

# Korea Environmental Policy Bulletin

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## Environmental Technology Development and Distribution Policies

### 1. Introduction

In the Korean Act on Environmental Technology Development and Support in Korea, environmental technology is defined as "technology necessary for preserving and managing the environment including the enhancement of assimilative capacity, suppressing and removing causes of environmental damages on humans and nature, preventing and reducing environmental pollution, and recovering polluted and destroyed environment. The definition does not mention the cost of technology, but focuses on preventing and reducing damages on the environment and humans. However, contemporary environmental technology means in two ways. One is environmental technology as a means of protecting people's health and the natural environment by solving environmental problems resulting from industrial activities. This means not only reduce of the environmental pollution, but also sustainable development possibly by securing the environment for future generations. This is environmental technology defined by law. Another is the environmental technology as a basic element that determines the success of the environmental industry, which has grown newly. The civil society's demand for the preservation and pleasure of the environment is a driving force behind the growth of the environmental industry. The environmental industry is already seen as one of the new industry that lead the 21st century. For the continuous growth of the environmental industry, it is obvious that we obviously need outstanding environmental technologies. The environment management is strengthened and expanding in Korean environmental markets are also exploding in neighboring Asian countries including China. All these brighten the future of the environmental industry.

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In the 1980s, Korean environmental technology was much inferior to that of developed countries such as the U.S. and Germany. At that time, people were more interested in economic growth than in environment protection. In addition, environmental problems were not global issues. However, since the late 1980's, political and economic progress has quickened democratization and increased national income, which has greatly changed the people's awareness of environment. The accident of the pollution of the Nakdong River with phenol in 1991 was an important turning point that engraved the importance of environmental problems in people's mind. Through the accident, there was a social consensus that advanced environmental technology must be secured first to solve environmental problems. Since then, environmental technologies began developing actively. "G-7 Environmental Technology Development Project" was launched in 1992, and the Act on Environmental Technology Development and Support was established to provide legal support for environmental technology development in Korea. Although government had supported, the Act accelerated environmental technology development and currently it is the legal ground of all governmental policies for environmental

technology development and distribution.

In this background, environmental technology development policies in Korea have been executed with two objectives, namely, the environmental preservation and the promotion of the environmental industry. The governmental programs are aimed for developing the various policies to promote the development of the environmental industry and to secure advanced environmental technologies with high efficiency. Various interest groups participate in making policies on environmental technology development. They include environmental technology specialists, environmental corporations, general corporations as consumers, policy makers in the government, the press and NGOs. This study briefly introduces the overall environmental technology development in Korea and a detailed explanation about the meanings of the three major policies. Three policies include "the next-generation core environmental technology development project," which is a technology development program aimed at becoming a country with advanced environmental technology, "the new environmental technology verification system," which is to certify the applicability of technologies owned by environmental corporations as well as environmental technologies developed

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- 1989 Clean energy development project (MOCIE)
  - 1992 G7 Environmental technology development project (MOE)
  - 1992 G7 New energy development project (MOCIE)
  - 1995 Clean production technology (MOCIE)
  - 1997 Critical technology development project (MOST): Greenhouse gas reduction technology, water resource development technology
  - 1999 40 environmental NRL(National Research Laboratory) (MOST)
  - 2000 Frontier project(MOST): Industrial waste technology, sustainable water development technology
  - 2001 Core environmental technology development project for next generation (MOE)

<Figure 1> History of major environmental technology development projects in Korea (Source: Next-generation environmental technology development projects, July 2002)

from various sources including "the next-generation core environmental technology development project," and "the local centers for environmental technology development" system, which is to solve environmental problems that arises in regional level and to give local businesses consultation on environmental problems.

## 2. Environmental technology development project

### 2.1 Characteristics of demands for technoly

#### (1) Characteristics of social demands

Korea has a small territory and high population density. Korea is however the 10th largest economy in the world due to rapid industrialization, which is why Korea suffers from various environmental problems. Thus, the development policies of the environmental technology also related closely to the social conditions of Korea. The social conditions relate to the demand for environmental technologies are as follows.

