

# Appendix **4**

## **Korea Country Review: Reviewing Sustainable Development Policy in Korea; Past and Future Direction**

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March 2009

**This chapter should be cited as**

Kim, J.-I. (2009), 'Reviewing Sustainable Development Policy in Korea; Past and Future Direction', in Habito, C. F. and S. Kojima (eds.), *Mainstreaming Sustainable Development Policies in East Asia*. ERIA Research Project Report 2008-6-2, Jakarta: ERIA.

## **Appendix 4**

### **Korea Country Review**

## A.4 Reviewing Sustainable Development Policy in Korea; Past and Future Direction

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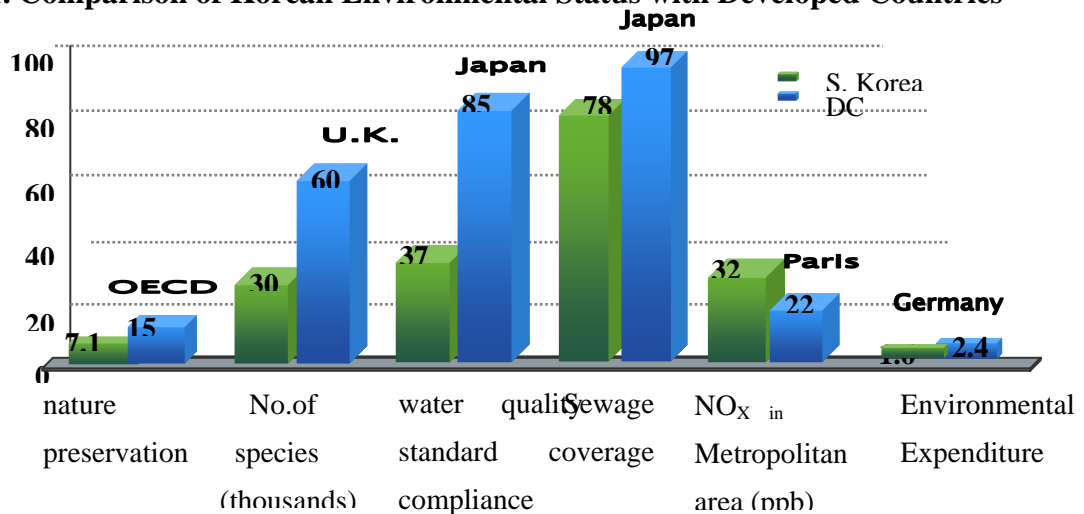
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### 1. Background of Korea

The Korean peninsula is surrounded by the Pacific Ocean on three sides with more than 3,200 islands, and the coastline extends for about 17,000 km. The continental shelf including tideland accounts for twice the size of terrestrial land at 500,000 km<sup>2</sup>, of which 80% is located along the west coast. With population of 48 million, Korean population density with 481 people per km<sup>2</sup> is among the highest in the world and hence causes high burden on the environmental pressures.

**Figure 1. Comparison of Korean Environmental Status with Developed Countries**



Source; Lee Chang Heum, "Major Environmental Policies of Korea and Future Direction," 2007.5.30

The number of species in Korea is believed to be around 100,000 kinds. However, besides from vertebrate and flowering plant species, species are not well known exactly. However, total number of 29,852 known species is identified so far<sup>1</sup> Average yearly precipitation is 1.3 times

<sup>1</sup> 18,052 animal species, 821 plant species, and 3,528 species of mycota and protista.

<sup>2</sup> OECD average was 41%

more than the world average at around 1,283mm, however due to high population density per capita precipitation per year is 2,705 tons, which is 10% of the world average. Rainfall is usually in the summer season, so streams and rivers often become dry for most of the year, which makes water supply is very vulnerable to heavy volume of water fluctuations.

Korean's forests have cool-temperate and warm-temperate at the same time. The warm-temperate zone is south of the 35° north latitude where the annual mean temperature is over 14°C. The cool-temperate zone is in the 35~45° north latitude where the annual mean temperature is 6~14°C. Most of Korean territory lies in the cool-temperate zone where the forests are dominated by broad-leaved deciduous species such as *Quercus* spp., *Acer* spp., *Fraxinus* spp. Although 63% of the total land area is covered by forests, 87% of the trees are less than 30 years old, and have not yet reached full maturity. Most of the timber is importing and domestic supply rate shows a merely 13%.

After the Korean War, Korean economic growth was quite high until economic crisis in 1997. Even if Korea had overcome economic crisis, economic growth rate was not high compared to before economic crisis Korean economy achieved about 4-5% economic growth rate per annum. As a result of rapid economic growth, energy consumption has also increased. In terms of energy consumption, Korea ranked as 10th in the world, oil imports as 4th, and oil consumption as 7th as of 2006.

**Table 1. Comparison of World's Energy Consumption with Korea, 2006**

Division	1	2	3	4	5	6	7	8	9	10
Energy consumption (million toe)	America 2,326	China 1,698	Russia 705	Japan 520	India 423	Germany 329	Canada 322	France 263	England 227	Korea 226
Oil imports (million toe, '05)	America 600	Japan 216	China 127	Korea 117	Germany 115	India 102	Italy 95	France 84	Netherlands 63	Spain 61
Oil consumption (million bbl/d)	America 20.6	China 7.4	Japan 5.2	Russia 2.7	Germany 2.6	India 2.6	Korea 2.3	Canada 2.2	Brazil 2.1	Saudi 2.0

Source: MKE, "Energy Information Korea," 2008. 4.

## 2. Serious Environmental Problems from Economic Growth

Korea's economy grew overall by 116% during 1990 – 2004.<sup>2</sup> while its population grew by 12%. Except from the recession period from 1997-2000, GDP has continuously increased between

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1990 and 2004. GDP increased by 33% while industrial production increased by 71%, road freight traffic by 41%, total primary energy supply by 19%, and total final consumption of energy by 17% <See (Table 2)>.

During 1990-2007, SO<sub>x</sub> emissions were strongly decoupled from economic growth, primarily due to adoptor of industrial combustion technology such as low-sulphur heavy fuel oil, strengthening of emission standards, and imposition of an heavy emission charges. However NO<sub>x</sub> emission increased from industrial combustion and road transportation.<sup>3</sup> Intensity of CO emissions is highest among the OECD standards.

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<sup>3</sup> SO<sub>x</sub> emissions per unit of GDP are well below the OECD average while NO<sub>x</sub> emission per unit GDP are close to the OECD average

**Table 2. Economic Trends and Environmental Pressures (% change)**

	1990-2004	1997-2004	2007
Selected economic trends			
GDP <sup>a</sup>	116	33	5.0 <sup>a</sup> (969.3 <sup>a</sup> billion us\$)
Population	12	5	4.84mill
GDP <sup>a</sup> /capita	93	27	20,045US\$
Agricultural production	14	-4	-
Industrial production <sup>b</sup>	192	71	-
Car Ownership <sup>c</sup>	395	35	10,880,000
Selected environmental pressures			
Pollution intensities			
CO emissions from energy use <sup>c,d</sup>	98	7	1.9(2005)
SOx emissions <sup>c</sup>	-46	-36	-
NOx emissions <sup>c</sup>	47	7	-
Energy intensities <sup>e</sup>			
Total primary energy supply	127	19	3.0
Energy intensity (per GDP)	5	-10	0.34h)
Total final consumption of energy	122	17	3.4
Resource intensities			
Water abstractions <sup>f</sup>	28	3	-
Nitrogenous fertiliser use <sup>c</sup>	-29	-29	-
Pesticide use <sup>c</sup>	-13	-9	-
Municipal waste	-32 <sup>g</sup>	6 <sup>c</sup>	-

a) At 2000 prices and purchasing power parities.

b) Includes mining, quarrying and manufacturing, electricity, gas and water industries.

c) To 2003.

d) Sectoral approach excluding marine and aviation bunkers.

e) 2004: estimates

f) To 2002

g) 1992-2003

h) This single year data

i) ton/1000\$

Source: EMEP; FAO; IEA; OECD. 2006. MKE, "Energy Information Korea" 2008. 4

The Korea has driven its economic development based on oil-intensive industry. Therefore, primary objective of the Korea's energy policy has been to secure an economically stable supply of energy. This policy has been promoted by governmental intervention and regulation rather than free competition. However, restructuring has been carried out in the energy industry since the late 1990s based on the Plans for Privatization of State-owned Companies initiated in 1999. Government regulations were reduced, leading to price liberalization in the oil sector, eliminated entry barriers, and restructured electricity and gas industry.

