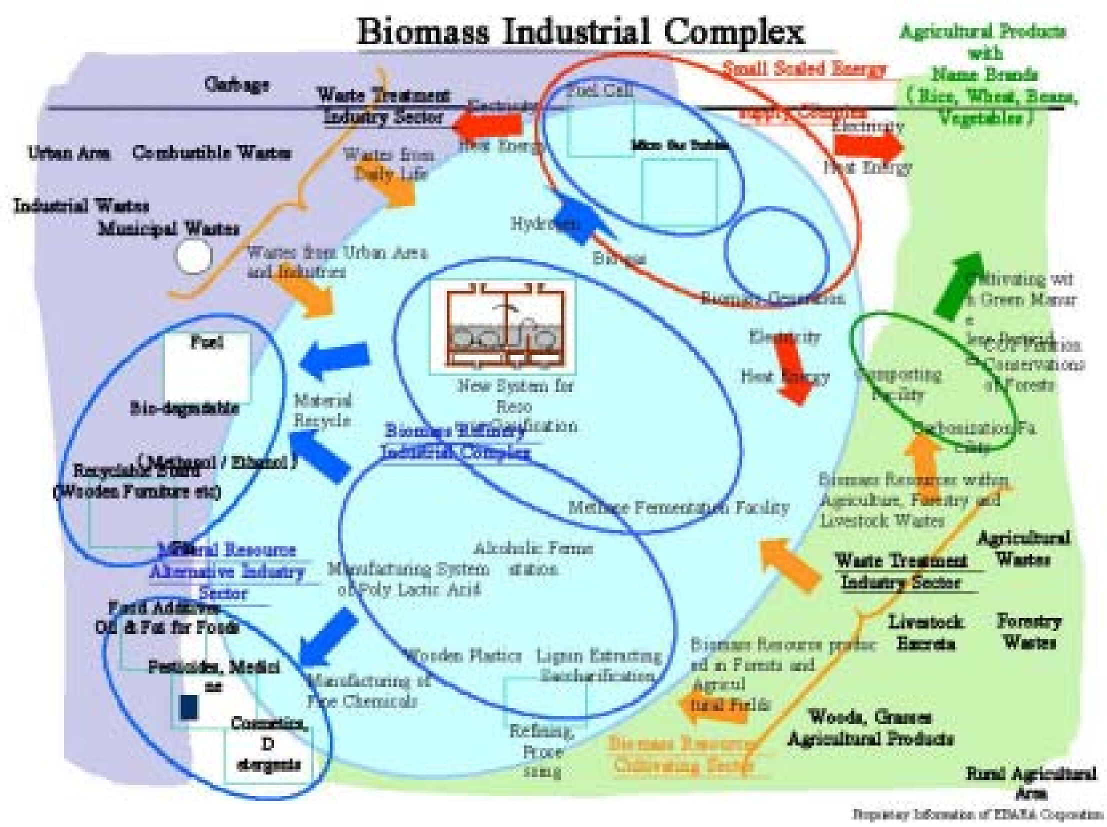
6) Japanese companies programs for CO2 emission: Many Japanese companies are trying to reduce CO2 emission in their operation and also some companies are trying to establish emissions trading in their companies group. Mitsubishi Electric, Asahi Breweries, Kirin Breweries, Sapporo Breweries and Suntory announce officially their target figures for reduction of CO2 emission. Matsushita establishes their in-house system for emissions trading and starts their emissions trading system on a trial basis. Ricoh Company is planning to establish CDM by aforestation up to 2010.

The above mentioned examples are recent Japanese companies' activities to improve environment issues. These corporate behaviors also improve subcontractors' attitude for environment. It seems that consciousness for the environment leads to set up the environmental industry market in developing countries.

Adding to the environmental measures of Japanese manufacturing companies, Japanese engineering companies are strengthening environment business activities. Ebara Corporation, one of Japanese contractor of environmental engineering systems, is focusing in their activities on the realization of the Zero Emission, which is a concept proposed by the United Nations University. Under the Zero Emission concept, EBARA is aiming to create a sustainable society by developing hardware and processes for new recycling, maintenance, and production systems. EBARA is trying to transform the one-way flow of resource consumption and waste into a sustainable circulating flow of resource in their environmental business.

EBARA is proposing to combine biomass and natural energy as future environmental business in developing countries. There is so much renewable biomass energy in Japan. It is equivalent to about 12% of annual primary energy consumption in Japan. The amount of stocks of the biomass energy in the world is presumed to be about 70 times of annual energy consumption of the world. It is expected that biomass energy production in a rural community achieves effective use of agricultural resources. EBARA is conceiving the idea of the biomass industrial complex to industrialize and develop biomass energy. This technology will be useful in developing countries. Also this will lead to further growth of environmental industry in the developing countries. EBARA's biomass industrial complex is shown in figure2.

Figure 2 Biomass Industrial Complex



The environmental consideration of Japanese multinational companies in developing countries will raise the environmental consciousness of local companies. Moreover, local companies will be able to develop their technology for the environment in their subcontract work of Japanese multinational companies. Japan’s ODA offers the basic technology for the environment protection and raises the consciousness for environment in developing countries. And governments of developing countries will get the hands to secure the implementation of environmental restriction. And engineering companies will offer practical technology to protect environment issues. The combination of three actors will lead the development of environmental industry.

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Chapter VII

International Environmental Cooperation between Kitakyushu and Asian Cities: Fostering Environmental Industries

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Summary and Recommendations

Zealous pursuit of economic growth and industrial development in the twentieth century left Kitakyushu with disastrous air pollution and water contamination. To overcome the city's terrible pollution, popular calls for change, spearheaded by women's groups, united citizens, businesses, research institutions and the government. These efforts have met with great success. The city is dedicated to sharing its experience to challenge new environmental problems in Kitakyushu.

To promote the environmental sustainable development, Kitakyushu has actively participated in international environmental cooperation, focusing on Asian countries facing severe environmental pollution over these 20 years. Kitakyushu's technical assistance has received international attention and even awards, including Local Government Honors from the United Nations Conference on Environment and Development, Rio De Janeiro, Brazil in 1992.

1. The partnership between citizens, businesses, research institutions and the government is making a significant contribution to fostering environmental industry in Kitakyushu such as Eco-Town Project. At the same time, Kitakyushu has been utilizing production technology called "Cleaner Production," or simply "CP," which features lower environmental impact and increased production efficiency.
2. Initially, only the transfer of EOP technology to developing countries was emphasized, but it became clear that providing such technology to businesses without adequate financial and production foundations would do nothing to lessen their environmental impact. Therefore, Kitakyushu concluded that the transfer of CP technologies is propitious. The city implemented research on the steel, cement, textile/dyeing, paper/pulp and chemical industries in Japan. The results of this research were reported in "Environmental Protection Production Technology—Cleaner

Production Technology" (published by Daily Industry), the first full-scale publication on CP in Japan. With accumulating knowledge of CP, Kitakyushu is actively engaged in CP transfer to developing countries.

３． The City of Kitakyushu is engaged actively in fostering environmental industry and playing a leading role in this area within Japan.

Kitakyushu devised a strategy relying on three basic points to promote Eco-Town Project started in 1997: "basic research and personnel training," "Applied Research on technology" and "business set-up."

Kitakyushu is promoting international environmental cooperation in each country based on its overcoming experience of pollution and the achievement in environmental industry.

４． Kitakyushu's cooperation with Korea mainly focuses on acceptance of trainees (since 1994), dispatch of technical experts (since1995), holding of seminars and training for municipal workers (since 1997).

A member of OECD, Korea is no longer regarded as a developing country; our relationship with Korea is one of cooperation rather than one of support. To cultivate human resources for medium and small companies, Kitakyushu's trainings are based on the "municipality-to-nation" level while earlier cooperations were based on the "nation-to-nation" model. Trainings include 4 courses such as "Cleaner Production and environmental advanced technology". Additionally, Kitakyushu is contributing to Incheon and other local governments in solving environmental problems, utilizing its knowledge of environmental protection and environmental management. Currently, business exchange between Korea and Kitakyushu is increasing through environmental cooperation.

５． Main contents of environmental cooperation between Dalian, China are holding of seminars (since 1981), acceptance of trainees (since 1990) and support for construction of Dalian Environmental Demonstration Zone (1996-2000). Especially, the preliminary study for the Dalian Environmental Demonstration Zone Project was the first case of a municipal level cooperation leading to national-level cooperation. The model projects are mainly based on Cleaner Production, which will promote CP industry in China in the future.

Cooperation between Chongqing, China and Kitakyushu includes acceptance of trainees (since 2000), acceptance of study missions (in 2000) and holding of seminars (in 2000). Moreover, in 2002, at the request of Japan Bank for International Cooperation (JBIC), Kitakyushu conducted a survey of a "System of Waste Reduction, Appropriate Disposal and Recycling" in Chongqing, based on an agenda formation survey. This would be able to foster resource-oriented society and environmental industries such as solid waste management.

6. Environmental cooperation with Semarang started fully in 1998. Personal exchange between the two cities and partnership between the two local governments resulted in the JICA Development Partnership Program, which funded the Demonstration River Purification Project (2001-2004) to treat waste water from tofu factories. In this project, technology for waste water treatment has been developed in collaboration with local university and materials such as pipes and pumps are procured employing local consultants and executing companies. Accordingly, technology for waste water treatment has been improved, which helps to foster technology suitable to the city.

As for environmental cooperation with Surabaya, Indonesia, Kitakyushu has dispatched experts and held seminars since 1996. In 2003, Kitakyushu conducted a research for reduction of solid waste and establishment of recycling program based on an agenda formation survey, a scheme newly proposed by JBIC. In future, environmental industry would be improved toward resource-oriented society.

7. The goal of inter-city environmental cooperation is to create conditions that foster the growth of environmental industries in place of direct intervention on behalf of such industries Namely, as local government and regional environmental management gain in strength, public awareness of environmental issues grows, creating demand for environmentally-friendly products and services. In that sense, Kitakyushu Initiative for a Cleaner Environment, listed in the Implementation Plan of the World Summit on Sustainable Development held in Johannesburg, South Africa in September 2002, would be a good example.

Additionally, ASPRO(Asian Partnership Programme Towards shared Prosperity), registered on the Promissory Document in the summit, projects to foster environmental cooperation and economic exchange between regions with the goal of developing sustainable communities. Kitakyushu has a long-term dedication to collaborating with other cities to develop the industries of sustainable development.

1. Overview

The City of Kitakyushu actively seeks to assist city and regional administrations in developing nations to improve environmental conditions, taking as a foundation the experience and techniques developed through its own process of environmental recovery. The city’s campaign in international environmental cooperation began after the government of Dalian, China requested lectures on environmental management in 1981, and has since expanded in both content and scope to include several cities in East and South East Asia.

The importance of regional partnerships received emphasis at the Johannesburg Summit, and leaders urged positive action from all stakeholders. From now on, the efforts of citizens and private enterprise—all stakeholders—to improve environmental balance in their regions must receive international support. Kitakyushu intends to move forward with current local policy initiatives and inter-city cooperation projects, promoting environmental-friendly industries to accomplish both environmental and economic goals.

2. Efforts of Kitakyushu

1) Background

Zealous pursuit of economic growth and industrial development in the twentieth century left Kitakyushu with disastrous air pollution and water contamination. Pollution was so bad that it provoked Japan's first air quality alert, and not even bacteria could live in heavily contaminated Dokai Bay. Beginning in the 1960s, popular calls for change, spearheaded by women's groups, resulted in citizens, businesses, research institutions and the government uniting to overcome the city's terrible pollution. These efforts have met with great success. The city is proud of its achievements in environmental recovery and is dedicated to sharing its experience.

While striving to overcome its pollution problems, Kitakyushu began to utilize a production technology called "Cleaner Production," or simply "CP," which features lower environmental impact and increased production efficiency. To promote the environmental sustainable development, Kitakyushu has actively participated in international environmental cooperation, focusing on Asian countries facing severe environmental pollution. These efforts have received international attention and even awards, including Local Government Honors from the United Nations Conference on Environment and Development, Rio De Janeiro, Brazil in 1992 and a Sustainable Development Awards at WWSD, Johannesburg, South Africa in 2002.

2) CP and International Environmental Cooperation in Kitakyushu

Private enterprises have been instrumental in the Kitakyushu's fight against pollution. Together they developed a technology called Cleaner Production, or CP, which combines productivity improvements with improvements in low-pollution production methods. The Pilot Plant Project entails the introduction of CP technology to factories in Dalian and information sharing between private enterprises of both cities with the help of environmental experts from Kitakyushu. Seminars on CP have been held in Dalian and Beijing in the hopes of spreading this technology throughout China.

In 1989, research work on CP implementation was launched under the leadership of the newly founded Kitakyushu International Techno-Cooperative Association (KITA). The results of this research were reported in the "1992 Kitakyushu Industrial Technology Survey," followed by the "Kitakyushu Environmental Technology Survey '98," which focuses on environmental technology. Separately, systematic, in-depth research was implemented on the steel, cement, textile/dyeing, paper/pulp and chemical industries in the rest of Japan. The results of this research were reported in "Environmental Protection Production Technology—Cleaner Production Technology" (published by Daily Industry), the first full-scale publication on CP in Japan.

Building on an increasing public awareness of CP in the Kitakyushu area, the "Japan Cleaner Production Society" was established in May 1998, comprising businesses, the local government, research institutions and NGOs. The activities of this society were guided by three themes, "evaluation and systemization of CP in Kitakyushu," "Examination of the Hibiki CP Plan" and "Kitakyushu Food Self-Sufficiency Plan." The results were reported at the general meeting of the commemorative lecture of the society in 2001.

Initially, only the transfer of EOP technology was emphasized, but it became clear that providing such technology to businesses that lack adequate financial and production foundations is not enough, doing nothing to lessen their environmental impact. Therefore, Kitakyushu concluded that the transfer of CP technologies is most propitious when combined with the strengthening of business foundations. With the understanding of CP implementation in Japan, and the specialized needs of developing environmental industries in other countries in mind, Kitakyushu has began conducting international environmental cooperation.

Major initiatives in China, Indonesia and Korea include:

① Research on Cleaner Production in Dalian Zone Project (China, 1996～1999)
At the request of the Japan International Cooperation Agency (JICA), the feasibility of CP introduction in four major plants (representing the steel, chemical, cement and dyeing industries) was studied.

② Air pollution control support project in developing countries (1995～2002)
At the request of Ministry of the Environment, air pollution control measures for the steel, cement, fertilizing and petrochemical industries are being formulated.

③ River clean-up improvement pilot project in Semarang, Indonesia (2001～2004)

Through a JICA Development Partnership Program, tofu-manufacturing techniques from Japan have been transferred to Semarang as part of CP introduction to improve water quality in that city's rivers.

④ Technical Training programs for small and medium businesses in Korea and short-term dispatch of technical experts (1994〜)

Kitakyushu is operating training programs to increase productivity and advanced environmental technology among small and medium businesses in Korea. Also, at the request of Korean companies, Kitakyushu dispatches technical advisors to take a direct hand in plants.

Kitakyushu's first priority in international environmental cooperation for urban industries in developing countries is the implementation of CP. Where environmental improvement cannot be achieved even with CP introduction, EOP support is provided. A distinctive feature of the Kitakyushu Initiative is that experienced advisors introduce CP techniques.

3) The Kitakyushu Method and the Promotion of Environmental Industry

Kitakyushu devised a strategy relying on three basic points to promote environmental industries: "basic research and personnel training," "Applied Research on technology" and "business set-up." This approach is unique within Japan. The Kitakyushu Science and Research Park, one of the four major projects in the Kitakyushu area, is responsible for the "basic research and personnel training." The Park is founded on cooperation between the city government, the Faculty of International Environmental Engineering at Kitakyushu University, the Science and Technology Research Center of Waseda University, and other academic institutions. "Applied Research" and "business set-up" are conducted through Kitakyushu Eco-Town Project. The Applied Research Area currently has a total of twenty facilities, including research institutions of Fukuoka University, seventeen research facilities working on a wide range of recycling and waste management applications as well as Eco-Town Center, which provides research support and environmental education for the public.

In addition to the Science Park and the Eco-Town project, Kitakyushu also supports the "Comprehensive Environmental Industrial Complex, Hibiki Recycling Area." This area includes comparatively large-scale recycling plants for plastic PET bottles, office equipment, home appliances, fluorescent tubes, medical waste as well as medium and small-scale plants for the processing of cooking oil, organic solvents and waste plastics. Also, in April of 2002, seven separate automobile scrapping companies moved to this location in order to take part in high-efficiency automobile recycling. Waste paper recycling and construction waste recycling projects have been also launched.

Investment in "Applied Research" and "business set-up" was 22.7 billion yen as of the end of 2001, employing 287 researchers among 722 people. More business slated to locate in Kitakyushu will bring these figures to about 42.0 billion yen and 900 positions within two years.

Table: Promotion of Environment-related and Recycling Industries

Industrial Research Area

Technological Research and Testing Area

Basic Research and Personnel Training

Kitakyushu Eco-Town Project

Comprehensive Environmental Industry Complex

Hibiki Recycling Area

Applied Research Area

● Educational Institutions Involved in the Science and Research Park

- The Faculty of International Environmental Engineering at Kitakyushu University (opened in April, 2001)
- Kyushu Institute of Technology. Graduate School, Biological Functions and Engineering Department (established in April, 2000)
- Waseda University, Science and Technology Department, Research Center, Kyushu Research Center (opened in April, 2001)
- Waseda University, Graduate School, Frontier Technology Research Department (expected to open in April, 2003)
- Cranfield University (UK), Japan Center (opened in April, 2001)
- GMD-Japan Research Laboratory (opened in November, 2001)
- Fukuoka Research Center for Recycling Systems (Opened in June, 2001)

Table: Applied Research Area (Development Project)
Research Facilities: 1. Fukuoka University Institute for Recycling and Pollution Control 2. Kitakyushu Eco-Town Center Projects: 1. Waste Re-utilization Development 2. Dome-shaped Disposal Site Development 3. Disposal Site Maintenance 4. Biodegradable Plastics Production 5. Leak-Proof Waste Disposal Site Development 6. Chlorine-Proof Water Isolation Layer Technology Development 7. Waste Recycling Development 8. Exploration of Disposal Site Stabilization Using Molten Slag 9. Waste Concrete Recycling Technology Development 10. Glass Recycling 11. Airborne Ash Neutralization 12. Oil-Contaminated Soil Rehabilitation 13. Recycled Construction Materials Evaluation 14. Increasing the Efficiency of Final Disposal Sites 15. Waste Neutralization Systems Development 16. Tofu Food Refuse Recycling 17. Styrene Foam Recycling

Table: Detail of the Eco-Town Project
●Comprehensive Environmental Industrial Complex Project Recycling Projects: 1. Plastic PET Bottles 2. Office Equipment 3. Automobiles 4. Home Appliances 5. Fluorescent Tubes 6. Medical Waste 7. Mixed Construction Waste ●Hibiki Recycling Area Development Plan 1. Frontier Zone A. Solvent Recycling Project & Recycling Plastic Petroleum Chemicals B. Cooking Oil Recycling Project C. Project for Recycling Zone 2. Automobile Recycling Zone Automobile scraping businesses that were scattered throughout the city moved to this zone and aim at more complete and efficient automobile recycling.

4) Promoting Environmental Business Internationally

The goal of this project is the promotion of environmental industries in developing nations; but in place of direct intervention on behalf of such industries, we encourage using inter-city cooperation to create conditions that foster the growth of environmental industries. Namely, as local government and regional environmental management gain in strength, public awareness of environmental issues grows, creating demand for environmentally-friendly products and services. It is though that such practices among private enterprises in one location will naturally spread to businesses in partner cities.