- ① Concentration of population in urban areas: Korean population is concentrated into urban areas so densely that its urbanization rate is as high as 90%. In particular, the Seoul Metropolitan Area is suffering from serious air pollution and heat island effect caused by exhaust gas from vehicles and lack of water resources. There are also environmental issues related to living environment such as the noise, lack of green areas and disposal of wastes.
- ② Large-scale industrial complexes: Korea has consistently promoted policies for developing industrial complexes to accommodate manufacturing facilities in specific areas and, as a consequence, large-scale industrial complexes are scattered around the country. Industrial complexes separate manufacturing facilities causing pollution from residential areas, protecting people from direct damages

of pollution. However, the excessive environmental load upon specific areas causes another environmental problem. Representative industrial complexes in Korea include the petrochemical industrial complexes in Ulsan and Yeosu and several industrial complexes around the Seoul Metropolitan Area.

- ③ Geographical conditions: Korea is surrounded by the sea on the three sides and 70% of the land is covered with mountains and forests. Because the size of usable land, namely, flat fields is small, the population or industrial activities are concentrated on the specific areas and this aggravates environmental pollution. On the other hand, this has been a reason for the fine preservation of the natural ecosystem. The sea itself forms a beautiful landscape and the quality control of river water flowing into the sea is also an important task. Moreover, large-scale land reclamation projects are being executed to expand the land and they are triggering concerns over tidal flat.
- ④ International environmental problems: As a heavy energy-consuming country, Korea copes with the problem of global climate change. In addition, we need to deal with environmental problems common to neighboring countries China and Japan such as long-range transboundary pollutants and to prevent the pollution of the Yellow Sea.

In this way, various environmental problems are related closely to the social and geographical conditions, which are unique to Korea. Accordingly, technology development policies have to reflect the characteristics of Korea, and such characteristics are appropriately reflected in the government's mid- and long-term strategies for environmental technology development.

#### (2) Changes in technology paradigms

Social demands for technologies are directly related to specific environmental problems but, on the other hand, they are closely connected to social values, namely, people's consciousness of the environment. For example, if people's awareness of environmental problems is low and

social capacity is poor, efforts are concentrated on the reduction of the discharge of pollutants from their sources. Thus, technologies are required for solving visible environmental problems caused by such as dust and COD and these efforts are usually made after pollution. Like this, environmental technologies before 1990 were usually for end-of-pipe technology. However, end-of-pipe technologies were criticized for their limitations in the improvement of efficiency, high marginal costs, irrecoverable environmental damages by pollutants that cannot be solved with post-management technologies, etc.

With these criticisms and the advance of technologies, pollution prevention technologies began being emphasized from the 1990s. Because it

is impossible or take much cost and time to identify the effects of numerous pollutants on human health and environmental impacts, international society is changing its direction to prevent the pollution at the sources. Pollution prevention technologies have been spot-lighted in connection with clean technologies or manufacturing process technologies since the 1990s. Because pollution prevention technologies require detailed knowledge about each manufacturing process as well as know-how of various technologies other than those in the environmental area, they promoted the participation of manufacturers and specialists in other areas.

While pollution prevention technologies were emphasized, discussions was made on the nature of environment management means, namely,

<Table 1> Change in the paradigm of environmental technology by period

Period	1980s	1990s	2000s
<b>Paradigm</b>	<ul style="list-style-type: none"> <li>Dispose pollutants efficiently and manage pollution sources</li> </ul>	<ul style="list-style-type: none"> <li>Pollution prevention (minimize the discharge of pollutants and recycle them)</li> </ul>	<ul style="list-style-type: none"> <li>Establish total environment-friendly society</li> <li>Manage receptor-centered environment</li> </ul>
<b>Goal of technology development</b>	<ul style="list-style-type: none"> <li>with environmental regulations (solve current environmental problems)</li> </ul>	<ul style="list-style-type: none"> <li>Cope with regulations and save resources (strengthen environmental competitiveness)</li> </ul>	<ul style="list-style-type: none"> <li>Resolve environmental pollution load</li> <li>Preserve and restore natural ecosystem</li> </ul>
<b>Major characteristics of technology development</b>	<ul style="list-style-type: none"> <li>End-of-pipe technology (waste treatment)</li> </ul>	<ul style="list-style-type: none"> <li>Cleaner production technology</li> <li>Environment-friendly products</li> </ul>	<ul style="list-style-type: none"> <li>Restore and revive the environment</li> <li>Forecast and cope with long-term environment changes</li> </ul>
<b>Major technologies</b>	<ul style="list-style-type: none"> <li>Hazardous gas removal technology</li> <li>Dust collection technology</li> <li>Waste water /sewage treatment technology</li> <li>Water purification technology</li> </ul>	<ul style="list-style-type: none"> <li>Low-pollution manufacturing process technology (minimize the discharge of pollutants from manufacturing process and recycle them)</li> <li>Use low-pollution materials</li> </ul>	<ul style="list-style-type: none"> <li>Soil and groundwater remediation, ecosystem restoration technology</li> <li>Environment monitoring and detect</li> <li>Environmental risk assessment and</li> </ul>
<b>Characteristics of technology</b>	<ul style="list-style-type: none"> <li>Characteristics of technology</li> </ul>	<ul style="list-style-type: none"> <li>State-of-the-art engineering technology</li> </ul>	<ul style="list-style-type: none"> <li>Science-based technology</li> <li>Fusion technology</li> </ul>
<b>Academic area</b>	<ul style="list-style-type: none"> <li>Environment/chemical engineering, mechanics, electronics</li> </ul>	<ul style="list-style-type: none"> <li>Environment/chemical engineering, mechanics, electronics, life science, new material</li> </ul>	<ul style="list-style-type: none"> <li>Life science, health and medicine, new material, nano-tech, information, electronics and communication, etc.</li> </ul>