Table 3. Major Indicators of Energy

	'95	'96	'00	'01	'02	'04	'07
Primary Energy Consumption (1000 TOE)	150.437	165.209	192.887	198.409	208.600	220.238	240.5
Per capita (TOE)	3.34	3.63	4.08	4.191	4.379	4.58	4.96
Energy / GDP Ratio	100	102.9	101.6	104.2	103.9	103.2	103.4
Overseas Dependence Ratio	96.8	97.3	97.2	97.8	97.3	97	97

Note: 1) dependence ratio: petroleum imports amount out of total energy imports,

2) Energy /GDP: TOE/ 1990's 1000 US\$

3) Mid-year estimates

Source: KEMCO, "Handbook of Energy Saving," 2005, MKE, "Energy Information Korea" 2008. 4

Primary energy consumption over the past thirty years had increased rapidly along with economic growth from 19 million TOE (ton of oil equivalent) in 1970 to 240 million TOE in 2007<sup>4</sup>. As a result, Korea has become one of the world's 10 major energy consumers, hence, dependence on overseas energy sources has also a risen from 87.9% in 1990 to 97% in 2007. As of 2005, Korea is the sixth largest oil consumer and the fourth largest oil importer.

Table 4. GHG Emission and Key Indexes in Korea

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<sup>4</sup> Per capita consumption has increasing form 0.61 TOE in 1970 to 4.58 TOE in 2002.

	1990	1995	2000	2002	2004	2005	1990-'05 Annual Increasing Rate
GHG Emission (million tCO <sub>2</sub> )	300.0	451.8	528.5	569.0	587.3	591.1	4.6
Per capita(tCO <sub>2</sub> /person)	7.00	10.02	11.24	11.95	12.21	12.24	3.8
GHG Intensity (tCO <sub>2</sub> /Million Won, 00)	0.94	0.97	0.91	0.89	0.85	0.82	-0.9

Source: KEEI, “3<sup>rd</sup> National GHGs Report”. 2006.12

Korea has not adopted any domestic quantitative targets for overall green house gases emissions. However, since the late 1990s, Korea has prepared four national action plans focused on research, studies, mitigation of GHG emissions, and adaptation to climate change trends so far. Now the government is working for the 4<sup>th</sup> National Plan.

Since 1990, Korea’s CO<sub>2</sub> emissions from energy use have essentially doubled. No decoupling of CO<sub>2</sub> emissions from GDP growth has been achieved. Korean economic growth remains largely based on energy-intensive heavy industries and a petroleum-dependent transport sector. The energy intensity of the economy grew by 7.2%, as compared with decreases in energy intensity in most other OECD countries, e.g. France (-4.7%), Germany (-20%), Japan (-0.5%), Mexico (-10.4%), United Kingdom (-19.1%) and United States (-18.9%). Korea’s increase in energy production and intensity resulted in an increase in CO<sub>2</sub> emissions of 98.2%, in contrast to much lower increases in Japan (+19%), Mexico (+28%) and the United States (+18%), and an actual decrease in Germany (-12%) and the United Kingdom (-4%).



**Table 5. Current Status of Emission from GHG by Sector**

	1990	2000	2002	2003	2004	2005	<i>Increasing Rate/yr</i>
Energy	247.7	438.5	473.0	481.4	490.2	498.6	5.0%
	79.8	(83.0)	(83.1)	(82.7)	(83.0)	(84.3)	
		)					
Industry	19.9	58.3	64.5	68.7	69.4	64.8	9.3%
	(6.4)	(11.0)	(11.3)	(12.0)	(1.7)	(11.0)	
		)					
Agriculture	17.5	16.2	15.8	15.5	15.9	14.7	-0.7%
	(5.6)	(3.1)	(2.8)	(2.7)	(2.7)	(2.5)	
Waste	25.5	15.6	16.0	15.6	15.1	13.0	-3.7%
	(8.2)	(3.0)	(2.8)	(2.7)	(2.6)	(2.2)	
Total	310.6	528.6	569.3	582.3	590.6	591.1	4.7%
Emission	(100)	(170)	(183)	(187)	(190)		
Land use/ Forestry	-23.7	-37.2	-33.4	-33.3	-33.3	-32.9	2.4%
	(-7.6)	(-7.0)	(-5.9)	(-5.8)	(-5.6)		
<b>Net Emission</b>	286.8	491.4	535.9	548.6	557.3	558.3	4.9%
	(100)	(171)	(187)	(191)	(194)		

Source; KEMCO, "Handbook of Energy Saving," 2005, KEEL, National Report, 2007.10(draft)

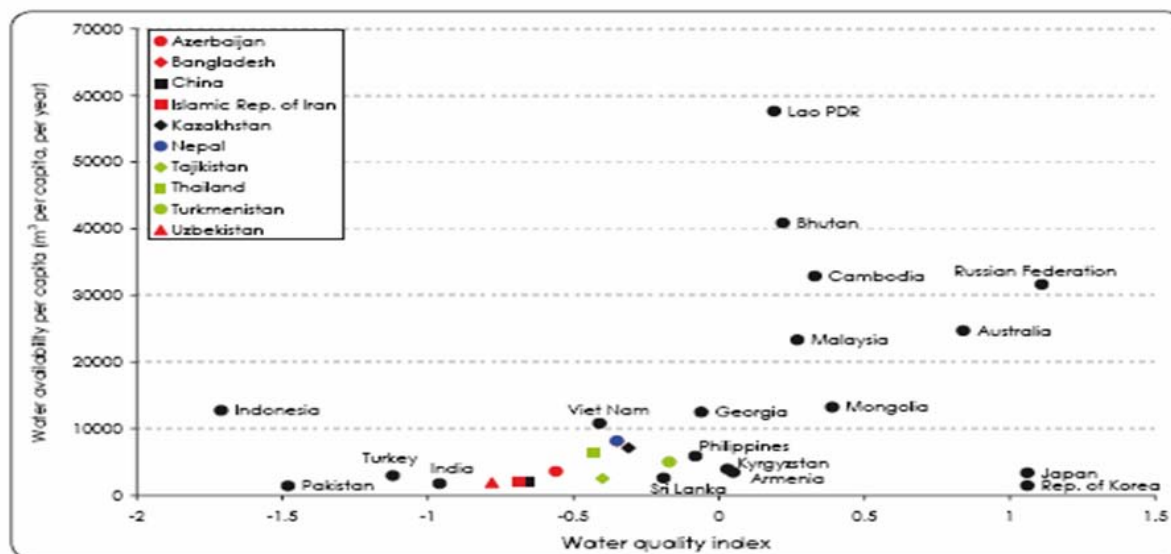
Korea is, however, counting on several factors to promote a steady decrease in the rate of growth of GHG emissions from 2005. These include: i) improved energy conservation and efficiency; ii) less reliance on fossil fuels in the energy mix ; and iii) a dematerialization of its economy.

After increasing by 10% between 1994 and 1998, water withdrawals were weakly decoupled from GDP growth due to declines in public water supply and irrigation facility.

Public water supply declined with some reasons ) a reduction in non-paying uses and leakages, and ) reduced household consumption, partly reflecting water price increases. In the early 2000s, the intensity of water use was among the highest in the OECD area and it is probably still very high by OECD standards, reflecting the widespread use of irrigation for rice production. Water quality has largely improved over the years, but non-point source pollution such as run-off from agricultural fields, forests, and roads has become most serious problems. (See Figure 2)

**Figure 2. Water Availability and Water Quality**

**Water availability vs. water quality**



Sources: FAO AQUASTAT online database, accessed on 18 August 2005 from <<http://www.fao.org/ag/agl/aglw/aquastat/main/index.stm>>; Esty, Daniel C., Mark Levy, Tanja Srebotnjak and Alexander de Sherbnin (2005). Environmental Sustainability Index: Benchmarking National Environmental Stewardship (New Haven, Yale Center for Environmental Law and Policy). Water quality index based on dissolved oxygen concentrations (1993-2002), electrical conductivity (1994-2002) and phosphorus concentrations (1994-2003). The lower the indicator value, the lower the assessment of overall freshwater quality. Based on data for the latest year available in the time period indicated.

Source: [www.fao.org/ag/aglw/aquaastat/amin](http://www.fao.org/ag/aglw/aquaastat/amin)

During 1997-2004, the use of pesticides and nitrogenous fertilizers decreased by 9% and 29%, respectively, while agricultural production decreased by 4%. This decoupling reflects changes in agricultural policy introduced in 1996 (introduction of cross-compliance and of agri-environmental payments). However, the intensity of pesticides use and nitrogenous fertilizer's use per-hectare is still much higher than the OECD average, partly because of support for agricultural policy. Nitrogen efficiency (nitrogen output/nitrogen input) is half the OECD average, as a major concern. Waste generation has steadily increased with economic growth and rising with consumption levels.

Municipal waste generation increased by 6%, a lower rate than GDP and private final consumption, while per capita waste generation remained lower than the OECD average. This reflects Korea's active policy of waste recycling and charging for waste collection according to the volume based waste charge system. In contrast, industrial waste generation increased by 45%, mainly reflecting a threefold increase in construction and demolition wastes. Nevertheless, the intensity of industrial waste generation per unit of GDP has remained slightly below the OECD average.

Urbanization is most serious problems from the economic growth. The population of Seoul metropolitan city increased more than the national population increase (see <Table 6>). Seoul's population grew by 5.47%, which was more than twice the national rate of 2.48%. In particular, the explosive growth of vehicles in the Seoul Metropolitan Areas, which accounts for 12% of the landmass, and has a high population density of 1,858 people per km<sup>2</sup>, has brought about severe deterioration of air quality.