As an example from this city, the Kitakyushu Interdependent Business Consortium (KICS)—a group comprising over forty environmental consulting, waste-water treatment, air-pollution prevention, environmental monitoring and detoxifying equipment manufacturing, and recycling firms—actively participates in overseas environmental business development. In 2001, KICS and the Dalian Environmental Protection Industry Association established a relationship and agreed to cooperate on business exchanges. Also, from 2000 to 2002, a business mission of KICS members traveled to Dalian and Chongqing to participate in the Chinese International Environmental Protection Exhibition and Conference (CIEPEC), offering technical seminars and business negotiation opportunities that proved very popular. In 2002, KICS and CIEPEC jointly held a seminar on environmental technology. There is every reason to believe that such cooperation projects will continue to grow.

3. Environmental Cooperation between Kitakyushu and Overseas

1) Environmental Cooperation with Korea

For the past few years, Kitakyushu has been engaged in international environmental cooperation with Korea. This cooperation has included the acceptance of Koreans as trainees since 1994, the dispatch of Japanese advisors to Korea since 1995, and the operation of environmentally oriented education programs and seminars for local governments since 1997. In Korea, popular election of local government officials began in 1995, and is now essential in meeting the policy demands of the public. Therefore, Kitakyushu began conducting seminars and educational programs for Korea in order to meet the desire for public servants knowledgeable about environmental issues. The Korean government pays living and travel expenses incurred under the program. These activities have been highly successful and well regarded.

A member of OECD, Korea is no longer regarded as a developing country; our relationship with Korea is one of cooperation rather than one of support. Local governments are actively working on environmental issues, a process which leads to the development of new environmental industries. Furthermore, the human networks formed by this cooperation are expected to foster business interchanges and lead to mutual economic growth.

1)-1 The Acceptance of Trainees and the Dispatch of Advisors

The exchange of Korean trainees and Japanese advisors (retired industrial planners) between Kitakyushu and small and medium Korean businesses began at Korea’s request, Kitakyushu’s industrial infrastructure and know-how being the major drawing points.

While earlier cooperations were based on the “nation-to-nation” model, Kitakyushu’s current relationships are on the “municipality-to-nation” level.

Table: Small-/Mid-Sized Business Technical Training Courses	
1994	(1) Steel Materials Processing and Characteristics (Approximately Two Months) Lectures and practicums on steel manufacturing, casting, rolling, refining, welding, cutting and processing, steel materials testing, steel materials processing and quality control, deterioration countermeasures for steel products, automation, etc. These are conducted in cooperation with fifteen businesses including Sumitomo Kokura Iron Works, Nissan Kyushu Plant. (2) Productivity Improvement Technology (Approximately Two Months) Composed of introductions to productivity, IE, QC, sequence control, plant arrangement, VE, distribution management, progress management, computer-invoking design and manufacturing and study tour, enlisted the help of Takada Manufacturing, Nippon Steel Yahata Iron Works and seventeen other businesses. (3) Industrial waste disposal technology (Approximately One Month) Comprises lectures on recycling technology and study tours of 33 facilities related to resource recovery technology including Kitakyushu Institute of Environmental Sciences and the Engineering Department of Fukuoka University. (Total number of trainees: 29)
1995	Course (1) restructured as Steel Materials and Automation
1996	Course (1) Restructured as Metal Processing and Productivity Improvement
1997	New Course Established: Equipment Maintenance Management Nine trainees were accepted for the seventy-day course providing the technical knowledge and remedial techniques needed for maintenance and management systems. Nishi-Nippon Sugar manufacturing, Dai-ichi High Cycle Manufacturing and seventeen other businesses lent their support to this course.
1999	Course Extensions [Industrial waste disposal technology]: 53 days Others: 73 days

As of 2001, 265 trainees have been accepted into the four courses.

Once introductions to Korean businesses have been made, Kitakyushu sends a research group to discuss the appropriateness of its course with company heads and concerned employees. Advisors dispatched to small and medium businesses in Korea focus on training in productivity improvement at the management and supervisor levels.

Table: Results of dispatch

	Number of Advisors Dispatched	Topics Addressed
1995	6	・Automobile Parts Manufacture ・Manufacture of Die for Automobile Parts ・Precision Molding Design and Manufacture ・Electronic and Electric Parts Manufacture ・Synthetic Rubber Adhesive Manufacture
1996	4	・Pump and Burner Manufacture ・Reduction Equipment Manufacture ・Automobile Parts Manufacture ・Motor and Gear Manufacture
1997	4	・Silicic Acid Soda Manufacture ・Industrial Furnace Design and Manufacture ・Electronic Equipment Parts Manufacture ・Electronic Parts and IC molding Manufacture
1998	5	・Automobile Parts Manufacture ・Silicic Acid Soda and Adhesive Manufacture ・Electronic parts and IC molding Manufacture ・Hydrogen, Carbon Dioxide and Oxygen Manufacture ・Valve Manufacture
1999	6	・Power Distributing Transformer Manufacture ・Molding for Home Appliance and Automobile Parts Manufacture ・Valve Manufacture ・Automobile Parts Manufacture ・IC lead frame and Molding Manufacture ・Satellite Receiver Manufacture
2000	4	・Eject/Radiate Mold/Form Metal Manufacture (schedule

		management) ・Developing and Commercializing Air-pressure Machinery ・Molding Design, Measurement, CAM Work ・Vacuum Molding Manufacture
2001	6	・Molding Manufacture (process management) ・Productivity Improvement ・Floor Space Index Improvement in Warehouse and Inventory Control Facilities ・Factory Arrangement Improvement ・Valve Manufacture Plants (Productivity improvement) ・Centrifugal Pump Impeller Design ・Development and Commercialization of 4/3 Way Valve

Total number of businesses: 36
Total number of advisors dispatched: 35
Total number of training days: 395 (as of 2001)

1)-2 Technical Cooperation with Incheon

The City of Kitakyushu and the City of Incheon concluded a Sister City Pact in 1988. In 1993, the five participating cities in the Pan-Yellow Sea Cities Conference issued a joint statement of support for the "exchange of industrial and environmental protection technology," which led to the Agreement for Cooperation on Industrial Technology.

Table: Technical cooperation with Incheon

Year	Content
1996	Incheon Exchange Project Seminars
1997-1999	An eight-day casting and molding technology training course to improve the manufacturing process and to establish basic knowledge of technological infrastructure in an eight-day course. 1997: 11 trainees in one course 1998: 21 trainees in two courses 1999: 15 trainees in two courses
2000-2001	"Mechatronics" training course for management sections from small and medium businesses, based on the Agreement on Industrial Exchange. Number of trainees: 15 (2000), 13 (2001)
2000	Productivity Improvement Technology/Inverting Control seminars for

	technical managers.
2000	Consultation on environmental problems, environmental training, participation in Pan-Yellow Sea Cities Environmental Protection Seminars.
2001	Technology guidance for small and medium businesses in 3S Electronics, Kyojo ENG, I.H.S. to improve productivity and quality control.

1)-3 Implementation of Environmental Training among Cities

Since 1997, Kitakyushu has been using its experience in environmental protection and environmental management to train civil employees of Korean cities facing severe environmental problems. These weeklong seminars are usually held in Kitakyushu, but financial concerns after the Asian Financial Crisis have forced a few relocations to Korea.

Table: Environmental training for civil employees of Korea

Year	Venue	Participants	Cities Represented
1997	Kitakyushu	18	5
1998	Korea	230	2
1999	Kitakyushu	25	16
2000	Kitakyushu	14	7
2001	Korea	15	16

After the 2001 training session, suggested by the head of Environmental Bureau, research group from the Pohang City Environmental Bureau visited Kitakyushu to study our environmental master plan.

1)-4 Pan-Yellow Sea Environmental Protection Seminars

Several cities from China, Korea and Japan conduct Pan-Yellow Sea Environmental Protection Seminars to develop common understanding of environmental problems in the region. Participating cities include Kitakyushu, Fukuoka and Shimonoseki in Japan, Incheon, Pusan and Ulsan in Korea and Dalian, Qindao, Yantai and Tianjin in China.

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Table: Environmental protection seminars for cities of Pan-Yellow Sea Countries

Year	Venue	Theme
1995	Dalian (China)	Introduction of each city's environmental problems.
1996	Incheon (Korea)	Methods of cooperation in environmental protection.
1998	Shimonoseki (Japan)	Improvement of environmental quality (management industrial wastewater)
2001	Yantai (China)	Cleaner Production

1)-5 Other Exchanges with Korea

In addition to the ongoing activities described above, several other exchanges between Korea and Kitakyushu have taken place. In 1997, "Seminars for Productivity Improvement Technology in Korea" were held in Siheung City. Forty-seven people enrolled in the five-day seminar, including members of management sections, field managers and technical advisors from small and medium businesses. Lectures and panel discussions with themes like, productivity improvement technology, TPM, QC, and etc., were conducted. In 2000, eighteen people from two medium-sized businesses took part in TPM training in Kitakyushu. In the same year, a Korean television broadcasting company making a documentary film on water quality in Masan decided to use Kitakyushu's Dokai Bay as a model for future improvement, and collected footage and materials during a short visit. In 2002, Lee Jung Ju, the president of the Korean Urban Land Management Consortium and nineteen of its other members paid a courtesy call to the Director -General of the Kitakyushu Environmental Bureau to discus possibilities for future cooperation with Kitakyushu and to visit Eco-town. Also, Kitakyushu sent a delegation to the Society of Asian Waste Management Advisors 2002 meeting in Seoul, Korea. Also, Kitakyushu will host the next meeting in 2004.

1)-6 Business Exchange

The number of business links between Japan and South Korea has been on the rise recently. In April 2003, Kitakyushu municipal administration and business representatives participated in the Incheon Environmental Technology Exhibition at the invitation of the City of Incheon, where they introduced local technology. Also, in August 2003, twenty four students enrolled in a public lecture series sponsored by Seoul University Graduate School entitled the "Korean CEO Environmental Business Forum," visited Kitakyushu met with

KICS representatives and made a field visit to Eco-town

2) International Environmental Cooperation with China

2)-1 Environmental Cooperation with Dalian

Kitakyushu's environmental cooperation with Dalian ranges from the seminars held since 1981, to training courses held since 1990, to support for the Dalian Environmental Demonstration Zone Project in 1994-, and beyond. The preliminary study for the Dalian Environmental Demonstration Zone Project was the first case of a municipal level cooperation leading to national-level cooperation as an ODA project. Moreover, JICA (national level) and the Kitakyushu (municipality level) are making use of the ongoing experience in cooperation between the two cities in a cooperative study to decide the future of ODA projects.

In June 2001, Dalian was awarded the United Nations Environment Programme "Global 500" in recognition of the dramatic environmental improvement it achieved. In appreciation for its cooperation in environmental improvement in Dalian, the Chinese national government gave the Mayor of Kitakyushu a National award. Listed below are the City's achievements to date.

2)-1-1 Environmental Seminars

- October, 1981 "Environmental Pollution Control Seminar" (air, water pollution), Dalian
- October, 1993 "Kitakyushu-Dalian Technical Exchange Seminar"(environmental technology, productivity improvement technology, etc.), Dalian
- January, 1995 "Kitakyushu-Dalian Environmental Exchange Seminar" (environmental protection technology), Dalian
- September, 2000 "Environmental Technology Seminar"
  (introducing businesses with environmental protection technology), Kitakyushu
- March, 2001 Seminar on Environmental Exchange between Cities in Japan and China (PR for the achievements through cooperation with Dalian to all over the nation), Beijin
- September, 2002　Environmental Technology Seminar
  (presentation of businesses in Kitakyushu), Dalian

2)-1-2 Training

- 1990～1995 Training for factory managers (1 month, 63 trainees)
- 1993～1997 Training for corporate technical advisors (1 month, 23 trainees)
- 1993～ Training for Environmental Protection Agency workers (1 trainee per year for six months, nine trainees)

2)-1-3 Joint Projects

- 1995～1997 Publication of "Environmental Education Text"
- 1996～1997 Publication of "Glossary of Japanese-Chinese Environmental Terms "
- 1996 Publication of "Manual for Analysis of Water Pollutants"
- 1996～2000 Improvement projects for the combustion of small coal boilers

2)-1-4 Development Study on Dalian Environmental Demonstration Zone Project

Following Kitakyushu's proposal, the Chinese government designated Dalian as an Environmental Demonstration Zone, and gave high priority to the project. The Zone's objectives include establishing Dalian as a pilot city for metropolitan environmental improvement, pursuing environmentally friendly development through the reform of city infrastructure, rationalizing industrial and energy systems, and protecting ecosystems. Dalian expects to implement measures in 2010, in order of priority. Kitakyushu is promoting comprehensive environmental cooperation with China, involving not only the local government, but also businesses and citizens, in cooperation with the state, JICA and other institutions concerned. In order to assist the realization of the Zone, Kitakyushu made a development study and created the master plan for environmental improvement in cooperation with JICA.

<Goals>

- The Creation of an international city featuring sustainable, environmentally-friendly development.
- To achieve environmental standards similar to those of Kitakyushu by 2010

<Content>

- Completion of the ODA preliminary study (December, 1996～March, 2000)
- Setting of Environmental Standards (March, 2000)

<Characteristic>

- The first case in which international cooperation at the municipality has lead to national-level cooperation with ODA.

- JICA (national level) and Kitakyushu (municipal level) are collaborating for the first time in a study to make use of the ongoing experience in cooperation between these two cities.
- Yen loans (total: ￥8.5 billion) are distributed to especially important projects, including the following five.

Table: Yen Loan Projects in Dalian Environmental Demonstration Zone Project

Year	Plant	Project	Amount of money
1999	Dalian Pharmacy Plant	Plant Transfer	￥5.3 billion
	Power Plant in Yandao Chemical Industry Area	Flue Gas Treatment at Thermal Power Plants	
	Chunhai Power Plant	Improvement of Boilers at Thermal Power plants	
2000	Dalian Iron Works	Electric Furnace Pollution Countermeasures	￥3.2 billion
	Dalian Cement Plant	Airborne Dust Countermeasures	

2)-1-5 CP Model Plants Project

This project aimed at dissemination of Cleaner Production technology, or CP technology in Dalian, as well as promotion of technology exchange between Dalian and Kitakyushu. CP technology, which enables both productivity and environmental improvement, has been utilized by many enterprises in Kitakyushu ever since they started tackling with pollution. Company members in Kitakyushu participated in the project as environmental specialists.

Furthermore, CP technology transfer seminars were carried out in Dalian and Beijing to disseminate the project widely in China.

- August, 2001 — The first dispatch of advisors
- October, 2001 — The second dispatch of advisors
- August 2001-February, 2002 — Acceptance of trainees
- September, 2002 — Summary Report
- January, 2003 — CP transfer seminar (Dalian and Beijing)

2)-1-6 Business Exchange

Recently, improvements in the environmental policy in Dalian have triggered a demand for environmentally friendly industries. Relationships between these businesses and Kitakyushu's own environmental industry are expected to form the core of relations between these two cities. A brief history of business exchanges between Kitakyushu and Dalian follows.

Table: Business Exchange with Dalian

January, 2000	Kitakyushu-Dalian Environmental technology Exchange Seminar Nine Kitakyushu businesses participated in this seminar on technology of Dalian Cement, one of the Yen Loan Projects.
September, 2000	The Kitakyushu Environmental Technology Business Party visits to Dalian and Chongqing The party participated in the China International Environmental Protection Exhibition 2000 to introduce Kitakyushu's environmental technology. Seminars on environmental technology in Kitakyushu were also held.
November, 2001	Initiation of ties between the Kitakyushu Interdependent Business Consortium for Sustainable Development (KICS) and Dalian Environmental Protection Industry Association.
September, 2002	Kitakyushu Environmental Business Party Visit to Dalian and Chongqing. Twelve Kitakyushu businesses participated in the China International Environmental Protection Exhibition 2002 to introduce their technology. Seminars on environmental technology in Kitakyushu were also held. (number of inquiries: 288, number of negotiations: 23)

2)-2 Environmental Cooperation with Chongqing

Cooperation with Chongqing started in November 1991 after the Chongqing Economic Reform Committee visited Kitakyushu on a business exchange. Since then, Kitakyushu and Chongqing have worked together on infrastructure projects such as Chongqing's monorail (now under construction with Yen Loan financing). Building on this cooperation, in October 1999 the Chongqing Economic Committee established the Chongqing Technology and Economy Office in Kitakyushu to facilitate closer networking between the two cities. Then, in July 1999 a delegation of municipal environmental officials selected by the Chinese Government visited Kitakyushu to establish environmental cooperation. Agreeing to their request, Kitakyushu launched a formal cooperation in 2000. Moreover, in 2002, at the request of Japan Bank for International Cooperation (JBIC), Kitakyushu conducted a survey of a “System of Waste Reduction, Appropriate Disposal and Recycling” in Chongqing, based on an agenda formation survey. Although the cooperation with Chongqing began so recently, future exchange would be expected.

Efforts to date are outlined below.

2)-2-1 Acceptance of Trainees

- October, 2000 — Acceptance of Chinese Trainees for JICA Technical Cooperation Courses
- December, 2000 — Acceptance of Chinese Trainees for JICA Pollution Management Courses
- December, 2001 — Acceptance of 11 Chongqing Trainees for CP Technology
- May-December, 2002 — Acceptance of 1 Trainee from Chongqing Environment Protection Bureau

2)-2-2 Acceptance of Delegations from Chongqing

- December, 2000 — Acceptance of Chongqing Waste Incinerator Delegation (13 members)

2)-2-3 Seminars

- March, 2001 — Chongqing-Kitakyushu Environmental Seminar (8 Kitakyushu Representatives, 30 Congqing Businesses Representatives)

2)-2-4 JBIC Survey “Establishment of Waste Disposal in Chongqing”

The aim of this project was to cooperate with city residents to design an appropriate waste management system that would see a reduction in waste volume and an increase in recycling volume. In the period from April to December 2002, Kitakyushu conducted five surveys on the condition of Chongqing’s current waste disposal system held seminars both for citizens and the civil administration. An improved waste management system for solid waste reduction and recycling was proposed.

2)-2-5 Business Exchange

- September, 2000 Dispatch of Environmental Technology Business Party (28 members)
- May, 2001 Research on Environmental Industries in Chongqing
  (2 members, research on coal ash and environmental industry)
- January, 2002 Research on Environmental industries in Chongqing
  (5 members, research on coal ash and environmental industries)
- September, 2002 Dispatch of Kitakyushu Environmental Technology Party
- December, 2002 Dispatch of Kitakyushu Environmental Business Party
  (6 booths were made)

2)-2-6 Japan-China Friendship Center for Environmental Conservation

Japan-China Friendship Center for Environmental Conservation is a comprehensive research and administrative institution under the direct control of the National Environmental Protection Agency. It also plays a role as a contact point for international environmental technical cooperation and international exchange. The center was jointly established on May 5th, 1996 by a Japanese government grant of ￥10.5 billion and RMB 66.3 million in Chinese government funding.

In addition to the city-to-city cooperation observed above, the City of Kitakyushu has been dispatching its personnel to the center to implement cooperation with China, taking advantage of its know-how, since the phase Ⅱ in 1996. The center receives technical support from the Japan International Cooperation Agency (JICA). JICA is based on a partnership between the Ministry of the Environment, the Ministry of Economy, Trade and Industry (the former Ministry of International Trade and Industry), local governments and others, and conducts the “Project Type Technical Cooperation,” combinations of dispatch of Japanese experts, the training in Japan of Chinese technical advisors and provision of materials and equipments.

The target of the project itself is “to develop technology for pollution monitoring and control, build information networks, design policy for education and advertisement” and to serve as a “contact point for environmental cooperation projects between Japan and China.” Specifically, members of the project work on ISO14001 and RM manufacturing, establishing acid rain monitoring networks, researching urban air pollution by yellow sand, and on dioxide problems.

