

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 in 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. Businesses 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 m³, 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, 10 ³ US\$/km ²)	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 concerns. 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 endangered 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.

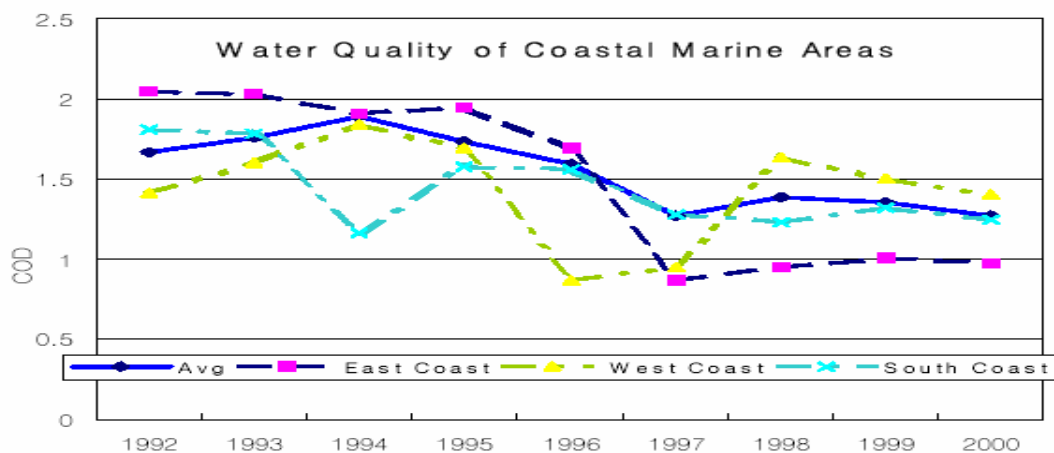
The government regularly conducts natural environment surveys, and designates and supervises so-called Ecosystem Conservation Areas. There are seven sites designated as National Ecosystem Conservation Areas, including migratory waterfowls habitats found at the Nakdong River estuary. Eight other areas 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

	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

Unit: BOD (ppm)

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 (SO₂), 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 Friendly 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		1999		2000(p)	
			Share(%)		Share(%)		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 EMS¹

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 Comple, 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

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 customers, 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
SIEMENS		ISO-14001	Comboard	ISO-14001
TOSHIBA		ISO-14001	Fujikura	ISO-14001
SMK		ISO-14001		
ALCATEC		ISO-14001		
FUJITSU		ISO-14001		
KENWOOD		ISO-14001		
PHILIPS		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 from 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 Chihuahangdao 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 1997 and 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 Table 15. These imports are considered to contribute to the upgrade of technology level of Korea's water treatment technology.

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	Market Share	Total Exports	Market Share
	1997	1997	1998	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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