**Table 6. Population in MSAs (Unit; thousands)**

MAS	2000	2005	rate(%)
Seoul	15,765	16,627	5.47
Busan	4,187	4,173	-0.34
Daegu	2,709	2,707	-0.07
Incheon	2,462	2,519	2.32
Gwangju	1,452	1,505	3.62
Daejeon	1,533	1,600	4.38
Ulsan	1,014	1,049	3.43
Nation	46,136	47,279	2.48

Source; MOE, "Environmental White Paper," 2007

For the periods of 1997-2003, motorization rates had recorded 5.1 per cent (ESCAP, 2005). In many of the urban areas in Korea, this situation has resulted to high road network densities, cause traffic congestions, increase high fuel consumption, and cause bad air pollution. For example, in 2004, the Republic of Korea's vehicle density (number of vehicles per route kilometer) is estimated at 150Km as compared to Japan's 62Km per day. The transportations cost as percentage of GDP for the road transport between Japan and the Republic of Korea is estimated at 2 per cent and 3-4 per cent out of GDP per year, respectively. It is particularly noteworthy that the Seoul metropolitan area occupies 51.8 per cent (US\$ 12 billion) of the national traffic congestion costs, causing the metropolitan area to become ecologically inefficient.

**Table 7. Congestion Costs of Road Transport in Selected Countries**

Country	Congestion cost as percentage of GDP	Sources and Year of estimates
Europe 17a	3 per cent	INFRAS/IWW(2004)
OECD countries	3 per cent	OECD(2001)
United states	1.5 per cent	OECD(2001)
Philippines (Manila)	4 per cent	Sigua and Tiglao(2000)
Thailand (Bangkok)	1-6 per cent	Lvovsky, K and others(1999); SweRead(1997);Pendakur(1996)
Japan	2 per cent	Ministry of Land, infrastructure and Transport(2000)
Republic of Korea	3-4 per cent	Korea Transport Institute(KOTI) (2005)

Note: a Europe 17 Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Norway, Spain, Sweden, Switzerland and the United Kingdom.

Source: Information compiled by ESCAP ESDD (2007)

One of main reasons for the high transportation congestion cost is related to high sales of automobiles size. In Korea, the sales rate of large car over 2000 CC has been increased from 29.7% in 2001 to 32.5 % in 2007.

**Table 8. Sales of Automobiles By Size in Korea**

Vehicle type (engine size)	2001		2004		2005		2006p		2007p	
	Unit	%	Unit	%	Unit	%	Unit	%	Unit	%
Light (800cc)	82	7.7	47	5.5	47	5.1	40	4.0	43	4.0
Small (800-1599)	79	7.4	47	5.5	59	6.5	81	8.1	80	7.4
Midsized (1600-2000)	58	55.2	430	50.1	509	55.8	560	56.1	611	56.2
Large(>2001 )	316	29.7	334	38.9	298	32.6	317	31.8	354	32.5
Total	1,065		858		913		998		1,088	

Source: Hong Jong-Ho, "Second Dialogue on Green Growth", 2006,

At the same time, large size of electric goods in household is also one of the reasons for the high social cost. Main electric goods such as TV, refrigerator, washing machine are getting bigger and bigger as year goes by. (See <Table 9>)

**Table 9. Large Consumer Electronics for Market Share in Korea**

	Car (2000cc over)	Color TV (25 inch over )	Refrigerator (500L over)	Washing machine (8.6kg over)
1995	10.0	26.7	14.0	13.2
1997	15.5	33.8	20.3	24.9
2000	17.7	50.4	42.0	46.2
2002	34.1	57.5	46.8	65.1
2004	28.8	58.1	49.7	74.0
2006	29.8	65.7	66.7	83.4

Source: KEMCO, “White Energy Paper, “ 2007

Besides, as a result of low energy price policy, and strong ownership tendency for the large volume of electric equipments in household, per capita energy consumption per household compared with the other developed countries, Korean household is very high comparing with the other countries.

**Table 10. Per capita Energy Consumption from HH & Comparison of Major Counties with Korea, 2005**

	Korea	Spain	Italy	Canada	Mexico
GDP (billion \$)	638	680	1,133	822	636
Population (million people)	48.29	43.40	58.53	32	105.30
Energy Consumption (million toe)	213	145	185	272	176
unit of energy source (toe/1000\$)	0.335	0.213	0.164	0.331	0.277
Per capita energy consumption (toe/person)	4.43	3.35	3.17	8.43	1.68
-Per capita consumption of home	0.38	0.35	0.55	0.97	0.17

Source: KEMCO, “White Energy Paper, “ 2007

Yale University’s Environmental Performance Index (EPI) for North-East Asian countries, shows that Korea’s EPI got lower scores. In average, the Korea acquired 75.2 scores and ranked 42<sup>nd</sup> out of around 100 countries. Especially, overfishing and low rate of renewable energy usage out of total energy use was lowest, and energy efficiency is one of the most concerned areas as we can see in <Table 11>. Energy efficiency was third area of concern.

**Table 11. Selected Environmental Performance Index for North-East Asian countries**

Indicators		Republic of Korea
Overall ERI Score		75.2
Overall Rank		42
Performance on selected indicators based on standardized proximity to target at (100=target met)		
Policy Category: Environmental health	Percentage with access to drinking water	85.6
	Percentage with access to adequate sanitation	100
	Urban particulates	76.8
	Nitrogen loading in milligrams per liter nitrogen in water bodies	99.2
Water Resources	Water consumption, percentage of territory with oversubscribed water resources	82.3
Production of Natural resources	Timber harvesting, percentage of standing forests	100
	Overfishing	16.7
Sustainable energy	Energy efficiency (in terrajoules per million US\$GDP (PPP))	67.5
	Renewable energy (percentage of total energy consumption)	0.7
	CO <sub>2</sub> per GDP (emission per GDP (PPP))	83.6

Source: Yale University (2006). Pilot 2006 Environmental performance index accessed on 20 January 2007.

**Case Study 1: Phenol Accident (Water)**

The “Phenol leakage from Nakdong River” occurred in 1991 had changed Korean people’s

general perception on environmental accident and its devastating consequences. It had much influence on the importance of effective environmental monitoring and policy implementation both in the national and local levels. Civilian environmental movement has gained more popularity and influence in the Korean society. Doosan Group, which was responsible for the leakage, suffered from massive protests from civilians all over the country, and had bad company group image..

On March 14, 1991, 30 tons of Phenol was leaked in the upper Nakdong River of Gumi. Five days later local police announced that Doosan Electro-Materials Co. in Kumi, Kyongsang-bukdo, was responsible for polluting the tap water source by discharging wastewater containing Phenol into the Nakdong River.

Doosan Electro-Materials Co. were accused of dumping huge amount of industrial waste containing phenol substance into the river, The contamination of tap water has spread from Taegu to Pusan, Changwon, and Masan, alarming approximately 5 million residents. 500 times based on the national standard levels of 0.005 ppm were detected in the Nakdong River.

President condemned the contamination of tap water as “anti-social and immoral acts, and ordered the administration to probe thoroughly the reported pollution of piped water.”

Some consumer groups boycotted all products manufactured by the Doosan Group and its subsidiaries including OB beer and Coca-Cola.

The city administration claimed a total of 1.35 billion worth of cost to the company for its economic losses. <Table 12> is the breakdown of the financial compensation claimed by the city. Doosan agreed to pay the claimed amount in full plus interest of 4,543,368 won.

**Table 12. Financial Compensation paid to Citizens by the Doo San Group.**

Category	Amount
Direct payment	1,100,000,000 won
LEDCC arbitration	290,000,000 won
CEDCC arbitration	62,000,000 won
Teagu Local Court Ruling	120,000,000 won
Total	1.572 billion won

Note : LEDCC = Local Environment Disputes Coordination Commission, CEDCC = Central Environment Disputes Coordination Commission

Source: Hong Jong-Ho , ‘ Environmental Protection Policy, : 2008,’ KOICA, 2008

City of Taegu asked the citizens to claim their financial losses with a deadline of April 30.

13,242 citizens reported damages for financial compensations in 13,455 cases, claiming a total amount of 16.6 billion won. After a negotiation process, Doosan was able to settle with 11,182 claimants out of 13,242, paying a total amount of 1.1 billion won.

### **Case Study 2: The Saemangeum Project (World Largest tidal flat. )**

The Saemangeum project initiated in the 1970s and launched in 1991, set out to reclaim part of these tidal flats to make rice fields. The project covers an area totaling 400 km<sup>2</sup>, composed of 280.4 km<sup>2</sup> of tidal land reclamation and a desalinated reservoir of 117.6 km<sup>2</sup>, including 33Km-long sea dikes.

This project connects Gusan to Buan by constructing sea dikes (sea wall) and two sluice gates. It will create 28,300ha of land and 11,800ha of freshwater lake until 2011. However, once if completed, the sea wall would destroy a 208-square-kilometer ecosystem.