SOURCE: THE MINISTRY OF ENVIRONMENT, 10-YEAR COMPREHENSIVE PLAN FOR NEXT-GENERATION SOURCE ENVIRONMENTAL TECHNOLOGY DEVELOPMENT, 2002

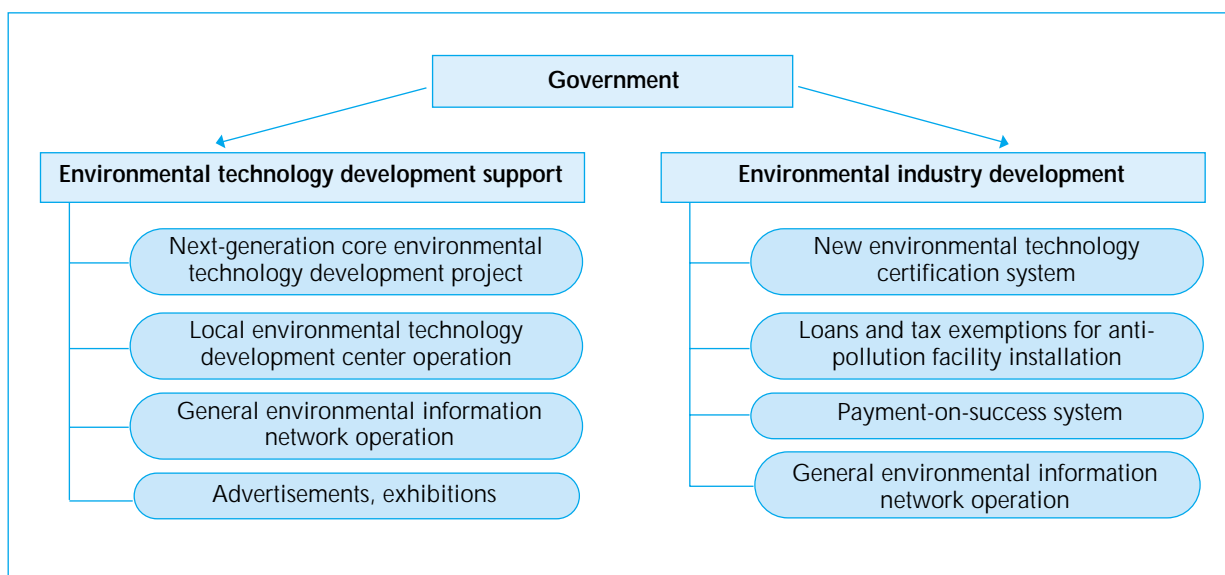
whether existing environmental standards including pollutants under control are harmless to the human body or the natural ecosystem and, these discussions convinced people of the importance of measuring the harmful effects of pollutants. In addition, as new health risks such as environmental hormones were found, there were public opinions that overall inspections are necessary for all chemicals. Moreover, since international agreements such as POPs Convention and United Nations Framework Convention on Climate Change are coming into effect, new technologies need to be developed. The recovery and preservation of natural ecosystem were also recognized as important tasks. Entering upon the 2000s, these discussions grows more active but the development of relevant environmental technologies are hardly possible without governmental support because they require high-level scientific knowledge, analysis and cost. <Table 1> shows the trends and characteristics of environmental technologies by different periods.