Table: Activities of the Japan-China Friendship Center for Environmental Conservation

Period	Context
September, 1992～August, 1995	Construction of Japan-China Friendship Center for Environmental Conservation
February, 1996 ～ January, 2001	Phase II (dispatch of 2 advisors)
April, 2002～	Phase III (one advisor currently dispatched)

An evaluation of Phase II conducted in September, 2002 found that it was both highly effective and visible, and that it could play a leading role in building relationships. In light of the positive outcome of Phase II, it was decided to implement Phase III, and advisors from Kitakyushu are now being dispatched.

3) Environmental Cooperation with Indonesia

Kitakyushu is currently promoting cooperation with Semarang, the provincial capital of Central Java, and Surabaya, the provincial capital of East Java. In 1998, Kitakyushu and Semarang formed the "Environmental Partner Cities" in order to foster environmental cooperation between the two cities. This program helps to develop comprehensive interchange between the cities, including residency exchange, while implementing various environmental projects.

Cooperation with Surabaya, also based on Environmental Cooperation Network of Asian Cities, is being jointly conducted with the same aims as the Semarang cooperation.

3)-1 Semarang

In 1998, Semarang held the "Semarang Conference on Sustainable Development," where the introduction of CP in small and medium businesses and the improvement of citizen participation in environmental management were discussed. Of particular concern in Semarang are the many rivers that have been heavily polluted by wastewater from tofu factories. Conference participants concluded that the best strategy for dealing with this problem would be to start with demonstration projects in small rivers, and then move on to larger ones. Kitakyushu has played an administrative role in this project, dispatching specialists from its Institute of Environmental Sciences and who teach at local institutions to improve Semarang's environmental monitoring capabilities.

Following the Semarang Conference, citizens of Kitakyushu and Semarang have initiated a busy interchange through KITA, various NGOs and their respective local governments. KITA organized a study group for citizens to go to Cebu, Bangkok, and Semarang. During the tour, KITA held environmental seminars in each city to allow for an exchange of opinions between residents of these communities. In Semarang, the final destination of the tour, a seminar for citizens was followed by a conference for the administrative body. Consequently, these activities, including interchange betweens the citizens, cooperation between NGOs and the partnership between the cities have been building up to the present river cleaning demonstration project.

Main Cooperation Activities

1992	Research was conducted on environmental measures suitable for developing countries (JICA Institute for International Cooperation).
August, 1996	Kitakyushu nominated Semarang as an Invited Guest to the World Bank Seminar.
December, 1996	Semarang participated in the World Bank Seminar in Kitakyushu and Penang.
December, 1997	The Director of Semarang Environmental Bureau, also acting mayor, attended the Kitakyushu Conference on Environmental Cooperation Among Asian Cities.
July, 1998	Preliminary survey for the Semarang Conference on Sustainable Development.
October, 1998	Dispatch of a research group from the International Centre for the Study of East Asian Development (ICSEAD) to examine the future policy on international environmental cooperation.
November, 1998	Semarang Conference on Sustainable Development; Kitakyushu dispatched nine advisors from tofu factories. Kitakyushu and Semarang concluded an agreement on environmental improvement cooperation.
November, 1998	KITA organized local environmental seminars for citizens and NGOs.
October, 1999	Kitakyushu invited municipal workers from Semarang, Ho Chiminh City and Surabaya to training seminars on environmental control administration and environmental

	monitoring and analysis supported by the JICA Local Framework Research System
October, 1999	A delegation from Semarang, including the mayor's wife and five NGO representatives, attended the Kitakyushu Citizens-NGO International Environmental Seminar.
October, 1999	Participation in Art and Environment: Drawings by Children of Asian in Kitakyushu.
March, 2000	Kitakyushu dispatched two municipal workers and one KITA staff member to the Semarang Institute of Environmental Sciences for environmental analysis to develop human resources in applying JICA Advisors Dispatch Project with Public Participation.
2001	JICA adopted the Environmental Improvement Project for Demonstration Rivers in Semarang as one of the Development Partnership Programs.

The Tofu Project

In Semarang, there are nearly 300 tofu plants of various sizes, the wastewater from which is a significant source of river pollution. In order to help in the resolution of this problem, Kitakyushu has utilized the JICA Development Partnership Program.

The JICA Development Partnership Program financially supports logistically feasible NGO and local government projects. In 1999, the Demonstration River Purification Project became the first project to be approved for funding by the Partnership Program and was launched the following year. The main purpose of this project was to improve tofu manufacturing processes used in Semarang factories. Kitakyushu's own tofu makers have traveled to Semarang to help in this reform. With the introduction of better productivity in tofu factories, what was once dumped into rivers can be collected and made into food products (okara).

However, even with improvements in manufacturing methods, wastewater is still generated and must eventually be treated. To minimize the amount of pollutants getting into rivers, a wastewater treatment facility is currently being constructed. At this facility wastewater from multiple factories will be purified before being discharged into rivers.

Another important goal of the project has been the establishment of regular monitoring of the health of Semarang's rivers. In order to improve these capacities, Kitakyushu has been improving analysis methods and raising public awareness about the effects of waste dumping in and around rivers. In the future, environmental industries such as consulting on manufacturing technology and wastewater treatment are expected to take off.

3)-2 Surabaya

Kitakyushu' cooperative relationship with Surabaya began in 1996. Since then, they have worked several research studies on waste-related issues.

Main Projects through Cooperation

August, 1996	Kitakyushu nominated Surabaya as a invited guest for a World Bank seminar.
December, 1996	Surabaya attended the EDI/FASID Environmental Seminar in Kitakyushu and Penang.
March, 1997	A research survey on environmental problems in Surabaya was conducted by specialists in Kitakyushu.
July, 1997	KITA dispatched a survey party to develop training courses.
December, 1997	The head of Surabaya Development and Planning Board attended the Kitakyushu Conference on Environmental Cooperation Among Asian Cities. The Environmental Cooperation Network of Asian Cities was established.
October, 1998	Kitakyushu dispatched a survey party from ICSEAD to examine policy on international environmental cooperation.
November, 1998	The Semarang Conference on Sustainable Development was jointly held by Kitakyushu and Semarang. The Deputy Mayor of Surabaya City attended.
October, 1999	Kitakyushu accepted municipal workers and conducted a JICA Government Training Course for Surabayan City officials
October, 1999	Surabaya participated in the Art and Environment: Drawings by Asian Children.
March, 2000	Kitakyushu dispatched specialists in waste disposal, conducting a JICA Advisor Dispatch Project with Public Participation.
November, 2000	Kitakyushu for solid waste management conducted a JICA Government Training Course.

The collection, transport and disposal Surabaya's increasing waste volume are heavy environmental and financial burdens for the city. Moreover, much of the material that enters the waste disposal system could be put to further use. Research has shown that almost half of the total garbage volume in Surabaya is kitchen waste. To reduce the amount of kitchen waste, a compost program will be carried out.

Scavengers represent another important issue that must be taken into consideration in Surabaya. Scavengers make their living by collecting recyclable and reusable materials from dumping sites. Although their efforts comprise a kind of informal recycling market, their working conditions and income are very unstable. Widespread recycling and reductions in waste volume would further jeopardize the livelihood of Scavengers. It is therefore essential that waste management reform efforts also provide for the needs of these citizens.

In the case of Surabaya, current efforts are mainly focused on waste-related issues, but other problems, such as air and water quality, also need attention. Surabaya will need to draw up a master plan for environmental management in the near future. The following are some attributes of this master plan.

As the Surabaya city administration promotes environmental improvement, it will be essential to carry nonofficial influence to foster the environmental industry. Through the implementation of the program, it is expected that demands for environmental businesses such as recycling technology and selling recycled goods will appear.

Currently, thirty percent of the city's total waste collection is outsourced to private sector companies, a figure that should increase in the future.

At present, environmental monitoring in Surabaya is carried out only in limited places. Therefore, environmental monitoring should be expanded in the near future.

4. Review of City-to-City Environmental Cooperation

1) Basic Objectives of Kitakyushu's International Environmental Cooperation

Since 1981, Kitakyushu has taken the initiative in various international cooperation activities in order to make use of the technology and know-how acquired in its own fight to improve the environment, with developing countries. Those activities include acceptance of trainees from overseas, organization of international conference, dispatch of experts, environmental surveys in developing countries, and international environmental consulting activities. In recent years, the demand for international cooperation from cities in Southeast Asia that are facing environmental problems has increased dramatically.

Kitakyushu created the "Kitakyushu Master Plan for International Environmental Cooperation" in January 2000, in order to demonstrate the mid- and long-term perspectives of the desired approach to international environmental cooperation in the 21st century, as well as the means to achieve that objective. The basic concept of the plan is the creation of a sustainable city with limited impact on the environment, and has the following three objectives:

① Contribution to the protection of the global environment (improvement of the environment in developing countries for the protection of the global environment)
② Contribution to the creation of a living-friendly environment (collection and dissemination globally of information of knowledge)
③ Contribution to vitalization of the region (business-based cooperation)

The above objectives represent Kitakyushu's commitment, as a local government, to internationally promoting "Environmental Improvement by Local Communities" in response to increasing demands for ① international cooperation from cities in Southeast Asia that are facing environmental problems ② cooperation based on environmental business to solve worsening environmental issue in Asia, not only volunteer-based cooperation ③ comprehensive cooperation that involves not only technical support for each field, but also know-how concerning operation/maintenance of equipment and planning/enforcement of environmental policy.

2) Outcomes of Inter-city Environmental Cooperation

A large number of cities in Asia faces severe environmental stresses from a variety of origins, including overburden in solid waste management, destruction of biodiversity, and is exposured to hazardous chemicals, due to worsening of air quality, worsening of quality and lessening of amount of water resources, and changes in lifestyles to mass production and mass consumption.

A proper understanding of the state of the environment is the first step for cities to begin to address their own critical issues. This is accomplished by the acceptance of trainees and dispatch of experts, among other activities. Based on fundamental studies, issues to address between discussions with the target city are narrowed down and concrete cooperation projects, such as full-scale studies and seminars, are promoted. Then, as will be indicated, the different methods of environmental cooperation activities are carried out with local governments.

Cooperation with Korea first began in 1994 with training for the private sector in the processing of metal parts and equipment technology, with a direct bearing on improvement in industrial production. One environmental training course on cleaner production (CP) and environmental advanced technology includes training on cleaner production and industrial solid waste management systems. According to a questionnaire from the trainees, evaluated the course highly indicating that they were acquiring skills for difficult technology, as compared to other training courses in industrial production. In addition, the Korean trainees had great interest in Kitakyushu Eco-Town. Korea is looking towards the creation of a resource recycling society; this in particular will necessitate technological demand. In this way, the development of environmental business can be expected.

In the area of capacity building, employees of local governments in Korea participate in fee-based training. This demonstrates the importance of improving the capacity of local governments in environmental improvement and environmental industry.

International environmental cooperation with Dalian has been carried out since 1981. In support of the Dalian Environmental Model Zone, an environmental protection plan was created in March 2000 and a development study was concluded. Contents of the plan include pollution countermeasures for air, water and solid waste, as well as plans for comprehensive urban environmental improvement including industrial relocation. In addition, infrastructure related measures such as dust collectors and measurement analysis machinery, as well as soft measures including improvement of operational and management know-how, restructuring, and capacity building of personnel are also included in the plan. In March 2000, yen-based loans were decided based on the creation of the Japan-China Environmental Development Model City Project.

Cooperation with Dalian that began on a local governmental basis has developed into concrete exchange and cooperation with the private sector. As a result, Dalian was the recipient of the UNEP Global 500 Award in 2001, due to the improvement of its environment.

Cooperation with Chongqing is mainly focused on solid waste management and includes field surveys on the state of the environment and guidance for improvement. In 2002, a feasibility study on the establishment of a solid waste treatment system for Chongqing was carried out under the JBIC scheme. In the final report of the field survey, the following were proposed: (1) Creation of a comprehensive solid waste treatment system; (2) Creation of solid waste reduction and recycling model through public participation; (3) Promotion of special environmental business area in order to create a resource recycling society; and (4) Improvement of environmental governance for the creation of a resource recycling society. In order to implement this plan, cooperation will be promoted through linkages with the local government and the private sector.

With the practical application of the JICA Development Partnership Study, a facility was constructed for the treatment of wastewater from a tofu factory as a model for river pollution prevention. With the employment of local businesses and use of materials that could be procured locally, contributions were made to the cultivation of environmental industries in Semarang. Together with the construction of wastewater treatment facilities, environmental education activities were also carried out to raise awareness of residents on the illegal disposal of waste into the river. River clean-up activities were carried out by local NGOs with tangible results including the posting of signs to stop the illegal disposal of waste and environmental education at local elementary schools.

Field surveys were carried out in Surabaya on solid waste management, a pressing problem in Surabaya. This was conducted making use of the JBIC scheme, similar to Chongqing. The field surveys found that door-to-door collection of waste is carried out, however, pick-up rates are low due to the distance between transfer stations and the final disposal site. As a result, large amounts of waste accumulate at the transfer stations. One cause may be that cost distribution is not appropriate, since cost accounting for solid waste management is not carried out. Other problems facing Surabaya include sanitary management of the final disposal site the necessity of constructing a new final disposal site in a little less than one year in order to accept the maximum permissible limit of waste. The field surveys demonstrated the need for cost accounting and for clear cost distribution, as well as the promotion of separation and recycling in order to reduce waste, considering the local customs and culture.

The outcomes of the field surveys can be linked to infrastructure type projects such as the establishment of a composting center, as well as soft projects including environmental education and public participation to reduce waste.

3) Effects on Environmental Industry through International Environmental Cooperation of Kitakyushu

3)-1 Possible Impacts on Other Nations and Cities through International Cooperation of Kitakyushu

Cooperation between Dalian and Kitakyushu, which has been based on friendly interaction, is the starting point of inter-city cooperation in Kitakyushu. In the development research on the Dalian Environmental Demonstration Zone Project by Kitakyushu and JBIC, the inter-city cooperation developed into the one at a governmental level between China and Japan. The aim of establishing the demonstration zone is to intensively improve environment in the area designated for the zone in Dalian. Therefore, manufacturing methods of representative companies in Dalian were revised from the perspective of Cleaner Technology, which led to the yen loan of 8.5 billion yen. Currently, CP technology is becoming the main stream of production technique. In China, CP Promotion Law has been in effect since January 2003. Kitakyushu is now requested for CP technology seminars and development researches by different cities in China. Environmental industry related to CP in China and Dalian is expected to increasingly thrive in the future.

In Chongqing, domestic solid waste management is becoming an issue along with increasing population and diversification of their life style due to significant development of the city. Also, the city is challenged by industrial solid waste problems, including coal slug, iron and steel slug and coal ash in terms of environmental protection.

To solve these problems, Kitakyushu carried out a research based on proposal to establish solid waste management system in cooperation with Chongqing. This could foster environmental industry that promotes solid waste management and recycle-based society.

In Semarang, Indonesia, as described before, a model project for river pollution caused by waste water from tofu factories is in operation as one of the development partners projects. This project aims at developing technology for waste water treatment jointly with a local university, and procuring materials such as pipes and pumps with local consultants and executing workers. This approach allowed technology for waste water treatment suitable for the local condition. However, it would take longer to evolve into environmental industry since they do not have financial resources enough to disseminate this kind of technology.

3)-2 Possible Effects on Development of Environmental Industry of Kitakyushu through International Environmental Cooperation

In Japan, The Basic Law for Establishing a Recycling-based Society was introduced in 2000 and five more recycling laws were formulated or revised in each material. Based on "Kitakyushu Eco-town Plan" and its implementation plan, approved by Ministry of International Trade and Industry (currently Ministry of Economy, Trade and Industry) in July 1997, the city is developing various kinds of businesses through Kitakyushu Eco-town project with the target year set at 2005. Since Asian countries are having difficulty to secure solid waste disposal sites, as well as Japan, they are greatly interested in recycling of resources.

The City of Kitakyushu, as a pioneering city, has been promoting eco-town project with an ideal to become "international base for resource-oriented society and environmental industry" in Asia as a part of the second-stage eco-town project aiming at 2010.

The following is the outline of the objective.

1. City where environmental industries, including recycling businesses, are accumulated.
2. City where range of research & development and capacity development facility for resource recycling are accumulated.
3. City where local enterprises develop their environmental technology and businesses on a global basis.
4. City as a base for environmental industry aiming at international resource recycling.
5. City that demonstrates the future of urban recycling-oriented system toward Asian countries

As automobile parts for repairs, used paper and waste plastic are internationally distributed, it is hoped that environmental industry in Kitakyushu would be promoted through international environmental cooperation.

4) Roles of Local Governments in Intercity Environmental Cooperation

In the field of environmental international cooperation, needs and assets of intercity environmental cooperation beyond national borders are described as follows.

(1) Improvement of environmental administrative capacity and competence of local governments

Local governments can take an active role in the reduction of environmental pollution and implementation of environmental improvement measures. This is because, in many cases, local governments possess the political will and responsibility for land use, transportation, building, solid waste management, and often energy supply and management. Moreover, local governments can incorporate various policy measures and disseminate information through face-to-face communication and campaigns in order to encourage the independent activities of residents and businesses. That is to say, local governments have know-how to promote general environmental governance of local communities as a core of various partnerships in the local communities.

In the Kitakyushu Initiative for a Cleaner Environment, a program adopted by the Environmental Ministers at Ministerial Conference on Environment and Development 2000, following terms are indicated as policy guidance concerning environmental measures in order to show the local initiative of Kitakyushu itself and the outcome of intercity cooperation.

1. To strengthen local initiatives
2. To enhance partnerships
3. To strengthen environmental management capability at the local level
4. To improve the environmental technology base
5. To promote public and private sector investment in the environment
6. To promote environmental information and education
7. To strengthen international environmental cooperation based on local initiatives

The Kitakyushu Initiative for a Cleaner Environment, endorsed at the September 2000 ESCAP conference on the environment, mandates the achievement of measurable progress towards environmental recovery for signatory cities in the Asia-Pacific region based on the model provided by the pollution control and environmental recovery achievements of Kitakyushu. At present, the Institute for Global Environmental Strategies (IGES) is conducting pilot projects in nine cities including Surabaya (Indonesia), Weihai (China), Ulaanbaatar (Mongolia), Cebu (Philippine), Korat and Nonthaburi (Thailand) at the request of the ESCAP and other organizations.

(2)Ensuring long-term stability in international cooperation through consensus building

When citizen's groups, NGOs, and the private sector carry our international cooperation separately, regional policy needs are not always met and regional administrations often experience difficulty in improving social services. But when consensus on international cooperation projects is reached between cities, substantial environmental improvement based on an over-reaching perspective that takes into consideration environmental conditions and policy needs in developing countries becomes possible. Furthermore, as regional authorities accord a central importance to the environment in their policy-making, long-term stability in environmental policy is assured. This kind of inter-city environmental cooperation encourages openness on environmental problems among citizens and local businesses. This generally increases the ability of municipalities to coordinate environmental policy among stakeholders, which provides a basis for the continuing evolution of environmental policy.

5) Kitakyushu's International Environmental Cooperation Projects

At the Global Conference on Sustainable Development held in Johannesburg, South Africa in September of 2002, all stakeholder groups—citizens, NGOs, corporations, and local governments—committed themselves to concrete action to achieve sustainable development. Furthermore, the Conference adopted the Kitakyushu Initiative for a Cleaner Environment. In Kitakyushu, citizens and business leaders, not just the city administration, realize the necessity of developing sustainable methods. This is to achieved by creating a balanced government and improving regional environmental management policy. To realize these goals Kitakyushu created ASPRO (the Asian Partnership Programme Towards Prosperity). Endorsed in the action plan adopted at the Johannesburg Conference, ASPRO projects cross national borders to foster environmental cooperation and economic exchange between regions with the goal of developing sustainable communities. Kitakyushu has a long-term dedication to collaborating with other cities to develop the industries of sustainable development.

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Chapter VIII

Drivers of Environmental Industry in Asia: Bilateral and Multilateral Cooperation and Multinational Corporations

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Summary and Recommendations

Summary

1. Exogenous and endogenous factors, which include policy, institutional and economic variables, drive the market for Environmental Industries (‘EI”) in the Asia Pacific region.”