Government goal of Saemangeum reclamation project was having rice field and secure food security in Korea. But, the size of rice field disappearing every year is larger than the size of rice field getting from the Saemangeum after 2011. Among various problems, the first serious concern is habitat destruction of migratory birds. Saemangeum provides the most important feeding ground for hundreds of thousands of shorebirds that migrate between Australia and the Arctic. Among visitors are the Spotted Greenshank (estimated population of 700) and Spoon-billed Sandpiper (estimated population of only 2,000). Second problem from the project is destroying spawning ground for oceanic lives. It is known that more than 70% of fishes in the Yellow sea live in and near Saemangeum tidal flat. Thirdly, Saemangeum purifies huge amount of water, provides most marine products to North Jeolla province, prevents from flood, storm and costal erosion. Therefore it is considered as a “storehouse for biodiversity”<sup>5</sup>.

Most hottest and controversial issues regarding the Saemangum project is the possibility of change in beach morphology. KARICO (1988; formerly Rural Research Institute) suggested that environmental conditions might be changed from the deposition-dominated to erosion-dominated after construction of Saemangum Dike. Recently, LEE et al. (2006) reported the local changes in coastal topography outside of Saemangum dikes. At Byunsan Beach, Korea Ocean and Research and Development Institute (KORDI, 2006) also found evidence of beach erosion obtained by the in situ measurements of sediment transport. However, KARICO (2005) reported no serious erosion or even deposition/pro-gradation at Byunsan Beach. Choi and

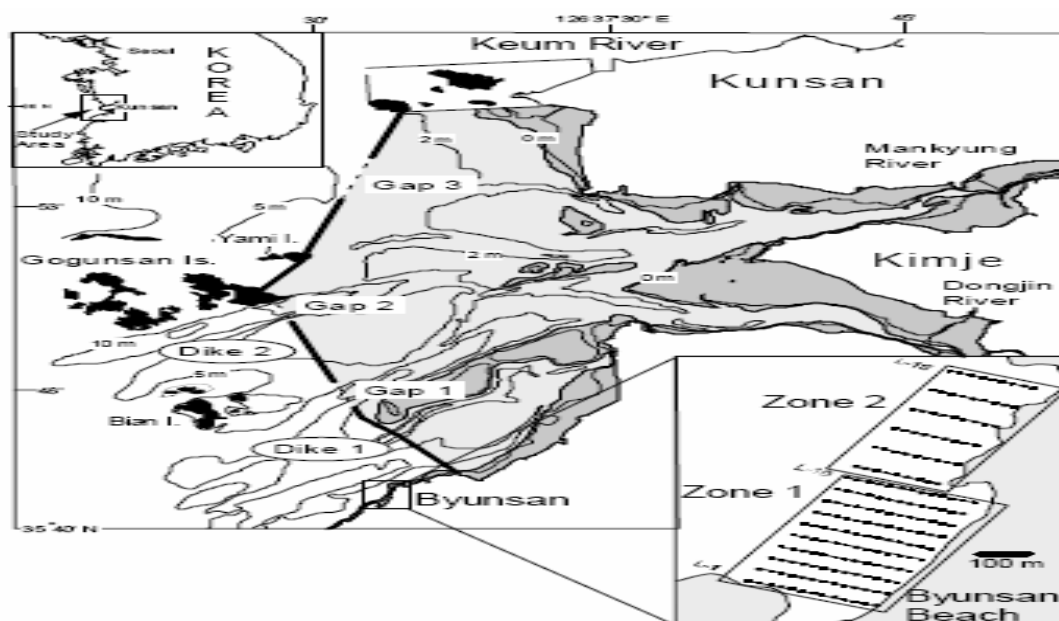
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<sup>5</sup> Jang, Jaehyun , “Nonviolent Factors Found in the Recent Samboilbae Movement”, 2005.



Lim(2007)'s 14-year monitoring of beach morphology demonstrate temporal changes such as reduced wave energy levels and destroyed the natural seasonal cycle of beach morphology. However, it is early to say very certain ecological change,. Therefore further long term study will be necessary.

**Figure 3. Saemangum Sea Dikes in 2000**



Note; In 2008, Gap 3 was closed, and small sluices are open at Gap 1 and Gap 2.

Source; J.Y. Choi† and D.I. Lim‡, “Morphological Change at Byunsan Beach, West Coast of Korea; 14-years Monitoring During the Saemangum Reclamation Project”, *Journal of Coastal Research*, Special Issue 50, 2007.

LEE H.J., JO. H.R. and KIM M.J., 2006. Topographical changes and textural characteristics in the areas around the Saemangum Dike. *Ocean and Polar Research*, 28, 293-304 (in Korean with English Abstract)

The project has been the focus of intense criticism and opposition for many years, provoking protests by individual citizens and by NGOs. Between 1999 and 2001, the project was temporarily halted while a specific committee made of government officials and civilians undertook a comprehensive assessment of its environmental impact and economic feasibility. The lower court ruled to suspend the project in 2003. But the high court allowed the project to resume in 2004. The administrative court issued an injunction to cancel or alter the original plan in February 2005. In December 2006, the Supreme Court ruled finally in favor of the government. From 1990-2005, nearly 2

trillion KRW was invested for the project, and 2007 the dikes were completed.

### **Case Study 3: Sihwa Lake**

In June 1987, Korean government had initiated wetland development program around Kyunggi Bay and ended the embankment work for 12.7 km - long Sihwa dike in June 1994. However, the water quality of Sihwa Lake became rapidly deteriorated. Korean government tried various efforts to improve the water quality of this freshwater lake but did not produce satisfactory results. In 1998, the government decided to allow circulation of the seawater into Sihwa Lake and announced that original plan for freshwater lake will be modified.

After the construction of Sihwa dike, many peoples from two islands, especially fisherman, were experiencing significant environmental changes. Since 1992, Hyungdo island has prepared for a lawsuit against the government to win compensation. They began the suit in 1993 and started procedures in 1994. They won at the district court in June 1997.

On the other hand, residents of both Uldo and Hyungdo islands have failed to transition to an alternative livelihood in near area or city area even if government failed them for compensation. Residents expected, at first, to benefit from the project since they had seen a lot of visitors before. But tourists stopped visiting after 1994, when the embankment was completed, the fishing field in the ocean had closed and the Sihwa Lake pollution problem became public.

'The Sihwa Lake Marine Environment Improvement Project' had carried out during 2003~2007 focuses on securing institutions, policies and core technologies required for smooth implementation of the Comprehensive Sihwa Lake Management Plan in Phase 1. The phase I Plan was to achieve the COD level of 2mg/L by the end of 2006 with the investment of total USD 952M. In 2005, however, the average COD was not improved better than 4.2mg/L. The COD level in 2006 is 4.7PPM which is similar to 1994 (5.2PPM) level.

**Figure 4. View of Sihwa Lake and Death of Passage Birds in Sihwa Lake**



Source; KORDI, “Comprehensive Sihwa Lake Management Plan : Phase 2,” Ocean Policy Research Annual Report 2007, pp 82-85

In May 2007, the Sihwa Lake Management Committee decided to invest total USD 898M on Phase 2 for the Plan. One of the significant features in the Phase 2 plan is that spatial range of the plan is considered from the inner sea of Sihwa Lake to both the inland and the open seas of the Lake including the neighboring watersheds of Incheon. Four major management fields such as management of water quality and adjacent land environment, management of the ecological system and biological resources, management of coastal area and space use, and improvement of management system and institutions were expanded into the Plan. The other six major fields are also take into account: (1) improvement of environmental pollution, (2) preservation and restoration of the ecological system, (3) management of coastal resources, (4) strengthening of the local capability, (5) consolidated management, and (6) environmental investigation and

estimation<sup>6</sup> with feed-back management system which consists of (1) performance objective setting (2) project design (3) project implementation, and (4) project evaluation,

### 3. Priority Issues for Sustainable Development

#### (1) Water Quality Improvement in the Four Major Rivers and Shihwa Lake

Overall, water quality in four major rivers in South Korea has been improved since 1997, as a result of water management efforts made by the Ministry of Environment. Special measures for four major rivers have been implemented since 1998, so as to put in place the river basin management system (e.g., Total Maximum Daily Load Management), expand environmental infrastructure, and reinforce the emission standard. The water quality of the Han River, which is the water supply source of 20 million people in Seoul and metropolitan areas, is at a level of 1.2mg /L on average in BOD base in 2006, similar to the previous year. Water sources of four major rivers are managed at the level of 1~2mg/L. Water quality achievement rate for national rivers were increased 13.8% to 42.3% from 1994 to 2005.