## 2.2 Environmental technology development system

Governmental policies for promoting

environmental technology development are largely divided into environmental technology development and environmental industry development.

First, environmental technology development projects are programs to develop and supply environmental technologies demanded by society or manufacturers and a representative project is the government-led "next-generation core environmental technology development project." In addition, the program to operate and support "local ecnters for developing environmental technology" with the objective of solving environmental problems of local regions can be considered as an environmental technology development program in the broad sense. Environmental industry development policies include direct and indirect support to environmental corporations, e.g. give extra points to public tenders for new environmental technologies, the operation of web sites providing information on environmental technologies and the hosting of exhibitions promoting environmental technologies. In addition, special loans and tax exemptions for the installation of environmental facilities by general manufacturers may expand the size of the environment market. These are diagrammed in <Figure 2>.



<Figure 2> Schematic diagram of environmental technology development system

## 2.3 Next-generation core environmental technology development project

The "next-generation core environmental technology development project" is one of the representative environmental technology development projects implemented by the Korean government. A total of 1 trillion Won will be invested in the project from 2001 to 2010. To reflect changes in social demands for environmental technologies and the progress of environmental technologies as mentioned above, the project is composed of three stages. As of

2005, the second stage is in progress. In this section, we will examine in detail the "next-generation core environmental technology development project."

### 2.3.1. Program design

#### ■ History

Since the program is a long-term R&D project that will continue on until 2010, it is important to establish detailed plan on the ultimate goal of the project, objectives for each stage, implementation strategies, required technologies, guideline for budget allocation, and technology map for 10

<Table 2> Formation and roles of committees

Classification	Status and roles
Planning committee	<ul style="list-style-type: none"> <li>- Consist of sspecialists from industry, universities, research institutes, NGOs and the government, and give advices on the directions of planning.</li> <li>- Give advice on sub-committee activities (derive key tasks, prepare TRM, set the detailed goals of technology development)</li> <li>- Make decisions on major issues related to planning (setting strategic goals, planning methods and procedures, examine the results of planning, etc.)</li> </ul>
Technology committee	<ul style="list-style-type: none"> <li>- Consist of around 10 specialists in specific area (elect the chairperson and executive secretary)</li> <li>- Identify key technology areas through analyzing technology demands and markets</li> <li>- Set key programs and derive technologies in need</li> <li>- Prepare reports on the technology roadmap</li> </ul>

year period. For this, a task force team was formed in 2001, and the team drew up "a 10-year comprehensive developmnt plan for the next-generation core environmental technology" after about one year preparation period.

The technology roadmap needed for the comprehensive plan was drawn up by seven "technology committees" composed of 10 experts in each area. In addition, a "planning committee" was formed with representatives from the government, universities, research institutes, corporations, the press and NGOs. When the plans were drafted, the public's opinions were collected through public hearings and the plans

were finalized through the government's internal revision.

#### ■ Program design procedure

The comprehensive plan began with the basic objective of realizing national long-term environmental visions and supporting sustainable development by integrating the environment and economy without overlapping with the basic direction of other governmental agencies. Under the principles, we conducted a survey of policy makers, researchers, NGOs and corporations on demands for technologies and, based on the results, the meeting of the technology committee

was held and major environmental issues were derived. Using the results, the research team developed draft core programs, and reviewed and finalized programs in the technology committee. A questionnaire survey was conducted using AHP (Analytic Hierarchy Process) method to reflect specialists' qualitative opinions in deciding the priority of the goals of multi-dimensional policies in the decision of the priority of core programs. In this project, mutual comparison was made between draft core programs and their priority was decided through statistical processing of the results of mutual comparison.