2. International agencies and multinational corporations (MNCs) are affected by the exogenous and endogenous conditions, which also include national and international norms and standards and influential environmentally sensitive consumer movements and non-governmental organizations (NGOs).

3. Multinational corporations and local businesses are increasingly motivated by the “triple bottom line of value added: economic (profits), ecological and social,” which includes combating poverty through and with the market. Social and environmental responsibility is increasingly considered as good business.

4. Most recent data indicate that thousands of Asian companies (including in China, India, Indonesia and Korea) have adopted the ISO 14001,a standard that assesses the ability of companies to comply with environmental law and to manage environmental effects and risks of their operations.

5. More than 1000 Chinese companies have the ISO certification, many of which are joint ventures. This compares with 199 in Indonesia, 9,467 in Japan, 552 in Thailand, 333 in Singapore, 367 in Malaysia and 120 in the Philippines[1].

6. Socially and environmentally responsible Investment Funds could be a significant source to help finance the tens of billions of dollars required per year to grow EI in the Asia-Pacific Region. Korea is actively engaged in attracting and developing socially responsible investment in Asia (outside Japan), including development of a socially responsible investing index. Moreover, major Korean companies are making special efforts to be "first movers" in their industries to attract foreign investment.

7. Overall, however, in Asia socially responsible investment is still at an incipient stage, with only about US 1 billion committed for this purpose while globally the industry has US$2.4 trillion in assets. Australia and Japan are the most advanced in the region, with US$8.9 billion and US$599 million, respectively. On the other hand, in addition to the Islamic funds of Malaysia and Indonesia, Singapore, Hong Kong, Malaysia and India have one or two registered domestic funds while Thailand, Indonesia, the Philippines and China have none.

8. International agencies have been impacted by the Multilateral Environmental Agreements (MEAs) and have contributed to disseminating energy efficient standards and technologies, including energy efficient light bulbs for public and private lighting, low emission engines, and to a more limited extent renewable energy. Energy efficient standards for refrigeration (compressors) and the electronic industry, and capacity development have also benefited from interventions by international agencies.

9. The contributions of MNCs have been significant, and their role is expanding because of the growing demand for increasingly sophisticated and advanced environmental technology and engineering/consultancy services not yet available

[1] This data and related information about socially responsible investing and managed investment funds is revealed in a recent report prepared by the Hong Kong based Association for Sustainable and Responsible Investment in Asia (ASRIA), with the support from the IFC (Wall Street Journal October 29th, 2003.)

in the four countries, as well as the need to mobilize significant direct foreign investment for the EI industry.

10. MNCs, especially Shell and BP in China, have focused on transforming “dirty coal” into synthetic gas and to support development of hydrogen-based industries.

11. MNCs contribute to EI through wholly owned companies, joint ventures (including public-private partnerships), and through subcontracting and licensing of transfer of technology to national conglomerates or large public enterprises

12. More efficient conditions for MNCs to enter the EI market will be facilitated through filling gaps in regulatory frameworks and performance - based standards and through economic and fiscal incentives and streamlined institutional arrangements.

13. Developing countries, especially in Latin America, could benefit from the experience of the rapid growth of E I in the Asia Pacific region. It seems that opportunities exist for joint ventures between Asian and Latin American entrepreneurs and public-private partnership from countries such as Brazil, Chile, Costa Rica and Mexico.

14. Within the framework of the North East Asia environmental collaboration, trilateral (China, Korea and Japan), ministerial meetings take place annually to address issues of common interest. Working teams meet between the ministerial sessions to study specific topics for consideration by the ministers.

Recommendations [2]

Recommendations that require national action include:

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[2] The recommendations listed in this section require immediate action. However, such as R&D, capacity development, and establishment of credible databases and information systems will require longer time frames.

15. Consistent and focused policy in negotiating with international agencies and MNCs in order to optimize their contributions to growing EI. Minimal, simple guidelines, reflecting national policy and international conditions, might be useful..

16. Expand awareness among influential consumer movements and NGOs about EI, and mobilize their support for its development.

17. Motivate national companies to become ISO certified and provide rewards to them.

18. Adopt policies to promote the establishment of national socially and environmentally responsible investment funds, as an instrument to attract financing for EI. Asian, especially Korean, and other experiences could be drawn upon. A system of incentives should be consolidated to enable major national companies to attract DFI.

19. Islamic funds, where they exist, should be encouraged to expand their support to EI.

20. Directed R&D should be actively pursued, especially in areas such as: synthetic gas, renewable energy, low emission vehicles and engines, fuel cells and hydrogen-based industries.

21. Create more efficient conditions to facilitate entry by MNCs into the EI market.

Recommendations that require international actions include:

22. International agencies and major bilateral donors should adopt explicit policies in support of EI through their funded programs and lending activities.

23. MNCs, including corporate financial institutions, should promote investment in Asia by global socially and environmentally responsible investment funds. They should also participate with capital and technical know-how to develop and manage national similar investment funds.

24. MNCs should expand active participation in directed R&D.

25. Promote international environmental standards for major industrial sectors and corporate environmental management systems for MNCs.

26. Standardize consistent and comparable internal reporting by MNCs and national corporations about their sustainability performance. (About 50 WBCSD members do it already).

27. Expand ratings of MNCs and national companies based on their sustainability performance.

28. Working teams of the Trilateral Ministerial arrangements could, with support of IGES, explore specific follow-up to recommendations derived from this study with regard to E I implications for developing countries outside the region. The initial focus could be on select countries in Latin America and in the Asia Pacific region.

29. Similar follow-up explorations could be made through arrangements within ASEAN and SARC (South Asian Association for Regional Cooperation) framework.

1. Introduction

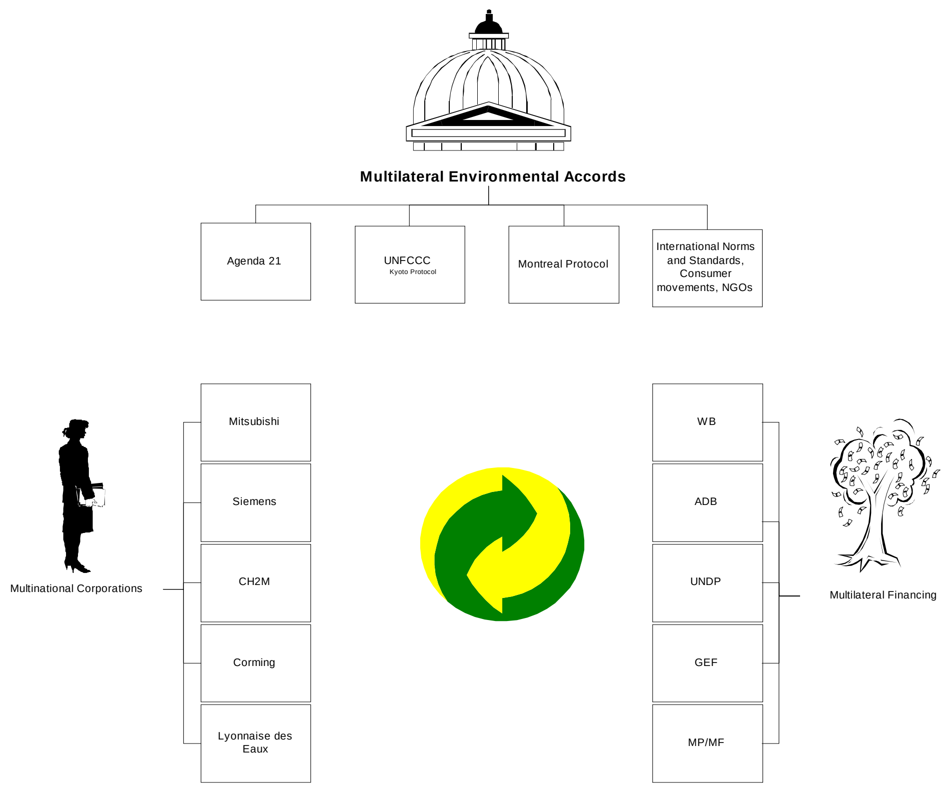
1. The paper focuses on the Environmental Industry (EI) in four selected countries of the Asia Pacific Region. The countries selected by IGES are: China, India, Indonesia and Korea
2. As defined by IGES, the paper outlines and assesses the contributions to EI by international organizations and major donors and by multinational corporations (MNCs). EI refers to:
   -Environmental management systems and reporting at corporate level,
   -Environmental technology and processes (software), and
   -Environmental products, equipment and instruments (hardware).

3. All the above-mentioned three categories are applied to three environmental market segments: air, water, and soil pollution, including industrial waste processing and disposal.
4. EI in the Asia Pacific region, and especially in the four pilot countries, which represent a wide range of social, political, economic and ecological conditions, is critical to sustainable development and to enabling nations to attain the Millennium Development Goals (MDGs) and to realize the Johannesburg Plan of Implementation by 2015
5. How the external factors-international agencies and MNCs-drive the EI markets is the focus of the paper, which concludes that their contributions are and will continue to be strategically significant. However, their role is assessed in the context of domestic policies and institutions that facilitate or impede the effective contribution by international agencies and MNCs to growing EI.
6. Structurally, the paper consists of an Introduction, Major Findings and Recommendations, a chapter on What Drives the Markets for Environmental Industry, four country chapters, Bibliography, and an Annex.
7. The information and data used are derived from hard cover publications, electronic/website reports and data available at no cost, and personal communications. Proprietary reports and information have also been identified during the research but have not been accessed and/or obtained due to significant costs involved.
8. Methodological issues exist with respect to projected investment and/or market value of EI in the four pilot countries based on the data examined. Classification and definition of environmental market segments and of the environmental technologies and services differ from country to country and even within countries. Likewise, the base years for which data is available vary. However, these elements do not affect the thrust of the analysis and the major conclusions and recommendations.
9. Lastly, the paper has benefited from the discussion at IGES on 14 and 15 of June 2003, especially the specific suggestions by Professor R. Hirono, and has been informed by the individual country papers.

2. What Drives the Markets for Environmental Industry

1) Basic Conditions and Analytical Framework

10. The market for Environmental Industries ("EI") is driven by exogenous and endogenous factors, which include policy, institutional and economic variables. They also include expanding national and international norms and standards and increasingly influential environmentally sensitive consumer movements and non-governmental organizations. International agencies and multinational corporations are affected by these exogenous and endogenous conditions. International agencies and multinational corporations, as well as smaller companies, are critical and strategic contributors to the development of EI in the Asia Pacific region for the domestic and export markets.



Exogenous Factors

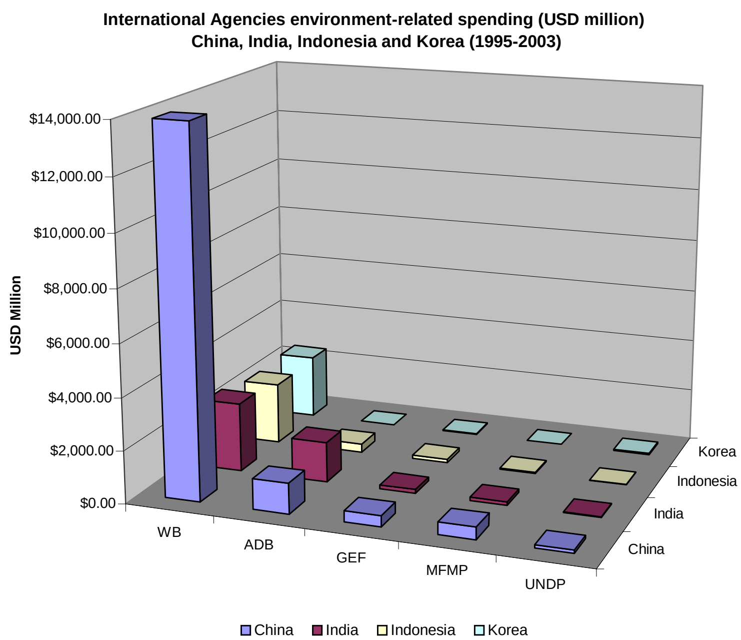
11. As the analysis of the four pilot countries indicates, there is a substantial but differentiated market for EI to address the growing needs of air pollution prevention and control, water pollution prevention and control, water conservation and agriculture, solid waste treatment and management, and environmental technology and management systems and services at the enterprise and corporate levels. More emphasis will be placed in the future on pollution prevention or reduction, waste minimization, including waste to energy reuse and biofuel, recycling and energy and raw materials recovery, technology and environmental engineering, and management systems rather than on end of pipeline processes and products.
12. “Early movers” gain comparative advantage by anticipating demand for environmental engineering and management services, including certification, eco-labeling, environmental audit, environmental impact assessment, environmental technology and processes, as well as products and instruments for cleaner and more efficient production and monitoring of performance. It also enables them to create a new market niche that is profitable and responsive to a “value driven demand” by consumer movements for green products, and to national policies that aim to develop the environmental industry as a strategic export industry by supporting environmental start-ups.

2) International Agencies

13. Multilateral Environmental Agreements (“MEAs) such as the United Nations Framework Convention on Climate Change (UNFCCC), including Clean Development Mechanism (CDM) of the Kyoto Protocol, the Montreal Protocol to Phase Out Ozone Depleting Substances (CFCs) and Agenda 21 adopted at the Earth Summit, constitute international policy instruments that have impacted positively on environmental lending (including soft loans and grants) and technical cooperation activities of the WB/IFC Group, the Asian Development Bank and UNDP. EI will be promoted through the potential financial and technological benefits offered by CDM. However, to optimize this potential, it is necessary to understand CDM “deal-making” among investors, entrepreneurs and government authorities. Moreover, it would be facilitated by governments creating a “one-stop-shop” for the CDM deal-

making process.[3] The Environmental Engineering and Technology Development Program of the G-7 has also contributed in some of the countries. Chart 1 reveals the direct financial contributions, which are only a partial indication of the total strategic and catalytic impact on EI, by these international funding instruments and agencies.

Chart 1: International Agencies environment-related spending (USD million) in China, India, Indonesia and Korea in 1995-2003



Charts 2, 3, 4, 5, and 6 (in the Annex) provide a detailed breakdown of funding by the WB, ADB, UNDP, GEF, and MFMP.

14. The GEF and MFMP are two multilateral environmental finding instruments contributing directly to EI, especially in the area related to climate change. Likewise, the MEAs establish the principle for transfer of environmental technologies to developing countries. More recently, the Millennium Development Goals (MDGs), and especially the World Summit on Sustainable Development (WSSD), established

[3] The scale of the business opportunities for EI and sustainable development is suggested by the World Bank's estimates of a carbon market of up to USD4.5 billion per year during the first commitment period in 2008-2012 (Lecocq and Crassous, 2003)

targets for water supply and sanitation and for expanded use of renewable energy and energy efficiency, which will have a significant impact on EI. Increasingly, multilateral trade agreements (WTO) and bilateral (Singapore-U.S.) or regional commercial agreements address environmental issues related to the products traded within the framework of such accords and affect market access. Korea's membership in the OECD has also contributed to EI development in the country.

15. Industrial and population growth, expanded urbanization and increased influence of civil society, and NGOs and consumer organizations in the four countries, combined with the impact of the exogenous policy and the multilateral environmental financing instruments, are creating an ever-expanding set of national environmental policies and performance-based standards and norms. Economic and fiscal incentives (especially in China, India and Korea) and opening of environmental infrastructure to private initiatives and public-private partnerships (PPP) are increasingly complementing the regulatory framework and the command and control systems. These endogenous factors affect the demand for environmental technologies and services, thus contribute to expansion of EI for both the domestic and external markets. Effective application, enforcement and monitoring of the environmental policies and regulations by state and local agencies also impacts on the EI since it transforms potential demand into effective, real demand.

16. National commitment to environmental performance–based standards is also reinforced by sub-regional cooperation. For example, since September 1992, Korea and others have championed environmental cooperation in Northeast Asia. This sub-regional cooperation focuses on monitoring and combating acid rain, which in turn creates effective demand for relevant equipment and technology. The need to meet European Union environmental standards for vehicles, (Euro I and II), and other products, also provides incentives to produce products for the European markets compatible with such standards. OECD environmental requirements regarding toxic substances have caused Korea to establish specialized databases such as the Toxics Release Inventory (TRI) Program.

17. Conditions for EI growth and for an expanded role by multilateral agencies, major donors and especially multinational corporations are created by:

    - Interaction between the mandates of international agencies and international norms and standards, corporate international standards of MNCs and the imperatives of access to markets and avoiding barriers related to the environment, on the one hand, and

- Greater awareness by the population of environmental problems and growing influence of "green consumer" movements, the commitments assumed by the countries within the framework of MEAs and other relevant accords, and the economic and fiscal incentives, on the other hand.

18. Moreover, national authorities are increasingly aware of the damage to the economy due to environmental degradation ranging between two to four percent of annual losses in GDP. Expansion of EI is accelerated by a realization by governments of the need to avoid trade barriers related to environmental issues and a potential loss of export markets for manufactured and agricultural goods and commodities, and of environmental products and services. This also creates conditions for gaining comparative advantage and profitability for EI.

3) Multinational Corporations (MNCs)

19. Turning now to the role of multinational corporations and smaller and medium size foreign companies, the evidence suggests that their contributions are significant. In fact, their role is expanding because of the growing demand for increasingly sophisticated and advanced environmental technology and engineering/consultancy services not available yet in the four countries.
20. The contributions to EI of the MNCs come through wholly owned companies, joint ventures (including public-private partnerships), and through sub-contracting and transfer of technology (licensing) to national conglomerates or large public enterprises. Subcontracting and licensing are especially prevalent in Korea, while China and India are encouraging joint ventures (see Table 1). MNCs and large corporations from Japan, the US, Germany, France and the UK are the major actors, with Denmark (wind energy), the Netherlands and Israel (irrigation and water conservation) also active. MNCs with international corporate policies and standards who are also active members of trade and related associations such as, for example, the World Business Council for Sustainable Development (WBCSD), impact on the growth of EI. Such corporations with plants and companies in the four pilot countries include, for example, BP, Shell, Rio Tinto, Corning, Nestle and CH2MHill. Three cases from China, India and Korea presented below are illustrative of the above.

21. Applying NEMS[4] to a specific factory in Nanjangud, India has reduced, over a three year period, water consumption per ton of product by 29 percent and waste water generation by 46 percent, with all the treated waste water used for irrigation. Similarly, plants located in areas with limited water supply of low quality (and in some cases salty), the raw water is treated and some of it is reused and recycled. The sophisticated technology process to treat the raw water includes: silica removal, flocculation and coagulation, cold lime softening, clarification, sand filtering, reverse osmosis with high recovery and demineralization.
22. CH2MHill through its operations in China, India and Korea contributes to promoting environmental management systems consistent with ISO standards at the corporate level of multinationals such as GE, General Motors, ICI, Elf Atochem, IBM, Motorola, Dole and others through a wide range of engineering/consultancy environmental services. It also impacts domestic large corporations such as Shanghai Electricity Meter Works involved in joint ventures with multinationals or by providing direct services to, for example, a ceramic insulation production facility and coal gasification plant in Shandong Province.
23. Moreover, it serves as a conduit to transfer technology and processes related to air quality and emission inventory assessment, energy management, transformation of organic waste to energy through bioreactor technology for managing organic solid waste, pollution prevention including reuse, recycling and material substitution, industrial water supply and treatment, and solid and hazardous waste management. More broadly, companies such as CH2MHill contribute to the development of the environmental engineering consulting industry, which is given high priority in the four pilot countries. Environmental engineering consulting companies need to be able to provide services in the various areas for which high market demand is anticipated. (see Table 2)
24. Corning (Shanghai) is a wholly owned foreign company in China, which belongs to the Environmental Products Division of Corning Incorporated (the multinational

[4] The Nestle Environmental Management System (NEMS) is an example of corporate policy that relies on action programs at global and local levels. Consequently, all manufacturing sites are required to report performance results annually on the basis of a series of environmental performance indicators (EPIs), which are consistent with the international standard of ISO 14031. EPIs cover internal manufacturing operations worldwide and measure both process inputs and outputs, including water consumption and wastewater generation.

corporation). Corning (Shanghai) illustrates what drives the markets for EI and how exogenous (international) and endogenous (national) economic and policy/institutional factors combine to develop and grow the environmental technology industry, especially products (hardware).. Corning supplies advanced materials and technologies, including clean air products such as catalytic converters, which require cellular ceramic substrates[5].