**Table 13. Status of BOD in 4 Major Rivers in Korea**

Classification	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06
Han(Paldang)	1.3	1.4	1.5	1.5	1.5	1.4	1.3	1.4	1.3	1.3	1.1	1.2
Nakdong(Mulgeum)	5.1	4.8	4.2	3.0	2.8	2.7	3.0	2.6	2.1	2.6	2.6	2.7
Geum(Daechong)	1.2	1.5	1.2	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.1	1.1
Youngsan(Juam)	1.5	1.1	1.3	0.9	0.9	0.8	0.7	0.9	1.2	1.0	0.9	1.1

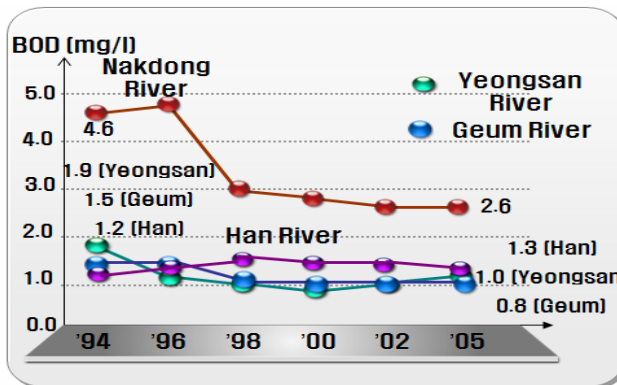
(Unit : mg/L)

Source: MOE, “Environmental White paper, “ 2007

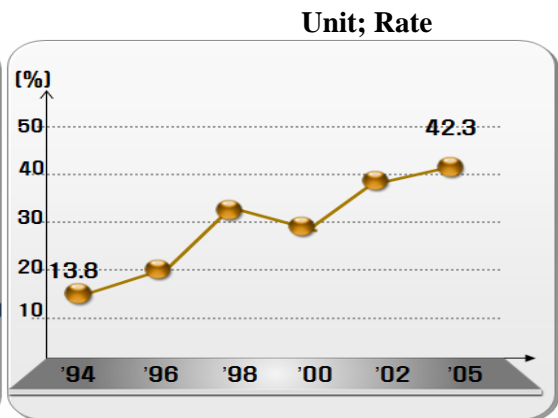
However, water quality in Nakdong River was continuously decreased during the past ten years. While quality of the other rivers have not been increased. <See (Figure4)>

<sup>6</sup> KORDI, “Comprehensive Sihwa Lake Management Plan : Phase 2,” Ocean Policy Research Annual Report 2007, pp 82-85

**Figure 5. Tap Water Source Quality Change in 4 major rivers**



**Figure 6. Water Quality Target**



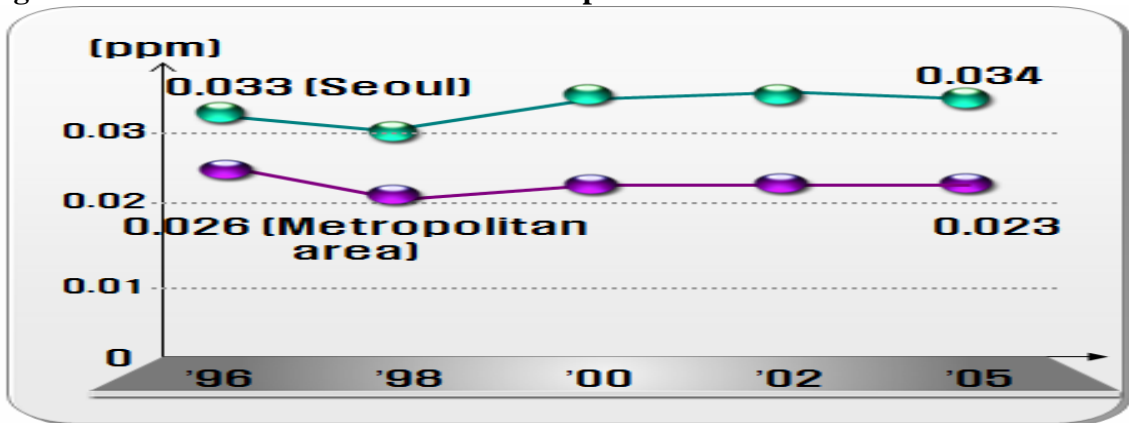
Source: MOE, "Environmental white paper," 2007

Besides, water quality, lack of water supply in southern and northern area is getting worse. Because of water shortage, water right is becoming an important issue in recent years. Construction of large scale hydraulic dam in Nakdong river area is under discussion.

**(2) Air Quality Improvement in SMA**

Emission of NO<sub>x</sub> as well as pm<sub>10</sub>, TSP in Seoul metropolitan area(SMA) shows about 1/3 times more than the other metropolitan areas during the last ten years.

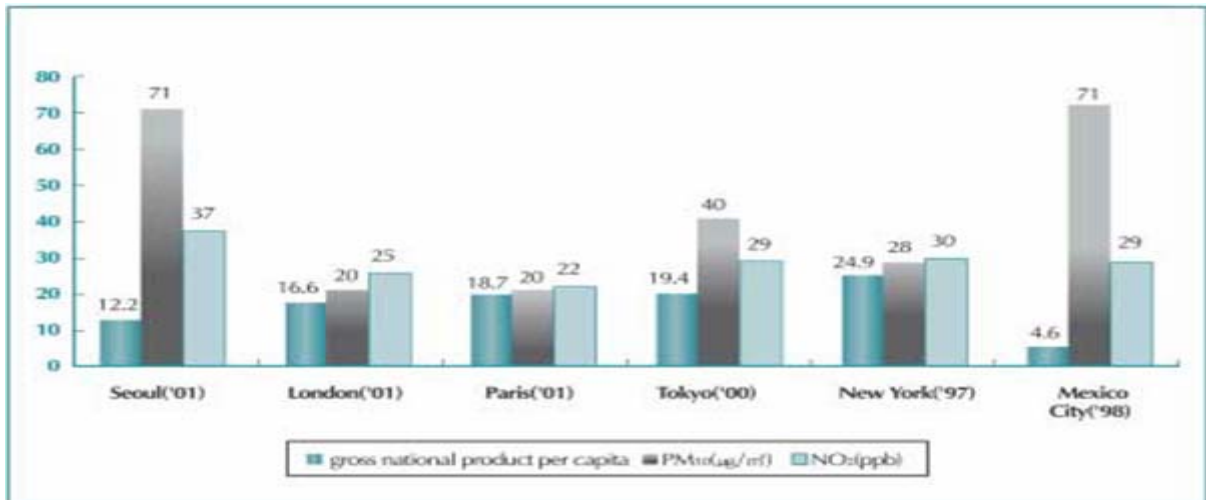
**Figure 7. NO<sub>x</sub> Pollution in Seoul and Metropolitan Areas**



Source: KEI, Korea Environmental Policy Bulletin, Issue 3, Volume IV, 2006

Present pollution level of pm<sub>10</sub> in Seoul reaches 1.7~3.5 times higher than in major cities of advanced countries while NO<sub>2</sub> reaches 1.7 times higher.

**Figure 8. Comparison of Air Pollution Level Both Seoul and Foreign Cities**



Sources: Korea Environmental Policy Bulletin, Issue 3, Volume IV , 2006

According to an outcome from a research on health damages due to the atmospheric pollution, the death toll due to PM<sub>10</sub> is estimated to be 9,641 persons a year in Seoul(Environmental Pollution Research institute, Yonsei University, 2000). An early-dying rate among the population, exposed to atmospheric pollution in Korea, amounts to 0.09%, which is higher than those of the advanced countries including France whose early-dying rate is known to be somewhere between 0.05% and 0.07% <sup>7</sup>. Infant mortality rate is increased by 9% due to the respiratory ailments. (Ewha University, 2002)

**Table 14. Comparison of the Chronic Dead due to PM<sub>10</sub> (1999)**

<sup>7</sup> Main cause of deteriorating atmospheric quality

- 1) Increase of Population and Vehicles
- 2) Increase of Energy Consumption
- 3) Improper Management of Secondary Air Pollutant
- 4) Improper Pollutants Reduction Measures against Vehicles
  - A. Improper Reduction Measures for Emitted Gas against Diesel Vehicle
  - B. Insufficient Efforts to Reduce Gas Emission of Gasoline Vehicles
  - C. Insufficient Regulation against Non-road Mobile Source
  - D. Low Railroad Transportation
  - E. Unreasonable Energy Policy
  - F. Adverse Meteorological Condition Impeding Atmospheric Circulation

Classification	Austria	France	S w i s s	Seoul	Major 6 cities
The chronic dead (persons)	5,576	31,692	3,314	9,641	20,895
Rate of the early dead among exposed population (%)	0.07	0.05	0.05	0.09	0.09

Source: KEI, “ Korea Environmental Policy Bulletin”, Issue 3, Volume IV , 2006

### (3) Prevention from Forest Land Area to Urban Land Area

Forested areas in Korea was 65,665 km<sup>2</sup> in 1992 and changed into 64,885 km<sup>2</sup> in 2004. Annually Korean forest decrease about 78 km<sup>2</sup>. Especially, tidal flats areas in Korea was 3,203 km<sup>2</sup> in 1987 but changed to 2,550 km<sup>2</sup> in 2005. It's annual decrease was 36 km<sup>2</sup>. However additional 3,838km<sup>2</sup> of urban land area is expected to be used in the next 20 years.