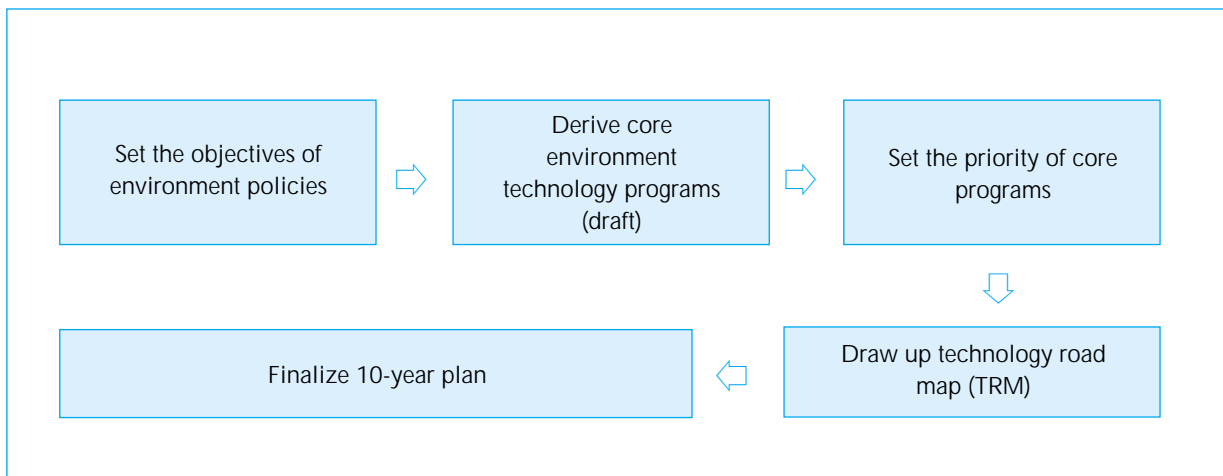
Based on core programs (draft) with priority decided, a 10-year technology map was drawn by the technology committee and finalized through public hearings and reflection of

people's opinions. The complicated process was taken because the project is of large scale up to 1 trillion Won and would result in the foundation of environmental technology development policies in Korea. In the process, important matters were reviewed by as many experts and general public as possible and actually many experts participated in the process. <Figure 3> shows the process of program design explained above.

### 2.3.2. Outline of the project

#### ■ Objectives

The ultimate objectives of the proposed project until 2010 are summarized into five; First, securing technologies for managing pollution related to air, water and wastes on the level of



<Figure 3> Schematic diagram of program design procedure

developed countries. The second objective is improving technologies for recovering ecosystem, pollution prevention, preserving global environment and improving health environment to meet 80% of the level of developed countries. The third one is creating 10 or more world-best products through technology development. Fourth, independent environmental risk assessment methods and environmental risk management models will be developed. The last objective is the securith of future core technologies. The government forecasts that with

successive achievement of these ambitious objectives, Korea will be one of the five major countries in the world in terms of environmental technology in the year of 2010.

The project was executed in three stages and each stage has its goals. The first stage, which is until 2003, secures technologies for imminent environmental problems and develops basic technologies for risk assessment. Stage 2, which is until 2007, develops key technologies for risk assessment and monitoring as well as competitive environmental technology products by improving

technologies developed in stage 1. Stage 3, which is until 2010, secures future core technologies and unique technologies for assessing harmful environmental effects and monitoring infinitesimal quantities of pollutants, which are the ultimate objectives of the project.

#### ■ Research fund investment plan

The total amount of research funds for the present project is 1,435 billion Won, 1,000 billion Won by the government and 435 billion Won by private corporations. The government already funded 195 billion Won in stage 1 until

<Table 3> Technology development goals in each stage of the next-generation core environmental technology development project

Technology	Stage 1 (2001 ~ 2003)	Stage 2 (2004 ~ 2007)	Stage 3 (2008 ~ 2010)
Monitoring	◐	◑	●
Assessment	◐	◑	◑
Treatment	◐	◑	●
Prevention	◐	◑	◑
Management	◐	◑	◑

Note) ◐: Low-level technology, ◑: Elementary technology, ◑: Partial technological innovation, ◑: Independent technological innovation, ●: World-class technological innovation

SOURCE: THE MINISTRY OF ENVIRONMENT, TEN-YEAR COMPREHENSIVE PLAN FOR NEXT-GENERATION SOURCE ENVIRONMENTAL TECHNOLOGY DEVELOPMENT, 2002

<Table 4> Investment plan for the next-generation core environmental technology development project in stages

	Stage		1 (2001 ~ 2003)	2 (2004 ~ 2007)	3 (2008 ~ 2010)
Funds (billion Won)	Total	1,435	280	660	495
	Government	1,000	195	460	345
	Private Corp.	435	85	200	150

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