25. Corning anticipates growing demand for catalytic converters because China already adopted the EURO I standard for vehicle emissions, which is the driving force in creating a market for catalytic converters in the country. Ultimately, Corning expects that at least 20 percent of its Shanghai production will be for the national market, compared to only 5 percent currently, and 80 percent for export. Eighty five percent of the total export from Corning Shanghai now goes to Korea, which previously received its products from Corning plants in Germany and the US, with the remainder targeted for Japan, India and Malaysia. Effective demand for catalytic converters in China will also be affected by a significant increase in vehicles and by more effective enforcement of compliance in the rural areas.
26. Overall, the exports of environmental equipment to the Asia Pacific countries (excluding China) indicate the contributions to EI by MNCs and their countries of origin. Recent reports reveal that Japan and the U.S. control over 60% of the environmental equipment exports to the countries of the U.S-Asia Environmental Partnership, with Japan being the dominant player (US-AEP)[6]. Japan, U.S. and Germany account for US$87 billion of the total exports in the U.S.-AEP countries for the period 1995 - 1999. Currently, only U.S., Korea and Austria show growth of exports to the US-AEP countries.

[5] Catalytic converters convert noxious exhaust gases to water vapor and harmless gasses. Other environmental products include particulate filters for diesel engines, industrial control systems and ceramic membrane liquid filters.

[6] U.S.-AEP countries are: Hong Kong, Indonesia, India, Korea, Sri Lanka, Malaysia, Philippines, Singapore, Taiwan, Thailand, Vietnam and the U.S.

3. China

1) An Overview

27. China constitutes one of the largest markets for EI, as well as the fastest growing. Contributions by the international agencies and by the MNCs have been significant and are expanding. The World Bank, the Asian Development Bank (ADB), GEF, MFMP and UNDP are active contributors. However, in China it is especially important to distinguish between effective, real demand and the enormous magnitude of the potential demand, which is linked directly to the economic and financial capacity of the business enterprises and the local governments. Furthermore, the ability of China to produce advanced environmental products, technologies and engineering/consulting services will also impact on the real domestic and export demand which are to some extent interdependent.
28. The 10th Five-Year Plan (2001-2005) establishes for the first time a plan for the environment technology industry (ETI) in order to reverse the severe environmental degradation that has taken place during the accelerated economic and industrial growth in recent decades. Accordingly, the government estimates that to meet the environmental objectives of the 10th Five-Year Plan will require a total investment of US$85 billion (RMB 700 billion) which amounts to 1.3 percent of the GDP, assuming annual growth of 7.5% for the five-year period. China is giving high priority to EI and considers it a strategic component required to sustain high exports and 7.5 percent of overall economic growth annually.
29. According to the Chinese Research Academy for Environmental Sciences (CRAES), the three main domestic sources that will fund the required investment are: business enterprises (55 percent), provincial and local governments (34 percent), and the central government (11 percent). US$4 billion (RMB33 billion) will be mobilized from international financial institutions and major bilateral donors. It is assumed that MNCs will make significant contributions to projects undertaken by business enterprises and provincial and local governments through direct foreign investment, joint ventures, and public-private partnerships.
30. Because of a public shift in the late 1990s to “greener” economic growth policy, including substantial improvement of indoor air quality, the market for environmental products, technology and services outperformed other industries. EI has grown between 15 and 20 percent annually during the 9th Five-Year Plan (1996-

2000). A target of the 10th Five-Year Plan is to reduce overall pollution levels by 10 percent by 2005 as compared to 2000. Furthermore, a larger number of environmental national laws, standards and regulations have been issued in recent years, which are complemented by more than 900 environmental regulations that exist at the local level as of early 2002.

31. The magnitude of the anticipated growth of EI is also illustrated by the major financing allocated in the 10th Five-Year Plan, and by some of the projects related to the 2008 Olympics, which offer unique opportunities for contributions by MNCs.

2) Selected areas of EI future Business Opportunities for MNCs in China

32. According to the Chinese Research Academy for Environmental Sciences (CRAES) report**,** under the 10th Five-Year Plan (2001-2005), major projects are being financed (see Table 3). The following is the list of projects that will be carried out in preparation for the 2008 Beijing Olympic Games: Increase of natural gas consumption to 1.8 billion m^3 by the end of 2002; build twelve sewage plants; within the 10th Five-Year Plan, the Beijing Municipality expects to spend RMB 45 billion in the environmental sector; by 2007, 8,000 buses and 40,000 cabs in Beijing will be fuelled by green energy, respectively 90% and 70% of the total number of vehicles. *(Source: People's Daily 22/02/2002)*

33. Based on China's environmental priorities of water and air quality and waste management, the Tenth Five Year Plan specifies11 programs, which should be completed. (Table 4)

34. To facilitate implementation of the ETI, the State Economic and Trade Commission and State Taxation Administration jointly issued in March 2000 the Directory of Environmental Industry Products Being Encouraged at the Current Stage by the State. The Directory includes 8 categories of environmental industrial products.[7] (see also Table 5)

[7] 1) Water pollution treatment; 2) Air pollution control; 3) Solid waste recycling and disposal; 4) Noise pollution control; 5) Environmental monitoring instruments; 6) Energy saving and renewable energy resources; 7) Cleaner production and comprehensive resource utilization; and 8) Environmentally sound materials and environmental chemicals.

35. The Directory established the following financial and fiscal incentives with a view to promote the production and use of the environmental technologies and products:

- Enterprises, which install the 62 types of environmental protection products listed in the Directory can benefit from the national policy to reduce their corporate income tax by up to the amount of the investment in the products.
- Enterprises, which utilize the environmental protection products named in the Directory, can also request their accelerated depreciation.
- Any enterprise engaged in the production of any type of environmental products listed in the Directory can be exempted from income tax up to an annual profit of RMB300, 000.
- The State Economic and Trade Commission (SETC) will provide, through the existing technological renovation programs, interest free loans and grants towards some of the investment projects or technology development projects, which are aimed at producing the environmental products listed in the Directory.
- Government-funded construction projects or government procurement should give preference to the environmental products listed in the Directory.

36. According to both national environmental targets and major environmental projects planned in the 10th Five-Year Plan (2001-2005), China's environmental market will focus on the following areas (Han 2002):

- sewage (large scale, medium and small scale) treatment, and industrial wastewater treatment (high-density organic waste, heavy metal, oil and chemical containing effluents, pharmaceutical effluents, recycling and resources retrieval);
- air pollution control, such as dust removal, desulphurization, vehicle emission control;
- municipal solid waste collection, transportation, incineration, landfilling, and management;
- monitoring equipment for all types of pollution, automation control systems for all treatment facilities, and environmental materials and chemicals;
- resources utilization, including value-added reuse of industrial wastes, cleaner production technology and equipment, comprehensive utilization of agricultural wastes, waste recycling;
- environmental services for all above areas

3) International Agencies

37. In the last two decades, the **World Bank** has concentrated its lending in areas such as environmental technical assistance, water pollution and watershed management, and phasing out ozone depleting substances (see Table 6).
38. Cumulative **ADB** lending to China as of 31 December 2000 was US$10.3billion, targeting six areas for environment protection and natural resource management: 1) improving air and water quality in urban areas; 2) increasing efficiency and greater diversification to cleaner sources in the energy sector; 3) increasing energy conservation and using clean technology processes in the industry sector; 4) promoting comprehensive basin planning and pollution cleanup in rivers and lakes; 5) protecting watersheds, conserving bio-diversity, and preserving unique ecosystems; and 6) strengthening institutional capacity in sectoral agencies involved in environmental management.
39. From 1996 to 2000, **UNDP** provided core resources of approximately US$100 million, with supplementary cost-sharing and other anticipated financial resources amounting to about US$121 million (see Table 7). The focus of this funding has been in areas such as fuel cells in public transport, biomass energy modernization, capacity development for managing reforms in the energy sector, phasing out ozone depleting substances, and energy efficiency (including the household appliances).
40. The total amount of **GEF** assistance to China has reached US$357 million. Eighty percent has been allocated to climate change, 15% to biodiversity protection, and 5% to international waters and ozone layer protection. More recently, in 2002, the GEF approved two large projects (GEF 2002) (see Table 8).
41. The **MFMP** has allocated a total of US$471 million of which US$276 million has already been disbursed (see Table 9).

4) Major Bilateral Donors

42. The development cooperation between the **U.S.** and China relies on the US Trade Development Agency (US TDA). The TDA reopened its grant assistance program for China in early 2001. The renewed cooperation between TDA and China's private and public sectors benefits both nations. During TDA's previous program in China, almost $1.4 billion in US exports resulted from nearly $24 million of overall TDA obligations for feasibility studies, orientation visits and training programs

43. **Sino-German** environmental cooperation is provided through three major agencies: the German Agency for Technical Cooperation (GTZ), the German Investment Development Agency (DEG) and the German Development Bank KfW (Kreditanstalt fuer Wiederaufbau).
44. **Canada's** bilateral cooperation in China focuses on: global environmental issues (reducing greenhouse gas emissions by targeting the energy, transportation, and industry sectors); economic cooperation, focusing on the water, urban management, GIS, energy, and waste management sectors; environmental impact assessment, including policy frameworks, technology transfer, and public consultation mechanism.
45. The **European Union** provides assistance designed to encourage China to adopt environmental policies, and to help China realize the objectives proposed in the Government's National Agenda 21 strategy.
46. From 1993 to 2000, **Spain** has supported 13 projects, amounting to 49 million EUR. These projects are mainly in the areas of wastewater pollution control, drinking water supply and solid waste treatment.

5) Air Pollution

47. Air pollution in China is recognized as the most critical threat to public health and economic development of the country. The level of pollutants in the air is among the highest ever recorded worldwide. It reaches up to ten times higher than WHO standards. No less than 30 percent(USDC-USAEP 2002) of China's total territory is affected by acid rain (mostly in the southern part of the country). China's recent CO_2 and SO_2 discharges are lower than expected due to decrease in energy demand after its peak in 1996. However, oil demand is anticipated to double in the next 20 years.
48. The state also recognizes the urgency to resolve two other major problems in air quality improvement: 1) Indoor air pollution and 2) Auto emissions. As China becomes more focused on the problems of poor air quality in residential and office buildings, there are emerging opportunities for air quality monitoring and air purification and filtration equipment, as well as coating and chemical absorbers. China's government plans to invest a minimum 12 billion dollars in disulfurization technology, described in Table 10 (USDC-USAEP 2002). Additionally, the state plans to invest approximately \$ 6.6 billion in fuel gas desulfurization equipment for

thermal plants as summarized in Tables 11 and 12. (Han, Dietmar, and Methling 2002)

6) Water Pollution

49. Over half of the Chinese population does not have access to drinking water. Moreover, the government confirmed that no exploitable clean fresh water resources are left in the country. Overexploitation and mishandling of groundwater in the North have decreased the water table dramatically. Pesticides and heavy metal from the agriculture and leaking septic tanks and sewers contributed to water quality degradation. Due to strong focus on water supply, water and wastewater treatment, and water pollution problems, the state may realize significant investments in the next few years (USDC-USAEP 2002; Han 2002).
50. Water supply shortage and deteriorating water quality have led the government to consider a water diversion scheme, which assumes water pumping from the Yangtze River to the drought afflicted cities, such as Beijing and Tianjin. The World Bank estimates that Chinese industries discharged over 20 billion tons of wastewater in 1999.It is also stated that discharge rates declined through 1999 due to the economic slowdown, restructuring, increased regulatory effectiveness, and new measures for protection. However, little progress was achieved. Due to expected increase of the urban populations from 36% to 45%, the state strengthened its control over the construction of large-scale municipal wastewater treatment facilities (WWT), which began in 1980s (USDC-USAEP 2002). The government intends to increase the number of WWT to 1000 by 2010. This will require an investment of $1.8 billion, in order to improve the effluent quality to a minimum 50% (see Tables 13 and 14).

7) Solid Waste Management

51. Three components of Chinese solid waste management sector have been developed with a varied rate of success. Municipal Solid Waste (MSW) collection systems are relatively reliable, despite the obsolete equipment. On the contrary, transfer and disposal systems are inefficient and harmful for the public health and the environment. The following factors are recognized as barriers to an adequate response to the explosive growth of solid waste produced in China: funds scarcity; obsolete infrastructure; lack of enforcement of disposal; low treatment standards;

lack of professional waste facilities operators, unavailability of reliable, locally produced waste treatment equipment (USDC-USAEP 2002).

52. It is reported, that in 1999 Chinese urban areas generated 940 pounds per person. Solid waste generation per capita has a potential to increase by 8-10 percent annually. Food wastes, plastic, and polystyrene comprise the majority of the MSW. Most metals are extracted and reused for different purposes. In 1999, China generated over 700 million tons of industrial solid waste. Various statistical sources estimate the amount of hazardous waste between five to 30 million tons annually (USDC-USAEP 2002).

53. Composting, incineration, controlling emissions and ash management are the priorities to address the solid waste problems in the future (USDC-USAEP 2002). This creates a potential market for monitoring equipment, ash management and emission technologies, and management and consulting services. Moreover, foreign investors facilitate urban/municipal landfills, which limits access to the domestic market for local products such as compactors and compacting equipment, liner materials and leachate collecting materials (Table 15). Improving standards and quality of local supplies would enhance use of domestic equipment and technologies to manage landfills.

4. India

1) An Overview

54. India's EI market has taken off, although it is still in a developmental phase. It grew at an average annual rate of 15 – 20 percent through 1996, stimulated by the dawning of the age of economic liberalization in 1991 and more rigorous enforcement of regulations, including a more active role by the judiciary. Subsequently in 1997-98, the EI market experienced short-term fluctuation that affected primarily the environmental products and technology market segments, except for the engineering consulting segment that registered a growth rate of 27 percent. The total environmental products, technologies and engineering/consulting services market is estimated to be US$4.85 billion in 1999/2000, distributed roughly: US$2.5 billion, US$1.24 billion, and US$1.1 billion for air pollution, water pollution, and land and solid waste management, respectively. Overall, it is anticipated that EI market in the coming years could grow at 10-15 percent, provided economic performance is sustained and that market forces continue to operate effectively, including availability of direct foreign investment (DFI).

55. International agencies, major donors, national companies, and MNCs have and will continue to be significant contributors to growing EI in India for the domestic and export markets. The US, Japan, Germany, UK, France, Canada, Denmark and the Netherlands are major actors. Already in 1998, partnerships between Indian and foreign companies totaled about 350 covering the various segments of the EI market. Such partnerships, including public-private partnerships and joint ventures, are expected to increase and contribute to channeling the required investment and transfer of technology to grow the environmental industry. Likewise, national large and medium size companies are beginning to invest in environmental prevention and control since they discovered it is good business and essential in order to be able to access the OECD export markets. Consequently, Indian EI is increasingly diversified and it has strengthened its technological capabilities in conventional environmental management in areas such as: water and wastewater treatment (except for reverse osmosis membranes), air pollution control, and non-hazardous solid waste management.

56. A seven to eight percent annual growth of GDP through 2005-2006, targeted by the Government of India, requires substantial expansion in the urban environmental

infrastructure. It is also linked to the government's commitment to raise the level of foreign direct investment (FDI) to US$10 billion per year. Since FDI has consistently grown in the environmentally sensitive manufacturing and energy sectors, the demand for environmental products, technologies and services should also continue to expand. This is also applicable to environmental management systems, which has resulted in 175 industrial enterprises to be ISO 14001 certified in late 1999. Industrial enterprises seeking ISO 14001 certification are growing as corporations target increased exports to OECD markets. Central and state governments are promoting public-private partnerships, including BOOs and BOTs, in water supply and treatment, sanitation, solid waste management, including toxic, hazardous and hospital waste, and transportation that reduces the rate of Green House Gas emissions.

57. Over the next four to five years the public and private sectors will emphasize the following areas for EI development: energy efficiency, including renewable energy systems and clean coal technologies, urban water supply and sanitation systems, industrial wastewater treatment (particularly in SMEs through integrated solutions), urban air pollution control through stricter emission norms for automobiles, hospital waste management, and afforestation programs. Table 16 provides additional indications of investment and potential growth in select market segments of EI. India's diversified industrial base includes the following sectors related to EI: Infrastructure; heavy machinery, basic metals, mining, oil and gas, petrochemicals and other chemicals, pharmaceuticals, automobiles, food and agricultural products processing, pulp, paper, and textiles, electronics and computer software.

58. Three million of small and medium-sized enterprises (SMEs) are considered the backbone of the economy. Their share of the GDP is estimated to be around 40%, and 60% of the total pollution load (ETI 2000).

59. The high rate of population growth and economic development in India has resulted in significant degradation of the environmental quality. In 1996, the World Bank estimated that in order to mitigate the effects of degradation, US$9.7 billion should be devoted to the process of the environmental improvements. This corresponds to 3.2% of India's 1998-1999 GDP. Increasing demand for environmental services (Table 17), such as water supply and wastewater treatment, air quality, and solid waste management largely depends on the rapid urbanization rate. It is expected that 23 large cities with population greater than one million will account for over 40% of total Indian population in the 21st century (ETI 2000).

60. Recently, the U.S. government recognized India as one of 10 “Big Emerging Markets”. It is also considered as a priority target for U.S. trade and investment promotion efforts. It is also important to note that the private sector has increased its activity in India since the national economic liberalization in 1991(ETI 2000).

2) International Agencies

61. The **World Bank’s** principal objective in India is to support private sector, governmental institutions, and multilateral organizations to explore broad opportunities for investments in order to enhance ongoing processes of poverty reduction. India is the World Bank’s largest single borrower. The Bank has loaned more than US$45 billion to India in order to address diverse developmental problems. It is a major financial source for environmental and energy projects in India. Integrating environmental concerns into the economic mainstream is the major priority of the World Bank in the field of environment. Projects in energy and the environment constitute 26 percent of the Bank portfolio, including most of the external funding of water supply and sanitation projects. Recently, the International Development Association (IDA) has established credit line to support the program of industrial pollution minimization. Moreover, the WB implements a large portion of GEF and MFMP funded projects.
62. The **ADB** provides loans and market equity investments to enhance India’s economic and social development. A major portion of the ADB loans and technical assistance is devoted to the energy sector and social infrastructure development. Moreover, the ADB is also committed to promote environmentally sound development. Currently, the ADB supports fourteen programs, which directly address environmental aspects of social and technical development (see Table 18).
63. In addition to its GEF and MFMP funded projects, which **UNDP** implements, it provides developmental assistance through its own resources and synergies with other U.N. system resources and funds. UNDP facilitates “small grants” projects and programs in cooperation with grass-roots organizations and NGOs. The following are two major programs facilitated by UNDP:
    - UNDP Environment Program I. This program aims to improve natural resources management, management of databases and environmental advocacy. The Program also strives to address issues of capacity building for decision-making and participation. Non-governmental organizations (NGOs), non-profit

organizations and State Pollution Control Boards (SPCBs) serve as main implementing agencies[8].

- UNDP Environment Program II. Within this program, UNDP supports the government's ongoing activities in environment protection in forested areas. Most projects developed within this program's framework deal with conducting research, developing demonstration projects, and promoting environmental awareness. The following are the recent projects that are administered by this Program: "A Green Rating" of Indian Industries, coal-bed methane and its commercial utilization, eco-textiles and use of natural dyes in textiles. UNDP also focused on rural electrification and poverty reduction through introduction of solar energy.