**Table 15. Change of National Land Development ('92-'04)**

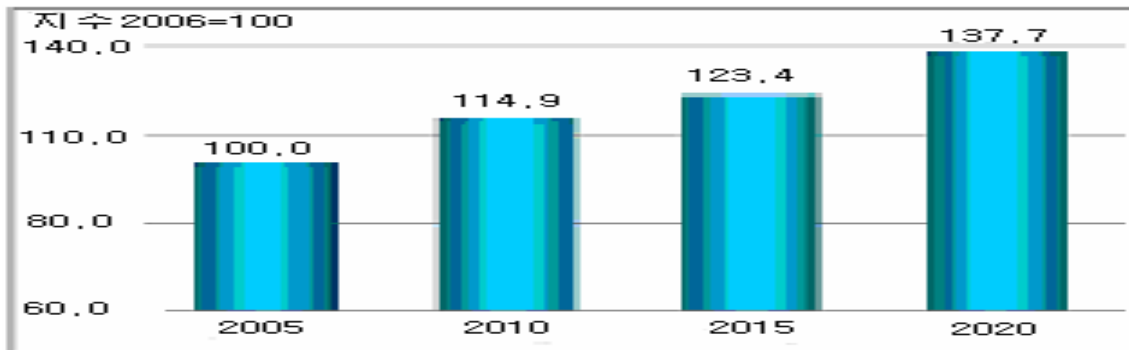
Forested and Area	Farm Land	Urban Land
804 Km <sup>2</sup> ↓	889 Km <sup>2</sup> ↓	1,475 Km <sup>2</sup> ↑

Source: Moon Jung Ho, “ Korea Environmental Policy,” 2007.6

### (4) Reduction of GHGs(Green House Gases) Emission

Since 1990, Korea's CO<sub>2</sub> emissions from energy use have doubled. The 5.4% annual increase has closely tracked the country's economic growth rate; no decoupling of CO<sub>2</sub> emissions from GDP growth has been achieved. Projections of GHGs by the Korean Energy Economics Institute indicate that the country's GHG emissions (dominated by CO<sub>2</sub>) will grow by 1.9% annually until year 2030, an increase of some 38% above 2003 levels. Anticipated GHG emission increases from the power generation and transport sectors are expected to offset decreases foreseen in the industrial and residential sectors between 2003 and 2030. If these projections prove to be accurate, by the year 2013 (when the post-Kyoto period will start), Korea may well be one of the largest emitters of GHG per unit of GDP among all OECD member countries (OECD, Environmental Performance Review, 2006).

**Figure 8. Projection of GHGs in Korea (2005-2020)**



Source: KEEL, “3<sup>rd</sup> National Climate Change Report,” 2007

#### **4. Existing National Sustainable Development Policy (SDP) for Priority Issues**

During the 1970s, Korea government introduced very basic environmental regulation such as minimum environmental regulation to protect public health, and very ineffective enforcement of pollution prevention measures. Between 1970s and early 1980s, Korean government introduced more stringent environmental standards for major pollutants and introduction of emission charges, and environmental impact assessment (See <Table 15>). During the 1990s, Korea government introduced effective implementation of environmental regulation such as extension of the coverage of environmental regulation from local to regional and national environmental issues. More emphases on incentive based policies and measures have been implemented. As a result, much more and improving effectiveness of environmental regulation have been accomplished.



**Table 16. Incentive Based Policy Measures in Korea**

Types	Starting	Target	Basis	Objective
Emission Charges - Excess - Basic	July, 1983 August, 1997	Air and Water Pollutants from Manufacturing and Production Facilities	Excess Emission Below Emission Standard,	- Discourage the Emission - User Charge
Environmental Improvement Charges	July, 1992	Commercial Buildings and Diesel Vehicles	Water and Fuel Consumption, Engine Size and Age of Vehicle	- Discourage the Emission
Water Quality Improving Charges	May, 1995	Manufacturing and Importing Company Beverage	20% of Market Price 5% of Production Cost	- User Charge
Waste Treatment Charge	July, 1993	Products Generating Excessive Waste	30% of Treatment Cost	- Financing the Treatment Cost
Waste Deposit	January, 1992	Recyclable Products	30% of Treatment Cost	-Encourage Recycling

Source: Chung, Hei-Sung (2002), *Environmental Regulatory Reform Towards a Sustainable Society in Korea*, KEEL.

MOE, "Environmental White Paper." 2007.

As the environmental awareness among Korean has also raised, needs for the sustainable development has increased in recent years. And so does the demand for improvements to be made in response to emerging environmental problems including the sick house syndrome and hyper-sensitivity to chemical substance from worsening indoor air quality in public facilities, apartments, etc.

**Table 17. Key Environment-Related Acts in Korea**

Category	Acts
Air Pollution	Road Traffic Act, Atomic Energy Act, Nuclear Liability Act, Petroleum Business Act Energy Use Rationalization Act, Construction Machinery Management Act, Integrated Energy Supply Act, Alternative Energy Development Promotion Act, Act on the Control, etc. of Manufacture of Specific Substances for the Protection of the Ozone Layer
Water Pollution	Prevention of Marine Pollution Act, Groundwater Act, River Act, Public Waters Reclamation Act, Aggregate Picking Act, Public Waters Management Act, Aggregate Picking Act, Act on Construction of Dams and Assistance, etc. to their Environment, Small River Maintenance Act
Forestry	Forestry Act, Erosion Control Act, Forest Management Act

Source; Re-arranged from the MOE, “Environmental White Paper,” 2007.

**(1) “Special Law for the Improvement of Seoul Metropolitan area Atmosphere (SMA) in 2007**

In order to have sustainable development of air quality for SMP area, “Special Law for the Improvement of Seoul Metropolitan area Atmosphere (SMA)” would be carried out as 10 year plans from 2003 to 2012 with investment of 4.73 thousand billion won. The final goal of Special Law is to improve metropolitan atmospheric quality to reach the level of advanced countries such as Tokyo in Japan . In order to achieve the goal, it is planned to reduce emission of PM<sub>10</sub>, NO<sub>x</sub>, VOCs, and SO<sub>x</sub> by 40~70% comparing with 2001. PM<sub>10</sub> will be improved to 40µg/m<sup>3</sup> same level of Tokyo, and NO<sub>x</sub> with 21ppb, the same level of Paris.

**Table 18. Goal of Atmospheric Quality Improvement in SMA**

	2001	2012
PM <sub>10</sub> (mg/m <sup>3</sup> )	71	40 (Tokyo Level)
NO <sub>2</sub> (ppb)	37	21 (Paris Level)

Source ; MOE, “Summary of Environmental Related Law,” Internal paper 2008

“Special Law for the Improvement of Seoul Metropolitan area Atmosphere (SMA)” has 8 chapters and 80 articles. It introduced total emission allowance same as emission trading in Kyoto protocol. Federal government (Ministry of Environment) set the allowance based on the average emission amount fro the past five years, and then local government should implement the reduction target through regular monitoring and some economic incentives. At the first stage starting from January 2007, PM<sub>10</sub>, NO<sub>x</sub>, and SO<sub>x</sub> will be included and 116 first class sites in SMA will be included and from year 2009, about 1,200 sites of second and third class sites

would be included. The affected areas of the Special Laws include Seoul, Incheon, and Gyeonggido. If a company meets the required target, then emission charges and usage of low sulfur fuel will be excluded. Besides, 174 first class sites have less regulated emission standard according the air quality law. If a company reduced more than designated allowance amount, they can sell the reduction credits.

**Table 19. Total Emission Allowance for SMA**

		SOx	NOx	PM <sub>10</sub>	VOC
Emission Allowance (Ton)	Total	43,025	145,412	8,999	160,900
	Seoul	6,375	46,148	2,702	54,274
	Inchun	10,030	28,286	1,574	33,120
	Kyunggi	26,621	70,977	4,724	73,506

Source; MOE, “Summary of Environmental Related Law,” Internal paper 2008

**Figure 9. Total Regulated Area in the Special Law for the Improvement of Seoul Metropolitan area Atmosphere**



Note; Inside of red area are is the special zone for the law.

Yellow area is Seoul Metro area, Blue is Inchun area, and Green is Kyunggi Area.

Source; MOE, “Summary of Environmental Related Law,” Internal paper 2008

In addition to these important incentives “Special Law for the Improvement of Seoul Metropolitan area Atmosphere (SMA)” has some policy instruments;

- a) Supply of Low Emission Vehicles

Emission from vehicles account for roughly 51% of NO<sub>x</sub>, 58% of PM<sub>10</sub>, and 85% of CO concentration in the metropolitan area, making emission reduction measure for vehicles and the supply of low emission vehicles(LEV)/zero emission vehicles(ZEV) are an important key to improving the ambient air quality. The Special Law categories the LEV /ZEV into type one and two according to the level of pollution reduction level. Starting from 2005, nearly all government bodies in the metropolitan area required to purchase a certain portion of newly purchased vehicles with LEV/ZEVs. On the automobile manufacturer side, automakers selling more than 3000 vehicles for 3year in the metropolitan region are advised to supply LEV/ZEVs at a certain ratio which set together with the government. Local government having more than ten cars should purchase at least 10 percent of low emission vehicles (LEV)/zero emission vehicles(ZEV)

#### b) Fuel Quality Improvement

Starting from October 2004, through tax incentives, only low-sulfur fuel was supplied in the Metropolitan area. Current national fuel standards on sulfur contents are 430ppm.

### **(2) Law of Protection for Baekdu Daegan Mountain in 2003**

Baekdu Daegan Mountains boasts a great diversity of species. 1,528 wildlife species (123 mammals, 457 birds, 43 amphibians/reptiles, and 905 fishes) known to be lived in the Korean peninsula, most of species are living in the Baekdu Daegan except for some indigenous species (e.g., *crocidura russula quelpartis*, *micromys minutus hertigi*, etc.) on Jeju island. Korean government initiated the “Law of Protection for Baekdu Daegan Mountain” in 2003 and there are 16 articles. The law was firstly suggested from Ministry of Environment and Agency of Forestry together. Among 2,634 km<sup>2</sup> key protected area is 1,699 km<sup>2</sup>(65%), and buffer zone area is 935 km<sup>2</sup>. 48 percent of national park is in Baekdu Daegan Mountains. In order to protect Baekdu Daegan Mountains, both government bodies set up 10 year plan and will have various activities including North Korean cooperation with tree planting. Based on the Law, they will purchase degraded land area and try to make original shape of mountain.

*Especially, The Forest Land Management Act (2002) applies stricter standards to prevent indiscriminate development and reckless forest destruction, and requires large-scale development projects to conduct a prior environmental assignment review. To secure ecologically sustainable forest resources, Korea has increased the number of plant species for afforestation to 78 species, resulting in an average annual planting of 53 million trees*

and afforestation of 210 km<sup>2</sup>. The *Act on Arboretum Constitution and Promotion* (2001) provides a legal basis for supporting the National Arboretum as well as six regional arboretums that conserve various forest genetic resources. An *ecological forest* building project is being conducted with a focus on Korea's native flora [e.g. Hanlla Ecological Forest (2000-04) and the Ecological Forest in the Baekdu Daegan Mountain (2001-09)].

**Figure 10. Map of Baekdu Daegan Mountain**



Source; MOE, "Summary of Environmental Related Law," Internal paper 2008

Korea had just finished *Fourth National Forest Plan* (from 1998 to 2007), which incorporated *sustainable forest management*. The plan aimed to: ) implement environmentally sound forest management in a sustainable way, ) increase the competitiveness of the forestry and forest industry, and ) enhance social benefits, *The Framework Forest Act* (2001) shifts forest management to focus on sustaining a healthy ecosystem and a balance between generations of trees.

**Table 21. Baekdu Daegan Mountain by Region**

(Unit : km<sup>2</sup>, %)

Classification	Total		Core region	% (Core/Total)	Buffer Zone	% (B.Z./Total)
	Area	%				
Total	2,634	100.0	1,699	65	935	35
Gangwon	1,339	50.8	941	70	398	30
Chungcheong	356	13.5	120	34	236	66
North Jeolla	179	6.8	143	80	36	20
Sough Jeolla	52	2.0	34	65	18	35
North Kyungsang	478	18.2	320	67	158	33
South Kyungsang	230	8.7	141	61	89	39

- Date of Designation: September 9, 2005
- Legal Framework: Article 6 of Act on the Protection of Baekdu Daegan Mountain System
- Area : 2,634 (Core Area: 1,699 (65%), Buffer Zones: 935 (35%))
- Location : The peak of Hyang-Ro (in Gosung, Gangwon Province), the Cheonwang Peak of Mt. Jiri (in Sanchung, South Kyungsang Province)
- Ownership: Public (86.8%), Private (13.2%)
- Current Status of Land Use: Forest/Fields (99.6%), Ranches (0.13%), Roads (0.16%), Farm (0.1%)
- Range: 6 Provinces, 32 Cities/Counties(Gun)(12 cities, 20 counties), 103 Towns (Eup/Myeon/Dong) note; 7 National Parks and Two Provincial Parks Included.

**(3) “Special Law of Water Management for Four Rivers in 1999 and 2003**

To establish clean and safe water supply system, Korean government planed to supply clean water for citizens from 55% in 2007 to 88% until 2012 including rural areas. At first, the Han river was mainly controlled. However, the water quality of the other main rivers such as Nakdon, Kumkang, and Youngsan was getting worse. Therefore Korean government extended Han rive related law to the other three rivers in 2003. Over the past four years from 2003 to 2006, there were many debating among the stakeholders. Since the law has very unique figures such as total wastewater allowance, application of beneficiary pays principles, and operation of four river fund.

According to the “*Special Law of Water Management for Four Rivers*,” Korean government introduced total emission allowance charges, water shore area management, and clean water use charge system. Here, clean water use charge system means that based on beneficiary pays

principles, people lived in lower river stream area have to pay some amounts of fees out of regular utility bill to the government. The charges set by the special committee for Han River have gone into special water fund every year. With the water fund, many projects have been conducting such as purchasing of water shore land, social activity support in upper area, monitoring and maintenance for river, etc.

**Table 22. Expenditures of Fund for Han River Stream Management**

(Unit: million won)

Rivers	Total	1999	2000	2001	2002	2003	2004	2005	2006	2007
<b>Total</b>	4,267,670	27,704	203,516	274,762	352,530	583,695	687,215	722,579	740,876	674,793
<b>Han</b>	2,627,447	27,704	203,516	274,762	310,823	335,588	333,418	376,010	396,335	369,291
<b>Nakdong</b>	893,301	-	-	-	26,852	149,149	196,848	185,064	174,311	161,077
<b>Kumkang</b>	417,128	-	-	-	7,029	52,110	79,451	91,785	98,718	88,035
<b>Youngsan</b>	329,794	-	-	-	7,826	46,848	77,498	69,720	71,512	56,390

Source; MOE "Internal Report," 2008

### (3) Reduction of GHGs to Stop Climate Change (Low Carbon, Green Growth Law)

Korean government need to prepare for the reduction of greenhouse gases even if it has not obligate to reduce the GHGs until 2012. In order to prepare effective climate change policy, Korean government have invested several areas such as development of renewable energy technologies, development of green IT and green building, enhancement of energy efficiency, introducing new policy measures, and strengthening public communication

Korea's climate change policy began to emerge in 1997 with the establishment of an inter ministerial committee on the UNFCCC, headed by the Prime Minister. The First Comprehensive Action Plan (1999-2001) was followed by a second and a third action plan (covering 2002-04 and 2005-07), which have been increasingly comprehensive and detailed. Korean government started 4<sup>th</sup> National Climate Change Action Plan in year 2008. President Lee already announced during the G-8 meeting in 2008 that Korea will make voluntary reduction targets in 2009. Key implementation action plans are;

1. Korean government will initiate the “Climate Change Prevention Law” and introduction of carbon tax as well as emission trading system would fully operating, which may cause new emerging carbon market as a whole. The use of carbon taxation and a well-designed domestic GHG emissions trading system could also markedly advance Korea's climate change goals, as well as serve as a model for other countries in the Asian region. The inclusion of specific objectives and precise measures in the Fourth Comprehensive Action Plan (2008-10) should also be pursued to reduce the rate of growth of GHG emissions in order to participate actively in the UNFCCC process.
2. In relation to the Climate Change Prevention Law, sector based reduction target will be made and GHGs registry also will be made. The portion of renewable energy will be increased from 2.39 % to 11% in 2030. And percentage of nuclear energy supply out of total energy will increase. In order to have the most advanced technologies such as solar thermal power, fuel cell, wind power, even hydrogen energy until year 2012, Korean government is planning to invest about 9000 billion Korean won for R & D, distribution, and marketing. Therefore promotion and development of various technologies related to automobile manufacturing are strongly activated.



**Table 23. Yearly Budget to Attain Renewable Energy Supply (2004-2012)**

(Unit: 100million)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	total
R&D	950	1,130	1,405	1,625	2,025	2,460	2,895	3,335	3,820	19,645
Supply	1,670	2,110	3,412	3,824	5,352	7,217	8,888	12,108	14,280	58,861
Sub tot.	2,620	3,240	4,817	5,449	7,377	9,677	11,783	15,443	18,100	78,506
Finance	900	1,340	1,800	2,280	3,300	4,100	6,300	10,600	9,600	40,220
Total	3,520	4,580	6,617	7,729	10,677	13,777	18,083	26,043	27,700	118,726
Private investment	1,300	4,900	7,000	9,000	12,400	18,300	21,700	28,500	30,100	133,200

Source; KEMCO, "Renewable Energy Supply Plan," 2008

3. To make progress, the government will need to raise public awareness, provide clear and strong incentives to industry, and invest substantially in R&D such as CCS(carbon Capture and Storage), fuel switching, and energy conservation.
4. There is serious warning for the climate change because of weather risk. Korea is experiencing high economic costs. Therefore, long term adaptation plan is also under progress
5. Federal and local government cooperation body will be made
6. Korean government will integrated the other policies for the protection of the Korean environment. Therefore, ministry of environment, trade and construction, urban planning, and agriculture will work together. Role of financial sector will be very important sector in the Action, hence climate change related various products for risk insurance and banking will play a major role in CDM project in the future. Hence, Korean government try to make carbon funds from public and private sector to share some carbon markets since the size of carbon market in the world will increase two times than before in 2030.