64. In India **GEF** programs are implemented through the World Bank, UNDP and UNEP providing co-financing for activities that address climate change, loss of biodiversity, ozone layer depletion, and international waters degradation. GEF also directly finances projects that focus on the problem of reducing the long-term costs of low greenhouse gas-emitting technologies. Tables 19 and 20 present major projects that were initiated and approved by GEF during 1998-2003.

65. As of April 2003, **MFMP** has allocated over US$125 million aimed at phasing out ozone depleting substances in areas such as refrigeration, production of CFCs and aerosols. (Table 21)

3) Major Bilateral Donors

66. **United States** Agency for International Development (USAID) through its. E3 – Environment, Energy, and Enterprise – is the coordinator for U.S. bilateral and sub-regional contributions to EI. The U.S.-Asia Environmental Partnership (USAEP) is designed to promote an Asian "clean revolution", based on sustained development and adoption of environmental benign and resource efficient products, processes and services in the Asian region. USAEP activities can be characterized as follows: Promoting clean technology and environmental management (CTEM), "Greening the Supply Chain", developing urban environmental infrastructure, and establishing a policy framework to sustain a clean revolution.

[8] A typical example is a common effluent treatment plant in West Bengal.

67. USAEP works in close cooperation with USAID, US Department of Commerce, USEPA, industrial environmental associations in India (regional scale), Pollution Control Boards, and others. USAEP has established Offices of Technology Cooperation in 12 Asian cities. These offices provide commercial counsel for local environmental markets (Venkateswaran 1998).

68. **Canada** has an extensive development cooperation program in India. A key element of the program is environmental consulting. One of Canada's primary goals is to assist India in establishing its own capacities to produce environmental technology adapted to the country's needs through long-term cooperation with Canadian producers of environmental technologies (Venkateswaran 1998). The Canadian private sector is collaborating with the Industrial Cooperation Programme (INC). The INC supports long-term business relations with developing countries, in particular with India, by promoting sustainable socio-economic development. CIDA does not invest in projects through a capital contribution and its support is limited to establishing joint ventures or other types of business[9].

69. Environment and engineering consulting is a focal area of **the Netherlands** in India. The program focuses on: Integrated Urban Water Management (includes wastewater treatment management practices, and technology transfer); energy efficiency and solid and hazardous waste; Environmental Management Systems; and Institutional strengthening and capacity building (Venkateswaran 1998).

4) MNCs in Air Pollution

70. Air pollution prevention, control and management are restricted to stationary and mobile sources, which includes primarily suspended particulate matter from industrial and thermal power plants and vehicular emissions. The annual market for products, technology and monitoring systems for air pollution as defined above is estimated at more than US$400 million per year. However, the energy efficiency and renewable energy market segments, which are linked to air pollution, were valued at US$2.5 billion in 1999-2000.

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[9] However, CIDA direct financial contribution is limited to Cdn$500,000 to support projects dealing with testing, adaptation and/or demonstration of environmental technology

71. Transportation and manufacturing are the major contributors to the deterioration of air quality in metropolitan cities. Transportation accounts for 52 to 67 percent and the industrial sector for 25 to 46 percent of air quality deterioration, with household activities contributing the remainder. Euro I and Euro II emission standards for vehicles will take effect by the year 2005. This will create demand for cleaner/alternative fuels, multipoint fuel injection systems, exhaust analyzers/testing equipment, and catalytic converters for tailpipe emission control. In 1998, there were more than 40 million vehicles in India.
72. Energy intensive industries, particularly in the form of combustion, such as coal-based utilities, cement plants, and petroleum refineries account for about two thirds of the demand for products and technologies to control and prevent air pollution. The technologies that are in demand for particulate matter reduction include electrostatic precipitators (60%), bag filters (20%), dust collection systems (15%), and wet scrubbers (5%).
73. India's EI has developed capabilities for manufacturing a wide range of equipment for dust collection and for some suspended particulate matter pollution control equipment. However, it requires collaboration from foreign firms to manufacture more sophisticated and high performance electrostatic precipitators and bag filters, as well as for special gaseous pollutants. Likewise, it requires external technology for catalytic converters. Table 22 indicates the external technology required from abroad for the industrial sector.
74. MNCs have established 25-30 joint ventures and collaborations with Indian firms to produce equipment and air pollution control systems. Currently, Japan and Korea account for most of the imported equipment for the mobile air pollution control sub-sector, with the US having about 15 percent. Fuel-efficient and emission control technologies are offered by those foreign firms as part of a comprehensive package. With respect to catalytic convertors, foreign MNCs which have shown interest in establishing collaboration with national enterprises are: Engelhardt Corporation (US), Friedrich Boyson GmbH (Germany) and Mathey Finance B.V. (the Netherlands).

5) MNCs in Energy Efficiency and Renewable Energy Sub-sector

75. The Energy efficiency and renewable energy sub-sector of EI in India requires special attention because of its magnitude and its direct links to the power, manufacturing, mining and agriculture sectors. It, therefore, influences the entire

economy. Although the energy efficiency is now valued at about US$500 million, its potential is estimated at US$3.5-US$5.0 billion. Consequently, its potential impact on EI is extremely important. ESCOs (energy service companies) will play a critical role in this area. With the inclusion of renewable energy in development, the impact of EI is even greater.

76. International agencies, MNCs and principal bilateral donors are major contributors to supplying and developing equipment, strategic technologies and engineering/consulting management services and systems to this market segment of EI. Likewise, they provide a significant portion of the investment required for this purpose.

77. Only a limited number of national and foreign firms are active in the incipient renewable energy (solar, wind, and small hydro). These are: Central Electric Limited, Tata Energy Research Institute (TERI), TATA, BP Solar, NEPC MICON, and BHEL, and some from Japan, U.S. and Denmark (wind power). However, there are numerous domestic and foreign firms active in the supply of equipment and technology for biomass generation. In the future, it is assumed, that R&D may focus on developing a hydrogen energy economy and fuel cell production for both the energy (stationary fuel cells) and public and private transportation sectors.

6) MNCs in Water and Wastewater Treatment

78. The water and wastewater treatment sector is technologically sophisticated and has a high level of participation by MNSs and international agencies. It is the largest market segment of EI, estimated to be US$1.24 billion. Growing water scarcity and water pollution is one of the critical environmental problems in India.

79. Since 1997, external funding for the urban environmental sector, of which water and sanitation is a large proportion, totals US$2.593 billion. The World Bank alone has provided US$853 million for urban water supply and sanitation, which has been the main source of external funding for this sub-segment of the EI market. Private-public partnerships (PPP), including BOOs and BOTs, are expected to increase in the future their contribution to channeling investment and technology to this sub-segment with the consolidation of the economic liberalization policies (Table 23).

80. A total of 240 foreign firms have established a variety of partnering arrangements with Indian enterprises in the water and wastewater sector. The U.S. accounts for about 65 of these partnerships, with the remainder being European firms, especially

from the UK, Germany, the Netherlands and France, and Japan. Government funding agencies from these countries provide credit and financing facilities to their MNCs in gaining market share.

7) MNCs in Solid and Hazardous Waste Management

81. As the Solid and Hazardous Waste Management sub-segment of EI develops, the scope for MNCs and major bilateral donors increases. Rather than using pure privatization to expand substantially the capacity to manage various sub-segments of this market, increasingly progressive municipalities are opting for joint ventures, and PPPs to mobilize funding and the required technology. The growth rate in this sub-segment is anticipated to be 10 to 20 percent.
82. Transfer of certain sophisticated technologies will be required to grow this segment of EI. These technologies relate to the areas of composting and waste-to-energy (biomethanation), coal ash utilization from thermal power stations, and hazardous waste management. Sources of solid waste generation are: residential (54%), industrial and commercial (44%), and medical (2%). Generally, 80-85% of waste is organic, which can be used to produce methane gas, and 13-20% is recyclable. Annual coal ash generation has increased from two million tons in 1947 to 70 million tons in 1999.
83. About 15% of major hazardous wastes can be disposed by incineration, which requires advanced technology not yet available in the country. Large and medium-size private sector firms in petrochemicals, refineries, chemicals, pharmaceuticals, and automobile industries prefer incineration. More than 100 incinerators are already installed, and the potential demand is significant, which presents opportunities for collaboration by MNCs.
84. Major technologies and products for which expanded cooperation is required include: flexible membrane liners; plasma and hydrogenation; solidification and stabilization of hazardous wastes; waste-to-energy (including co-generation); bioremediation
85. In the area of coal fly ash utilization, advanced technologies and substantial investment is required for: extraction and/or production of minerals, aluminum, magnetite, cino-sphere, fire-resistant tile and bricks, acid resistant tile and bricks, and light aggregates. Firms from Australia, Canada, Denmark, France, Japan, the UK, and the U.S. are involved in supplying incineration systems for resource recovery and environmental impact assessment studies. Nitettu Chemical Corporation from

Japan and Vicarb from France have supplied incineration systems. Most of the only eight domestic firms active in the municipal solid waste management market provide either composting or waste-to-energy equipment and services (Table 24).

5. Indonesia

1) An Overview

86. Indonesia's EI is the least developed of the four pilot countries, yet it faces the most severe challenges of environmental degradation and pollution that have accumulated over the years as a result of rapid industrialization and economic growth. Slow recognition by the public and by the government of the substantial health and economic damage afflicted upon the population has resulted in lack of required standards, regulatory frameworks, minimal monitoring and enforcement, and inadequate human and financial resources to meet the environmental challenges of a country with unique geographic and ecological characteristics.

87. A multiplicity of agencies and institutions responsible for environmental management, combined with incompatible and at times even conflicting laws, as well as absence of required data and information, has further aggravated the country's ability to generate effective real demand for environmental products, technology and services. More recently, however, with increased domestic (including NGOs) and external, political and market-based pressure, Indonesia has embarked on a process to "green" the economy and to improve health and overall quality of life for the population.

88. In Indonesia, in contrast with some of the other countries, the international agencies and financial institutions along with the major donors have so far contributed significantly more than the MNCs, including the national corporations, to the development of EI and more generally to sustainable management of natural resources. Overall, Japan, the US and Germany are the major donors active in the country. They are also the major exporters of pollution control products and technology, with a market share in 2001 of 26 percent, 21 percent, and 12 percent, respectively.

89. Five examples of international funding are provided below:

- The MFMP is providing a total of US$50 million (US$17 million in loans and US$33 million in grants) for a project involving the public and private sectors focused on replacing ozone-depleting substances in mobile air conditioners, refrigerators, solvents, and air resolvents.

- GEF is funding two projects:
    - -To introduce solar home systems, with a total of US$36.8 million (US$20 million in loans and US$16.8 million in grants).
    - -Renewable small energy power facilities, with a total of US$69.4 million (US$66.4 in loans and US$3 million in grants).
- An ADB loan of US$66 million for a project focused on capacity building for water loss reduction of water supply. A project was concluded in 1996 with a US$7.4 million loan for water pollution control.
- Cleaner Production Fund of the Japanese OECF project was launched in 1995 for US$115 million, and a second part was expected to be launched valued at US$500 million.
- The German Federal State co-financing institution (KfW) provided DM15.6 to co-finance a project for industrial efficiency and pollution control.

2) Air pollution

90. Severe air pollution in Indonesia, which also affects neighboring countries, is driven by increasing urbanization, motorization,[10] industrialization (including mining), and forest fires. Between 1985 and 1987, over 20 million hectares of forest cover were lost. During 1997 and 1998, 10 million hectares were burned (including 3.8 million of agricultural land), exposing 20 million people across Southeast Asia to air pollution. Total economic losses from these fires are estimated at US$9-10 billion. It is estimated that air pollution related health costs amount to US$ 400 million annually.

3) Water

91. Access to piped-water and disposal and treatment of sewage in Indonesia are among the lowest in Asia. The size of the population without piped water at the end of 1994, is estimated at 43 million people of which 30 million were in Java. Water pollution is aggravated by the fact that the majority of the population is not covered by

10 The number of vehicles increased by 6 million between 1995 and 2000, reaching a total of 19 million.

managed networks of sewage and sanitation but rather relies on on-site sanitation. Few cities have even rudimentary sewage systems. Mining and unregulated effluent run-off also contribute to surface and ground water pollution.

4) Soils-Solid Waste Management

92. Land degradation is severely affected by the existence of only minimal, modern management of solid municipal/industrial solid and hazardous waste. Likewise, air and water pollution and health are also adversely affected. EI development in the future would benefit form the creation of conditions for converting potential demand for environmental products, technology and management services into effective, real demand. Furthermore, market-based incentives, combined with effective management of streamlined and strengthened regulatory and monitoring frameworks and standards, will also contribute to the above endeavor. It will also facilitate participation by MNCs and national companies that are beginning, slowly and belatedly, to discover that investment in environmental protection and control is also good business.

5) International Agencies

93. Major activities of the **WB** are focused on: collaboration with the Indonesian Environmental Impact Pollution Board; research on industrial emissions; establishing and supporting environmental trust funds. Moreover, the WB has invested US$80 million into a project designed to improve potable water quality, and access to the water supply and sanitation services. (Unternehmensberatung 1998) In addition, this investment aims to implement a program that will increase people's awareness in health and hygiene.
94. The **ADB** provides financing for development projects that support various environmental areas (Schmidt 1999; ADB 2003). Major projects include: Capacity building of water supply for Water loss reduction (US$66 million); Water pollution control project (US$7.4 million); Participatory Irrigation Sector Project (US$90 million); Coral Reef Rehabilitation and Management (US$40 million); Central Sulawesi Integrated Area Development and Conservation (US$32 million); Marine and Coastal Resources Management Project (US$50 million); Clean Vehicle Fuel for Blue Skies (US$0.6 million). About 90% of the loans are targeted to the public

sector. If private projects are considered, they are mostly being implemented by large national enterprises.

6) Major Bilateral Donors

95. The Cleaner Production Fund of the Japanese Overseas Cooperation Fund (OECF) was started in 1995 with a total allocation of US$115 million. A second stage started in 1998 with a planned allocation of US$500 million. This is a revolving fund with a perspective of 30 years. Investments were made for promotion of the following: pollution control equipment; wastewater treatment and reuse for agricultural needs; air pollution protection; noise protection; CO_2 reduction; consulting services for designing pollution control or prevention equipment.
96. Kreditanstalt fuer Wiederaufbau (KfW) German Bank for Reconstruction and Development is the design to co-finance and to promote private, and public, investments. KfW allocated DM15.6million to the Bank of Indonesia as a part of financial cooperation within the industrial efficiency and pollution control program. German Investment and Development Company (DEG) provides an Integrated Advisory service for the Private Sector in Indonesia. The DEG also serves as the financing institution for direct private investments. Main activities include: consulting and advisory services to joint ventures and technical projects; investment cooperation opportunities and information; analysis and identification of qualified partner companies; facilitation of investment seminars (Schmidt 1999).

7) Multinational Corporations

97. The relative importance of multinational corporations from major countries is summarized below in terms of the market share of environmental equipment and services exported to Indonesia.

Air Protection Equipment (APC)

98. From 1995 through 1999 Indonesia imported APC for the total value of US$0.276 million. Japanese companies lead the sector for three of five years, with market share of 31%. The third major investor was Germany, with 13% of market share. The five-year cumulative major competitors market share is as follows: Japan-26%, U.S.-21%, Germany-12% (US-AEP 2001).

Monitoring & Analysis Equipment (M&A)

99. The total market size of the M&A in Indonesia reached US$0.108 million in 1999 (Total for five years is US$1.134 million). In this sector, Japan is the leader in Indonesia, followed by U.S. and German competitors. The five-year cumulative major competitors market share is as follows: Japan-46%, U.S.-13%, Germany-11% (US-AEP 2001).

Solid & Hazardous Waste, Other Recycling Systems and Remediation and Cleanup (SWM/ORS/RC)

100. This is the largest import sector in Indonesia. It accounts for US$0.168 million in 1999 (Total for five years - US$1.738 million). For the period from 1995 through 1999, the total SWM import has dropped by 58%. Two major competitors are still the U.S. and Japan. In this sector the Italian companies replaced German competitors. The five-year cumulative major competitors market share is as follows: Japan-42%, Italy-16%, U.S.-13% (US-AEP 2001).

Wastewater Management Equipment (WWM)

101. In the Indonesian WWM equipment sector the leader is Korea, followed by Japan and Germany. Total size of the WWM equipment market in Indonesia reached US$0.129 million in 1999, and for the period from 1995 through 1999, the total was US$1.1million. The five-year cumulative major competitors market share is as follows: Korea-33%, Japan-32%, Germany-8% (US-AEP 2001).

6. Korea

1) An Overview

102. Development and growth of EI in Korea has accelerated in recent years due to its overall economic performance, which is sustained in large part by exports, especially to the OECD countries, by designating EI as a strategic export industry, and by the growing influence of civil society and NGOs who are pressing for improved air and water quality. Moreover, Korea's joining of the OECD in 1997 and of co-hosting the World Cup Soccer Games in 2002 has also been a contributor to a growing demand

for environmental products and services and enforcement of stricter performance based environmental standards.

103. Several decades of rapid industrialization and urbanization have resulted in a significant deterioration of environmental quality, which the government had decided to reverse, as articulated in "Green Vision 21," a ten-year (1996-2005) environmental master plan, "1999 Environmental White Paper" and in numerous Acts and Laws. Consequently, Korea appears to be among the largest markets for environmental products, technology and environmental management services in the Asia Pacific region with a projected average annual growth of 10 percent. The total value of the environmental market in Korea in 1999/2000 is estimated at US$7.1 billion.

104. Three basic national environmental policy documents – "Green Visions 21" (1996-2005), the second mid-term comprehensive plan (the business plan for "Green Vision 21"), and the"1999 Environmental White Paper" shape the development of EI in Korea through the articulation of five strategic principles (including the "polluter pays principle") and six policy priorities. These priorities are: clean water and sufficient water supply, clean air, recycling and reuse of waste, managing safety with chemical pollutants, preservation of the natural environment, and strengthening international cooperation. Furthermore, currently the Ministry of Environment is responsible for 30 environmental laws. Other sectoral ministries are responsible for administering regulations of more than 50 other laws related to the environment.

2) International agencies

105. Overall, international agencies and international finance instruments will have a limited impact in coming years, except for catalytic importance related to the MEAs and the GEF providing some funding for cleaner production and related climate change advanced technologies. On the other hand, national corporations and MNCs will account for about 50 percent of total expenditures in the environmental market. As privatization and public private partnerships (PPPs) of major segments of environmental infrastructure expand, the role of domestic and international corporations is likely to increase with the MNCs making significant and strategic contributions to sophisticated environmental technologies.

106. Korean companies will continue to focus on traditional end-of the pipe areas as they position themselves to upgrade their technological capabilities; these include wastewater treatment, hazardous waste treatment, and more recently technologies for

dust filtration and sulfurization. Since the Korean Institute of Science and Technology (KIST) assesses Korea's overall level of environmental technology in the range of 30-70 percent relative to most advanced nations, the scope for MNC contributions to EI in the country in the coming years continues to be significant and of strategic importance, especially in advanced fields such as clean up, recovery, recycling and abatement of emissions from fixed and mobile sources. Korean companies will also continue to focus on developing technology related to engineering and construction of environmental infrastructure such as wastewater treatment plants and incinerators.

107. In view of the above, expanded future R&D by the government and industry will give priority to clean and renewable energy, energy efficiency, abatement of global warming, low GHG emission by automobiles and trucks, environmental bio-engineering, hazardous fine chemicals, waste minimization, and electronic monitoring/measuring instrumentation. While MNCs could be partners in such R&D, international agencies and, for example, the G-7 Environmental Engineering and Technology Development Program, would make catalytic and strategic contributions, which should not be measured in terms of the volume of financing

108. To accelerate R&D in priority areas and development of state of the art EI, tax incentives and low-interest loans are offered by the government. The tax incentives include customs duty reduction or exemption on imports of pollution control equipment in selected environmental and alternative energy technologies classified as "high level technologies."[11] Long-term, low-interest loans are offered to environmental investors and technology developers, in addition to the support to start-ups.

3) MNCs in Air Pollution

109. Although 52 items are defined as air pollutants, only 26 substances are affected by air pollution control standards, including Sulfur Dioxide (SO_2), Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), total suspended particulates (TSP), particulate matters (PM-10), ozone (O_3), and lead (Pb). Industrial pollution, including waste minimization through cleaner production, vehicle emissions, and energy efficiency

[11] It may include a hydrogen energy economy and fuel cell production for the energy (stationary fuel cells) and transportation sectors.

(including renewable energy technologies), are the primary focus of the government's prevention control and monitoring (including telemetering systems).

110.Of the 31,000 air pollutants emitting businesses, the regulatory authority over 24,000of these businesses is managed by regional governments, and the regulatory authority on the remaining 7,000 is managed by the environmental offices of the MOE, which classifies the businesses in five classes depending on the volume of annual fuel consumption. With registered motor vehicles approaching 12 million, they have become the main source of emissions amounting in 1999 to 41 percent of total volume of air pollutants generated, while industry accounts for 27 percent, power generation 17 percent, and heating 6 percent.

111.In Seoul, motor vehicles are responsible for 85 percent of total emissions, while commercial vehicles (buses and trucks), which account for only 4 percent of all vehicles, generate 47 percent of emissions. To combat emissions from motor vehicles, the government had planned to have 5,000 CNG buses operating in eight cities for the World Cup Soccer games in 2002, and 20,000 CNG buses and 210 CNG stations operating by 2007.

112.Korea's automotive industry is an illustration of the convergence of domestic demand for clean air, the need to meet international commitments under the UNFCCC, the Montreal Protocol, and the imperatives of maintaining and expanding export market share in the European and US markets which increasingly demand zero emission vehicles and trucks as the Euro I & II standard become fully operational. Advanced environmental technology (software) and products (hardware) are, therefore, critical to the sustainability and growth of the Korean automotive industry. Likewise, at the corporate level, the automotive industry needs to adopt state of the art environmental management systems and reporting procedures, and be rated internationally regarding its environmental and social responsibilities.

113.To expand, update and operate the monitoring and control system presents the EI industry with major challenges and opportunities with respect to equipment, electronic instrumentation technology and integrated/advanced management systems. Government and industry currently operate four air quality-monitoring systems: air pollution monitoring stations (telemetering); air pollution monitoring vehicles where telemetering is not installed; acid rain monitoring stations; and smokestack telemetering systems.

114.The Bank of Korea estimates that in 1999, the total market for air pollution prevention and control products and services was US$1.13 billion and it was anticipated to reach US$1.2 billion in the year 2000. According to the same source, the market is driven by the private sector, unlike the water supply, wastewater and solid waste sub-sectors, with industries accounting in 1999 for 91.8 percent of the country's total environmental spending, households 5.0 percent and the government 3.2 percent.

115. The Korean Environmental Industry Association estimates that 570 companies are active in this market, of which 169 specialize only in the air pollution prevention and control field. Since KIST rates Korean environmental technological capability at 30 to 70 percent compared to leading OECD countries, local manufacturers can now manufacture low-tech equipment such as bag filters and cyclone collectors. An exception is Korea Cottrell that has been in this business since the 1960's and produces electrostatic precipitators and other equipment and technology related to crude oil and other industrial desulfurization, and exhaust gas treatment required by national industries.

116. Consequently, Korean industry continues to rely on MNCs and foreign companies for advanced technology and equipment, which includes the following areas: flue, gas and fuel desulfurization/denitrification; high efficiency dust collectors, motor vehicle emission reduction; and air quality automated measuring instruments.

117. Major industries that require advanced air pollution prevention and control equipment and management systems technologies include: petrochemicals, cement, power generation (new and renewable energy), automotive, electronics and steel. Japanese, US and German companies have been the predominant actors among about 30 foreign companies that have transferred, primarily under licensing agreements, air pollution control technology to Korean enterprises in the 1990's.

118. In the future, MNCs affiliated with major Korean conglomerates (Hyunday, Samsung, LG, SK, and the Korean Electric Power Corporation), will be able to continue and even expand their contributions to EI in the country; joint ventures and possibly PPPs may also become feasible due to the policy of privatization and decentralization. Likewise, multinational engineering consultancy companies will continue to do business under licensing agreements and/or joint ventures with major Korean general and specialized environmental firms.

4) MNCs in Water Pollution

119. In 1999, the market for the water and wastewater sub-sector was estimated at US$3.3 billion accounting for 46 percent of the total environmental market valued at US$7.1 billion. During the same year, the government spent US$2.2. billion (about 70 percent of total) to manage water quality and wastewater while industry spent US$0.9 billion (about 30 percent) in the same sub-sector. Unlike the air pollution sector, the water and wastewater sector continues to be largely dominated by the government. However, the government has recently opened the area of local sewage treatment to the private sector, with 16 sewage treatment projects selected for privatization, including public-private partnerships (PPP).

120. According to the "1999 Environment White Paper," the major goals of the comprehensive measures for water management for the period 1996-2005 are:

Indicator	1996	2005
Ratio of municipal wastewater treatment (%)	50	80
Ratio of livestock waste water treatment (%)	42	74
Ratio of industrial wastewater treatment (%)	73	90

To achieve these goals the government plans to invest US$25 billion on infrastructure projects for water quality improvement. This will enable the government to build 165 new **municipal** wastewater treatment plants, and construct 14 new **industrial** wastewater treatment plants bringing the total to 53 in 2005.

121. With respect to drinking water, there are more than 3 million purifiers installed in homes. The annual market for home water purifiers has been growing from US$188 million (US$21 million from imports) in 1998 to US$250 million in 1999.

122. The contributions of MNCs and foreign firms to the water pollution control segment of EI has been to provide technology and/or equipment for purification and sludge treatment, including of membranes for reverse osmosis processes. In 1996, there were 76 license agreements reported for transfer of technology in the water pollution control field. Since licensing agreements were deregulated after 1996, no data is available for subsequent years.

123. In the past, Japanese firms dominated the market for advanced pollution control technologies, including water and waste treatment, commanding around 50 percent

of the market share, with the US commanding 20-25 percent and European companies 20 percent. Major Japanese companies include: Daiki, Daiwa, NCE, Tayobo, Denka Engineering, Nitto, Denko, Suirei and Nittetsu Chemical Engineering. Major US environmental corporations are: CH2MHill (Water treatment), Romm Hasy (filtering machines), Hydranautics (membrane products), Filterk corp. (backwashable micro filter products), VMT (pure water treatment), and Aeromix Systems (Surface aerator). European companies include: Led Italia (Italy), Danish Hydraulic Institute (Denmark), Rochem (Germany), TIA and Trailigas (France), Biothane Systems (Netherlands) and NYT (Finland).

124. More recently MNCs are entering the water and wastewater market by establishing partnerships-joint ventures- with major Korean companies. Samsung had signed in 2000 a joint venture agreement with Operation Management International, Inc. (OMI), a subsidiary of CH2MHill, to construct sewage treatment projects under the privatization arrangements whereby OMI will transfer advanced technologies and provide financing. Hyunday Engineering ad Construction has been pursuing a joint venture with Generale Desaux of France for the construction of a wastewater project in Kyongsangbuk-do. LG Engineering & Construction has recently introduced technologies from Japanese and US companies for sewage treatment and solid waste incineration.

5) MNCs in Soil Pollution and Industrial and Solid Waste Management

125. Waste minimization, progressive reduction of use of landfills and reuse of methane gas of existing landfills for power generation, (waste to energy), hazardous waste management and expanded recycling characterize the challenges faced by the soil pollution and solid waste management sector. The comprehensive plan for National Waste Treatment is based on three principles: encourage recycling and discourage landfill; prevent or reduce waste generation and expand recycling capacity; and expand incineration capacity for the waste that cannot be recycled. Consequently, waste management policy prioritizes actions as follows: reduction, reuse, recycling, energy recovery, incineration and landfill.

126. Generally, the Korean industry is able to manufacture medium to low tech components and parts for incinerators and other aspects of solid and hazardous waste management. However, advanced foreign technology and equipment is required for incineration, recycling, waste to energy, and hazardous toxic waste management.

Specifically, these needs include: heat treatment technology for manufacturing the furnace stall parts of an incinerator and the ash treatment technology to abate hazardous materials such as heavy metals, and of controlling dioxin emissions and other toxic substances (volatile organic compounds) from incinerators. Advanced technology is also required to reuse or recycle industrial waste, scrapped cars, computers and home appliances.

127. The magnitude of the market for solid waste treatment (see Table 25) products and services was estimated by the Bank of Korea to be US$2.5 billion in 1999, with US$0.5 billion for the private sector. The government is providing low interest loans to encourage private firms to expand substantially the number of private recycling plants. It is planned to expand the proportion of recycling industrial waste to 75 percent by 2005 compared to 67 percent at present. At the same time, the government is considering a model project of the Eco-Industrial complex aiming at zero discharge of solid waste, where cleaner production systems, technologies and equipment will be used.

128. Foreign companies active in Korea's market for municipal incinerators include five Japanese, two German and one each form Denmark, Belgium, France and Switzerland (Table 26).

129. MNCs will continue to be an important contributor to hazardous solid waste and toxic chemicals treatment and management, with an expected substantial growth in the market for technology and equipment. Revision of regulatory and administrative requirements to comply with European standards and the TRI of the OECD, which is already being applied by the oil refining industries, offers expanded opportunities by international environmental companies specializing in hazardous waste management. The main categories of hazardous waste discharge by industries are: acid waste, alkaline waste, non-halogen solvent waste, oil waste, and wastewater sludge. Technologies to treat and manage these wastes include: dust treatment using the plasma incinerator technology, recovery of oil-spilled soils and land fills, and extrusion of incinerated waste using plasma for large-scale municipal waste incinerators.

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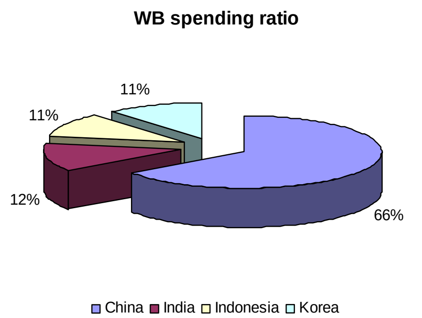
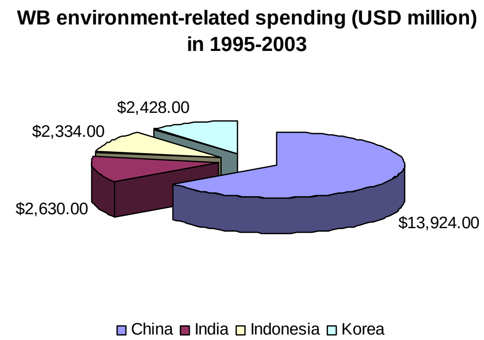
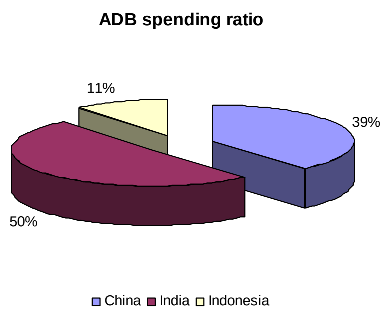
Chart 2: WB investments in China, India, Indonesia, and South Korea (1995-2003)

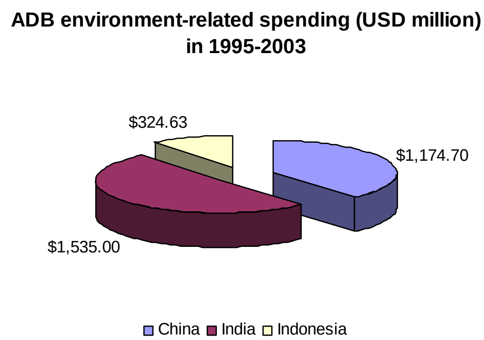




Source: http://www4.worldbank.org/

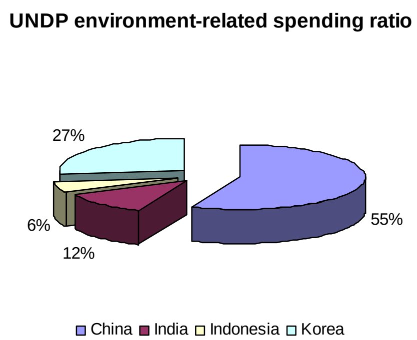
Chart 3: ADB investments in China, India, and Indonesia (1995-2003)

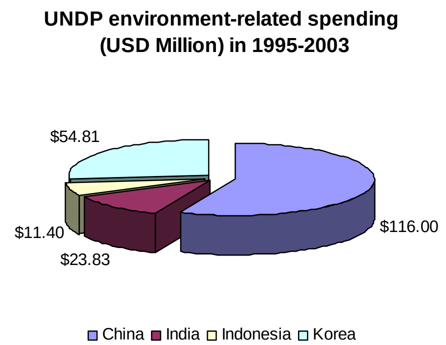




Source: http://www.adb.org/

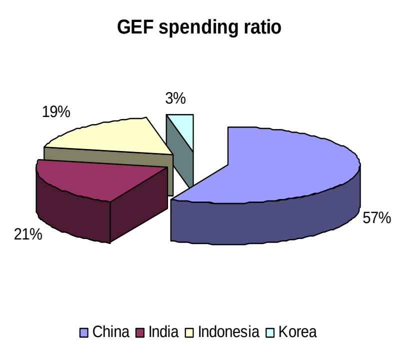
Chart 4: UNDP investments in China, India, and Indonesia (1995-2003)

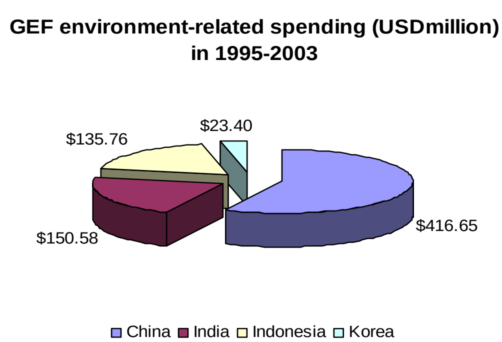




Source: http://www.undp.org/

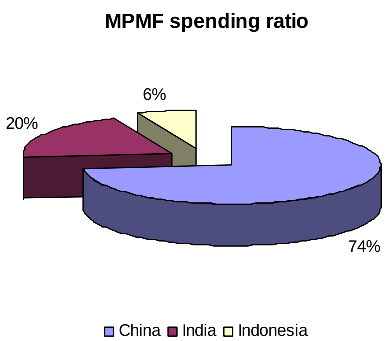
Chart 5: GEF investments in China, India, and Indonesia (1995-2003)

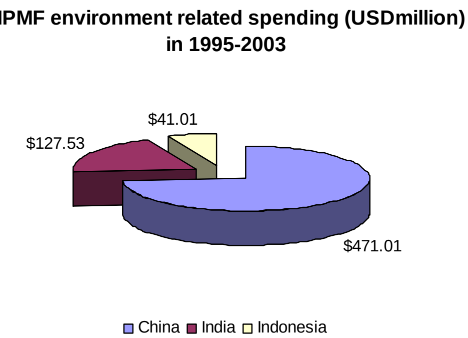




Source: http://www.gefweb.org/

Chart 6: MFMP investments in China, India, and Indonesia (1995-2003)





Source: The Multilateral Fund Secretariat

Tables

Table 1: Forms of contribution by MNCs to EI in selected coutries

Country	Form of contribution
South Korea	Subcontracting
China, India	Joint ventures
	Private Public Partnerships
China, India, Indonesia, Korea	Built-Own-Operate – BOO
China, India, Indonesia, Korea	Built-Own-Operate and Transfer – BOT

Table 2: Environmental consulting services demand in Asia

Anticipated demand	Marked demand areas
High	Clean process design, construction and operation
High	Sophisticated environmental management systems (includes "greening the supply chain").
High	Energy efficiency (demand-site management).
High	ISO 1401 Certification consulting services.
High	CDM related certification services.
High	Environmental impact assessments and audits.
High	Product life span assessment.
High	Resource utilization, including value added integrated reuse of industrial and agricultural waste.
High	Waste resources recycling and disposal for plastic, paper, wood, chemical products and metals.

Table 3: Finance allocation under the 10th Five-Year Plan (2001-2005) in China

Project	Amount allocated
To build or expand 145 urban wastewater treatment plants in the basins of the Huai, Hai and Liao rivers and the Tai, Chai and Dianchi lakes;	RMB27.1 billion
To build 22 hazardous waste facilities;	RMB20 billion
To install desulphurization equipment on 51 coal-fired power plants in the acid rain control areas;	RMB16.4 billion
To build four sewage plants and four other environmental facilities in Beijing;	RMB12.4 billion
To build 30 plants to treat sewage entering the Bohai Bay;	RMB9.3 billion
To build 37 urban sewage treatment plants and nine urban waste management plants in the Three Gorges Reservoir.	RMB7.3 billion

(Source: People's Daily 22/02/2002)

Table 4: First priority environmental programs specified by the Tenth Five Year Plan in China

Area	**Project description**
Water and wastewater	The water pollution control engineering of the Three Gorges Project
Water and wastewater	The water pollution control engineering of the Divert Water from the South to the North Project
Water and wastewater	Huai River Wastewater Control and Treatment
Water and wastewater	Liao River Wastewater Control and Treatment
Water and wastewater	Hai River Wastewater Control and Treatment
Water and wastewater	Taihu Lake Pollution Control and Treatment
Water and wastewater	Chaohu Lake Pollution Control and Treatment
Water and wastewater	Dianchi Lake Pollution Control and Treatment
Air	Two Controlling Areas — Reducing SO2 Emission and Controlling Acid Rain
Water and wastewater	Bohai Sea water pollution control engineering
Water, air, waste treatment	Beijing Environmental Programme

Table 5: Development of China's Environmental Protection Industry: 1993-2000

Sector for development	**1993**	**1997**	**2000**
Company/institution (number)	8,651	9,090	18,144
Employee (million)	1.882	1.699	3.176
Total annual income (RMB100 million)	311.5	459.2	1689.9
Envir. Protection products (RMB100 million)	104.0	182.1	236.9
Clean products (RMB100 million)	-	21.6	281.1
Environmental service (RMB100 million)	11.1	57.8	129.4
Waste recycling (RMB100 million)	169.3	181.4	757.1
Natural conservation (RMB 100 million)	27.1	16.3	285.4
Total annual profit (RMB100 million)	40.9	58.1	166.7
Average profit per capita (RMB)	2200	3400	5200
Average income per capita (RMB)	16600	30700	53200

Table 6: Environmental projects in China approved by the World Bank in 1991 through 2003

Project	**Amount (USD million)**
Environmental Technical Assistance Project	76.0
Montreal Protocol Ozone Depleting Substances Phase Out Project (04)	100.0
Montreal Protocol Ozone Depleting Substances Phase Out Project (03)	90.1
Xiaolangdi Resettlement Project	571.3
Loess Plateau Watershed Rehabilitation Project (02)	150.0
Natural Forest Biodiversity Project	16.0
Taihu Basin Flood Control Project	497.3
Lake Dianchi Aquatic Biodiversity Restoration Project	0.75
Beijing Environmental Project	298.7
Sustainable Forestry Development Project	214.58
Southern Jiangsu Environmental Protection Project	250.0
Second Beijing Environment Project - GEF Component	1200.0
Montreal Protocol Ozone Depleting Substances Phase Out Project (02)	6.0
Montreal Protocol Ozone Depleting Substances Phase Out Project	18.8
Huai River Basin Pollution Control Project	78.5
Beijing Environment Project (02)	1255

Table 7: UNDP contribution in China's environmental improvement

Project	**Amount (USD million)**
Demonstration of Fuel Cell Bus Commercialization in China	15.9
Modernized Biomass Energy in China: Jilin	1.24
Development of the Capacity to Manage China's Electricity Power Supply Reform	23.22
Demonstration of Fuel Cell Bus Commercialization in China	40.91
China: Promoting Methane Recovery and Utilization from Mixed Municipal Refuse	14.3
Building Capacity for the Clean Development Mechanism in China	0.078
Capacity Building for Environmental Education in Primary and Middle Schools through the Production of Interactive Teaching Materials	0.825
Capacity Building of Women Mayors and TVE Managers for Sustainable Development in China	0.96
Development of Coal-Bed Methane Resource	10.0
Modernized Biomass Energy in China: Jilin	1.240
Peanut Improvement in Poor Areas	-
Poverty Alleviation and Women in Development in Inner Mongolia	-
Prevention and Management of Marine Pollution in East Asian Seas	11.4
Seabuckthorn Development in China	1.04
Study on wind resources concession	0.13

Table 8: Major recent GEF projects in China

Project	**Implementing Agency**	**GEF allocation**	**Total cost**
Energy Conservation, Phase II	The World Bank	US$26 million	US$281.2 million
Efficient Utilization of Agricultural Waste	The World Bank/ ADB	US$6.4 million	US$77.3 million

Table 9: MFMP allocation in China

Sector	**Amount US$ million**
Aerosol	7.0
Foam	112.0
Fumigant	1.08
Halon	51.0
Process agent	22.22
Production	72.85
Refrigeration	159.03
Solvent	29.73
Several	9.21
Other	6.32

Table 10: Investment in China's disulfurization technology

Disulfurization technology for thermal power plants	$6.6 billion
Control and monitoring of domestic SO2 emissions	$3.6 billion
Desulfurization technology for industrial furnaces	$1.8 billion

Table 11: Air Pollution related Environmental Technology Development in China

Category	**Encouraged Development and Investment of Environmental Equipment and Technology (issued by SETC in 2000) To be commercialized**	**Environmental Equipment and Technology that need Development in the 10th Five Year Plan (issued by SETC in 2001) To be developed**
Air pollution control equipment technology	Limestone (lime)-gypsum gas hydro-desulfurization integrated equipment; Half-drier method gas desulfurization equipment; Gas recycle fluid-bed desulfurization equipment; High temperature and filtrate speed bag filter; Bag filter high-efficiency dust-out equipment; High-efficiency electrostatic separator;	Technology and equipment of choosing, washing, and desulfurization of coal; Wet desulfrization technology and equipment of large electricity station fueled by coal; Industrial boiler flu gas desulfurization equipment;

Source 1) The 10th Five-Year Plan for Environmental Protection Industrial Development in China (issued by SETC)

2) Encouraged Development of Environmental Equipment and Technology at Present (issued by SETC)

Table 12: Selected Large-Scale Foreign Investors in Chinese Air-Related Technologies Market

Country	**Company**	**Investment amount and Project Locations**
U.S.A.	Thermo Instrument Systems	Holds a 70% share in the environmental air quality monitoring market in China
	Hewlett-Packard	Gas-chromatography, air control and monitoring equipment
	Dasibi Environmental Corporation	Installed air monitoring equipment in 33 key cities in China for amount of $13.4 million
	Corning (Shanghai) Co., Ltd	Wholly owned foreign company; it produces ceramic substrates, used in catalytic converters.
Austria	W & Partner Group - Dipl.Ing.Michael Wachsmann GmbH	air measuring systems, air and treatment technology

Table 13: Water and Wastewater related Environmental Technology Development in China

Category	Encouraged Development and Investment of Environmental Equipment and Technology (issued by SETC in 2000) To be commercialized	Environmental Equipment and Technology that need Development in the 10th Five Year Plan (issued by SETC in 2001) To be developed
Municipal wastewater treatment technology and equipment	Revolving ladder grid; High-efficiency air-floating equipment; Suspending chain impulse wave aerator; Pneninatic aerator; Strip type spin-drier machine and sludge condense integrative equipment; Clean up algae machine; SBR sequential activated sludge reactor; Film-biological reactor; Sludge fast compost integrated equipment;	Whole sets of municipal waste water treatment equipment using activated sludge (200-500 thousand tones per day); Whole sets of municipal waste water treatment equipment using methods of oxidation ditch, SBR, and AB (100-200 thousand tons per day); Technology and whole sets of equipment of waste water treatment methods of A/O, A/AO, bio-filter, and aerobic hydrolyzation (below 100-200thousand tonnes per day); 10-50 thousand tonnes waste water treatment equipment for small towns; - Municipal waster reusing equipment;
Industrial wastewater treatment technology and equipment	Floating oil recycled machine; High-concentration bio-degradation organic wastewater treatment integrated equipment; Internal triphase recycle bio-fluid bed reactor; Neotype ozone generator; SBR method large-scale revolving	Technology and equipment of aerobic and anaerobic treatment for high-load industry organic waste water; Antibiotic production waste water treatment equipment technology; Pulp and paper waste water treatment equipment technology; Industrialization of middle water reuse technology and equipment; Industrialization of industrial wastewater reuse equipment;

Source 1) The 10th Five-Year Plan for Environmental Protection Industrial Development in China (issued by SETC)

2) Encouraged Development of Environmental Equipment and Technology at Present (issued by SETC)

Table 14: Selected large-scale foreign investors in Chinese water management

Country	Company	Investment amount and Project Locations
France	Suez-Lyonnaise des Eaux	Total investments: $120 million, including $28 million for Shanghai Huangpu River project
	CGE	Total investment: $780 million for project in Huizhou (Guandong Province), Xi'an, Shanghai, Tionjin, Chengdu, and other areas
	Degremont	Invested in 50 water treatment systems in Beijing, Guandong, Hangzhou, and other areas
Germany	Siemens	Total investment: $300 million (capitalized on aid finances)
UK	Thames Water and Bovis	$68 Million for Shanghai water treatment project $25 million for Guiyang water supply system
	Anglian Water	Total investment:$16 million
U.S.A.	Nalco Chemicals	$3 million for Suzhou project
	Lemma International	$120 million for Guangzhou Xilang project

Table 15: Solid and Hazardous Waste related Environmental Technology development in China

Category	Encouraged Development and Investment of Environmental Equipment and Technology (issued by SETC in 2000) To be commercialized	Environmental Equipment and Technology that need Development in the 10th Five Year Plan (issued by SETC in 2001) To be developed
Solid waste treatment equipment technology	Waste assort equipment; Urban living garbage incinerator; Small solid waste incinerator; Garbage ferment roller; Compost mix round machine; Back-load compress garbage gather trunk; Vacuum suck feces vehicle;	Municipal waste solid stoker- type incinerating boiler (150-1000 tonnes per day); Circulating- fluidized-bed type incinerating boiler system of waste solid (75-1000 tonnes per day); Municipal waste solid screening and crushing equipment technology; Waste heat utilization technology of incineration; Disposal automobile treatment and recycling equipment (5000 per year); Recycling equipment of waste battery; Waste plastic high purity sorting and washing equipment with capacity below 2000 tonnes per year; Manufacturing equipment of building materials from recycling of coal fly ash; Sorting equipment of fly coal ash; Whole sets of equipment of fertilizer made of sludge;
Hazardous waste treatment	Poisonous and harmful and solid waste incinerator;	Radioactive solid waste management and disposal engineering; Industrial hazardous and toxic solid waste incinerator; Industrial hazardous and toxic solid waste package and composting equipment;

Table 16: Required Investment for urban Infrastructure Services (at 1995 prices, US$ billions) in India

Services	**Low**	**High**
Water Supply	2.12	5.0
Sewerage	2.0	4.5
Solid Waste	0.23	1.0
Total	4.35	10.5

Source: Environmental Technologies Industries – Market Plans

Table 17: Potential growth estimates of the environment related business sectors in India

Business Segment	**Short-term potential**	**Long-term potential**
Water and Wastewater Treatment	Medium	High
Air Pollution	High	High
Municipal Solid Waste	Medium	Medium
Hazardous Waste	Medium	High
Hospital Waste	Medium	Medium
Environmental Consulting	High	Medium
Monitoring Equipment	Medium	High
Energy Efficiency	High	High
Renewable Energy	Medium	High
Clean Coal	Medium	High

Source: Environmental Technologies Industries – Market Plans

Table 18: ADB investment in India's EI

Progect	**Ammount US$ million**	**Year**
Renewable Energy Development	200	20003
Gujarat Power Sector Development Program (Policy Loan)	350	1996-2000
Urban Clean Fuel Project	1	2003
Chhattisgarh Irrigation Development Sector Project	0.7	20003
Energy Efficiency Enhancement	0.6	2002-2003
JFPR-Rainwater Harvesting and Slum Development In Rajasthan	1.9	2002-2004
Urban Water Supply and Environmental Improvement in Madhya Pradesh	213	2003
Calcutta Environmental Improvement	250	2000-2007
Rajasthan Urban Infrastructure Development	250	1998-2004
Urban and Environmental Infrastructure Facility	90	1999-2004
Karnataka Urban Development and Coastal Environmental Management Project	175	1999-2004
Kerala Sustainable Urban Development	1	2003
Integrated Urban Development in Madhya Pradesh	1	2002-2003
Calcutta Environmental Improvement US$1mln (1998-1999)	1	1998-1999

Table 19: GEF Regional and Global Projects - Carried out in various countries, including India

Country	**Project Name**	**Focal Area**	**Agency**	**GEF Grant (US$M)**	**Project Stage**
Global	Conservation and Sustainable Management of Below Ground Biodiversity, Phase I	Biodiversity	UNEP	5.296	CEO Endorsed
Global	Assessment of Soil Organic Carbon Stocks and Change at National Scales	Multiple Focal Areas	UNEP	0.978	CEO Approved
Global	Promoting Industrial Energy Efficiency through a Cleaner Production/Environmental Management System Framework	Climate Change	UNEP	0.950	CEO Approved
	Total Spending			7.224	

Source GEF Projects profiles: India (1998-2003)

Table 20: GEF Single Country Projects - India

Country	**Project Name**	**Focal Area**	**Agency**	**GEF Grant (US$M)**	**Project Stage**
India	First National Report to the CBD	Biodiversity	UNDP	0.025	CEO Approved
India	National Biodiversity Strategy and Action Plan Asia	Biodiversity	UNDP	0.968	CEO Endorsed
India	Conservation and Sustainable Use of the Gulf of Mannar Biosphere Reserve's Coastal Biodiversity	Biodiversity	UNDP	7.868	CEO Endorsed
India	Conservation and Sustainable Management of Dryland Biodiversity, Phase 1	Biodiversity	UNDP	2.040	Council Approved
India	Energy Efficiency	Climate Change	IBRD	5.000	CEO Endorsed
India	Coal Bed Methane Capture and Commercial Utilization	Climate Change	UNDP	9.190	Council Approved
India	Enabling Activity for the Preparation of India's Initial Communication to the UNFCCC	Climate Change	UNDP	2.000	CEO Endorsed
India	Biomass Energy for Rural India	Climate Change	UNDP	4.213	CEO Endorsed
India	Fuel Cell Bus Development in India (Phase II - Part 1)	Climate Change	UNDP	6.280	Council Approved
India	Removal of Barriers to Biomass Power Generation, Part I	Climate Change	UNDP	5.650	Council Approved
	Total Spendings			43.234	

Source GEF Projects profiles: India (1998-2003)

Table 21: MFMP investments in India's EI (1995-2003)

Segment	Allocated (US$M)	Support (US$M)	Disbursed (US$M)
Aerosol	3.096	0.369	2.261
Foam	33.099	3.545	26.692
Fumigant	0.035	0.002	
Halon	5.098	0.519	1.515
Process Agent	4.907	0.596	0.523
Production	46.115	3.665	32.501
Refrigeration	26.197	2.854	10.515
Solvent	4.675	0.545	2.839

Table 22: Business Opportunities in Industrial Air Pollution in India

Industrial Sector	Technology Required
Thermal power stations and iron and still plants	Energy efficient equipment High temperature filter bags
Dyes and dye intermediates, small boilers (up to 15t/hours), electroplating	Package scrubbers High efficiency cyclones
Thermal power stations, pharmaceuticals, and cement	NOx removal
Dyes and dye intermediates, chemicals	High efficiency scrubbers
Petrochemicals, distilleries, pharmaceuticals, and metallurgical industries	Monitoring equipment Odor control systems Fugitive emission control systems
Petrochemicals, pesticides, iron and steel, nitrogenous fertilizer, thermal power stations	Monitoring equipment
Fertilizers, iron and steel; sugar; pulp and paper; caustic soda; petroleum refining desulfurization of systems	Specialized air pollution treatment equipment; equipment for recovery units; smokeless flares, rapper recovery crude oil; sulfur

Source: EQMS India Pvt., Ltd.

Table 23: Generic Technology Needs/Business Opportunities in the Industrial & Municipal Water/Wastewater Treatment Sector in India..

Sector	Technology Required
Industrial Sector	
Process water treatment filtration systems	Advance reverse osmosis membranes
Dyes and dye intermediates, tanneries, nitrogen fertilizers, pesticides, pulp and paper	Total dissolved solids removal/reduction
Man-made fiber, pesticides, coke-oven electroplating, pharmaceuticals	Heavy metals removal/reduction
Dyes and dye intermediates, petrochemicals	Biological and chemical oxygen
Man-made fibers, textiles	Demand reduction, advanced oxidation process (wet oxidation, ultraviolet oxidation)
Sugar, distilleries, pulp and paper	Fixed film anaerobic bio-methanation systems, energy efficient biological treatment systems, energy recovery
Systems, sludge handling systems	
Dyes and dye intermediates, food processing, electroplating	Small and energy efficient package treatment systems
Pulp and paper, nitrogen fertilizers	Nitrification/denitrification systems
Pesticides, phosphatic fertilizers, nitrogenous fertilizers, distilleries	Special pollutant treatment
Pulp and paper	Caustic recovery/color removal systems
Nitrogenous fertilizers	Fluidized-bed biological treatment/trickling filter
Pesticides	Toxicity reduction
Coal mines	Coal beneficiation plants
Galvanizing industries	Acid recovery systems
Electroplating industries	Cyanide treatment, metal ion recovery systems
Tanneries	Chromium recovery systems
Industries located in coastal areas	Desalination plants
Small and medium-sized enterprises	Compact and prefabricated packaged systems
All industries	Rotary bio disc systems, sequencing batch reactor systems, reciprocating ion exchange and automated chemical dosing systems, systems for oil removal from sludge
Municipal sector	
Water treatment	Ultraviolet disinfection
Wastewater	Advanced oxidation systems, energy efficient aerators, sewerage farming, up-flow anaerobic sludge blanket (UASB) process
Analytical/Monitoring Equipment for Industrial and Municipal Sector	Auto analyzers for phosphate and nitrogen, thermo and municipal sector hydrograph, total organic carbon analyzer, electronic flow meters, ultra centrifuge micro-pure filtration units, ion electrodes for fluoride, cyanides, NO_3 and NH_3, Spectrophotometers, continuous pH meters.

Source: EQMS India Pvt., Ltd.

Table 24: Major Waste Projects in India Financed by Housing and Urban Development Corporation, 1997-1999

Project	Cost (US$M)	Loan (US$M)	Component Financed	Year of Approval
Bagasse-based co-generation project at Satara, Maharashta	18.6	8.31	Boiler, turbine, pollution control equipment	1998
Power production from waste at Nagpur	11.26	2.78	Pre-processing equipment, manure production equipment, digestors, dual-fuel engines	1999
Bagasse-based co-generation project at Satara, Maharashta	9.53	3.92	Boiler, turbine, pollution control equipment	1999
Solid waste management for the twin cities of Hyderabad and Secunderabad	3.45	2.47	Equipment for storage, collection and transportation	1997
Solid waste management project for Cochin	2.45	1.42	Development of sanitary landfills, incinerators for medical waste	1997
Solid waste management project for Calicut	1.50	0.58	Equipment for storage, collection and transportation, Compost plant (owned by the O&M corp.)	1997
Solid waste management project for Imphal, Manipur	1.07	0.66	Equipment for collection and transportation, Compost plant	1999
Solid waste management project for Shillong	1.01	0.61	Equipment for collection and transportation, Compost plant	1998

Source: Housing and Urban Development Corporation, Ltd., and EQMS India Pvt., Ltd

Table 25: Municipal Solid Waste Disposal in Selected Countries, 1997

Country	Land filling	Op. Dumping	Composting	Incineration	Other
China	30	50	10	2	8
India	15	60	10	10	
Indonesia	10	60	15	2	13
Korea	60	20	5	5	5

Table 26: Foreign Companies Active in Korea's Market for Municipal Incinerators

Country	**Foreign Company**	**Korean Partner**
Japan	Hitachi Zosen	Daewoo Corp
	Kawasaki Heavy Industry	LG Construction
	Mitsubishi Heavy Industry	Samsung Heavy Industry
	Sanki	Kolon Engineering & Construction
	NKK	Jindo Construction
Germany	Deutsche Babcock	Hyundai Heavy Industry
	Steinmuller	Dongbu Corp
Denmark	Volund	Halla Industry Development
Belgium	Seghers	SK Engineering & Construction
France	Stein Industry	Samsung Corp
Switzerland	ABB	SK Engineering & Construction
		Hyundai Precision & Industry

Source: Adapted from: Ministry of Environment, Status of Municipal Incinerators (June 2000).

p. 285 Section II (Nakaune's Report) Table 2 Export of Environmental Equipment from Japan

(Unit: Million Yen)

	East Asia										West Asia		Others		Total	
	Korea		China		Thailand		Others		Total		Total					
	FY2000	FY2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
Air pollution control equipment	336	346	2,363	993	4,953	265	7,504	3,958	15,156	5,562	2,912	5,852	3,185	5,345	21,253	16,759
1.Dust collectors	57	192	1,397	268	176	27	498	677	2,128	1,164	0	0	26	146	2,154	1,310
2.Flue gas desulfurization equipment	189	101	892	647	4,630	0	4,703	1,680	10,414	2,428	2,690	5,806	122	1,420	13,226	9,654
3.Others	90	53	74	78	147	238	2,303	1,601	2,614	1,970	222	46	3,037	3,779	5,873	5,795
Water pollution control equipment	514	618	8,497	3,408	196	171	8,125	4,291	17,332	8,488	1,813	7,903	3,818	923	22,963	17,314
1.Industrial wastewater treatment equip	420	425	3,737	754	80	46	4,630	2,715	8,867	3,940	709	1,206	696	148	10,272	5,294
2.Sewage treatment equip.	0	0	0	0	43	0	1,899	53	1,942	53	0	4,752	2,312	455	4,254	5,260
3.Others	94	193	4,760	2,654	73	125	1,596	1,523	6,523	4,495	1,104	1,945	810	320	8,437	6,760
Waste treatment equipment	1,126	129	1,761	702	20	13	6,790	4,946	9,697	5,790	55	41	946	739	10,698	6,570
1.Urban waste treatment equipment	906	94	916	125	9	5	5,274	3,825	7,105	4,049	52	20	0	20	7,157	4,089
2.Industrial waste treatment equip	10	28	474	3	0	0	184	636	668	667	0	0	696	653	1,364	1,320
3.Others	210	7	371	574	11	8	1,332	485	1,924	1,074	3	21	250	66	2,177	1,161
Noise and vibration control equipment	48	205	2	0	2	0	83	165	135	370	2	79	7	7	144	456
1.Noise control equipment	3	86	2	0	1	0	83	25	89	111	2	0	7	7	98	118
2.Vibration control equipment	45	29	0	0	1	0	0	75	46	104	0	44	0	0	46	148
3.Others	0	90	0	0	0	0	0	65	0	155	0	35	0	0	0	190
total	2,024	1,298	12,623	5,103	5,171	449	22,502	13,360	42,320	20,210	4,782	13,875	7,956	7,014	55,058	41,099