**Table 24. Projection of Carbon Market until 2012**

Year	Market	Trade (billion US\$)	Volume (million ton)	Price (US\$/ton)
2006	CDM	5	475	11 (6-27)
	JI	<1	16	9
	EU ETS	24	1,101	22 (5-40)
2010	CDM/JI	5-25	400-600	24 (14-34)
2030	CDM (Low)	5-25	400-600	24 (14-34)
	CDKM (High)	90-125	4,000-6,000	24 (14-34)

Source; Point Carbon , “Current Status of Carbon Market and Future Perspective,” 2007

### 5. Problems of Implementation for Sustainable Policy and Law

Even if Korean government initiated ambitious environmental policy at the end of the 1980s, there are still some more work to do in the future.(See <Table 24>). In this study, we will discuss about some problems of priority issues in order to implement for the policy.

**Table 25. Some Indicators of Sustainable Development as of 2007**

	2003	2005 and 2007
Human Development Index Ranking(Value)	30th (value 0.88)	26th (value 0.921, 2005)
Environmental Sustainability Index	135th	122th (2005)
CO2 Emissions from Fuel Combustion (2001)	436 million ton of CO2(2001)	591 million ton of CO <sub>2</sub> (2005)
GDP (PPP, 2001)	674.9 billion 1995 US \$(2001)	969.3 billion US\$ (2007)
GDP per capita (PPP, 2001)	14,268 1995 US \$ (2001)	20,045 US\$ (2007)

Sources: *CIA World Fact Book, 2003, UNDP 2003, Yale University and Columbia University 2002, OECD/IEA CO2 Emissions from Fuel Combustion 1971-2001, 2003 Edition*

#### (1) Special Law for the Improvement of Seoul Metropolitan area Atmosphere (SMA)

Even if Ministry of Environment and Local government (SMA, Kyuggi Do, Inchun) and professional research groups work together for three years, and did some pre-test period,

business groups and local government officer could not understand the system well and did not prepare very core basic statistics such as registry for SO<sub>x</sub>, NO<sub>x</sub> data and allocation principles from the federal government. Industry sectors have complaint about the allocation and boundary of targeted area and require strong institutional and financial incentives.

Therefore, when the Law was discussed several years ago, PM<sub>10</sub> was included after 2009, but at current, PM<sub>10</sub> will not be included until the Law is stabilized.

## **(2) Law of Protection for Baekdu Daegan Mountain**

This Law is operated with Korea Forest Service and MOE after 2005. However, 70% of owner of forest in Baekdu Daegan Mountain Area is from private owner. Even if there is a Law and some support for the protection of forest area, very weak financial support goes to the private owners. because of far lacking support and budget<sup>8</sup> in Korea Forest Service.

Hence, private owners and Korea Forest Service have insisted the introduction of direct payment from the various forest services for the protection of Baekdu Daegan Mountain Area same as direct payment for agricultural rice field in Korea and in abroad such as U.S.A and Japan for example.

## **(3) *“Special Law of Water Management for Four Rivers***

According to the *“Special Law of Water Management for Four Rivers”*, Korean government introduced total emission allowance charges, however, it is very hard to find and allocate total emission for the non-point source because of data availability. Scattered animal farming houses for pig and cattle, small scale company and many hotels around the restricted water reservoir area are the main source of polluters. Based on the rule of beneficiary pays principles are also under target. There is not transparent and subjective rule for the water use charge, it depends on the special river management committee decision every year.

## **(4) Management of GHGs to Stop Climate Change**

In recent years, Korean government is dramatically and strongly changing their plans and strategies for the mitigation of climate change in Korea. However, still some energy intensive

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<sup>8</sup> The yarely budget for the agency is 1300 billion Korean won in 2008.

industry sectors are unwilling to participate for the government policy and criticize the introduction of emission trading with cap and trade system, and carbon tax. Some sectors like household and commercial sector, transportation sectors need more work for the energy efficiency improvement and have lots of rooms for the GHG reduction in the future.

Korean government need to participate actively for the Asia Pacific Partnership (APP) in the future. Now six countries such as Korea, U.S.A., China, India, Australia, Japan EPA, and USA CH4 reduction partnership are involved in APP. Environmental sector need to be regarded as one of the main topic. At the same time development of negotiation strategy and public communication is quite important for the people and for the 2nd commitment period from 2013-2017.

## **6. Road to Ahead – need work for the 2<sup>nd</sup> Pahse**

The Republic of Korea has continually implemented strategies for Sustainable Development since the Rio-Summit in 1992. The most important strategic plans are: a) The ten-year plan of *Green Vision 21* (1996-2005), where currently work is undertaken to formulate the second long term plan, b) the *Mid-Term Plans* for putting the long-term planning into practice, where currently the third Mid-Term Plan is in action (2003-2007) and c) several strategic plans in different sectors. Green vision 21 ([http://www.gef.or.jp/20club/E/seoul\\_e.pdf](http://www.gef.or.jp/20club/E/seoul_e.pdf))

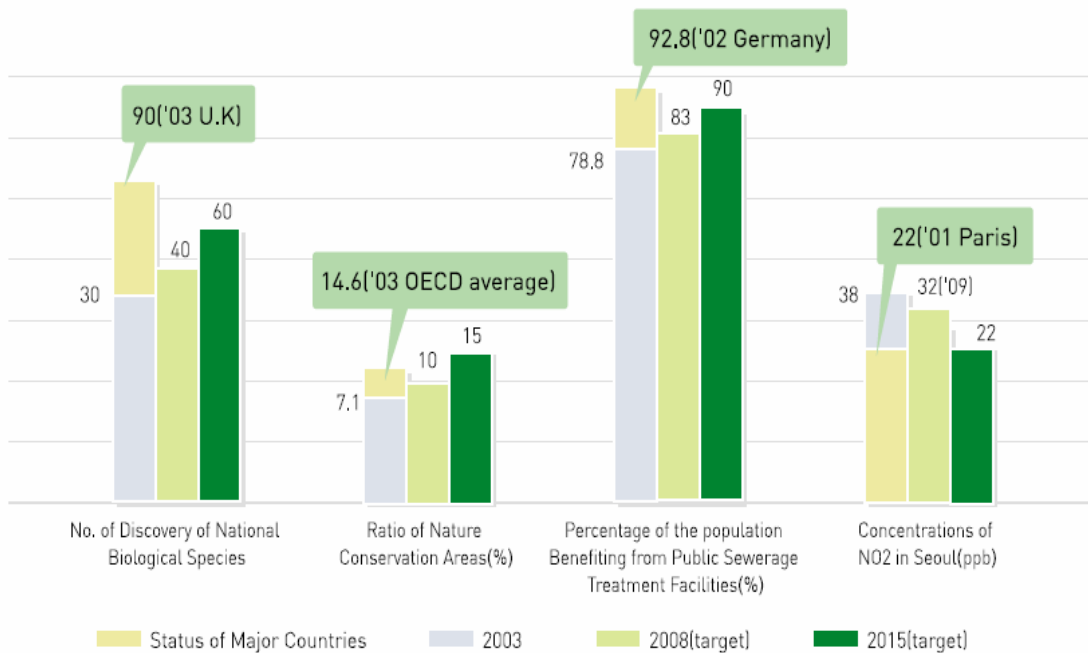
The *Green Vision 21* obliged ministries to adopt sectoral environmental plans. For example, the Ministry of Knowledge and Economy (MKE) has developed the 10-year *National Plan for Energy Technology Development* and two 5-Year *National plans for Energy Conservation*. The Ministry of National Land and Marine (MOCT) adopted the “plan first, develop later” concept of development for the whole country including urban and agricultural areas. In order to promote sustainable development of the national territory, MOCT also enacted the *Act on Planning and Use of National Territory* effective as of January 1, 2003, combining the *Urban Planning Act* and the *National Territory Use Act*. Under the Fourth Comprehensive National Territorial Plan (2000-2020), which is the highest-ranking national plan on territorial development and which was formerly called the Comprehensive National Development Plan, MOCT paid greater attention to *Green Vision 21*, making integration of development and environment one of the 3 keynotes of the plan. The Ministry of Knowledge and Economy has also set up a plan *Environmental Policy in Agriculture, Forestry and Fisheries for the 21st Century* that aims at policy integration and contains specific targets for the development of

technologies for reducing the use of chemical fertilizers and synthetic pesticides by 30% until 2004, and by 40% and 50% respectively until 2010 (basis year 1993) (UN 2002).

2015, when a comprehensive national environment plan is expected to be completed, will make Republic of Korea join the ranks of the advanced nations in the field of the environment. Main indicators in Korea, signaling the quality of natural surroundings and living environment, will be upgraded to the level of those in the OECD. For instance, the concentrations of nitrogen dioxide in Seoul will be improved from 38ppb in 2003 to 22ppb in 2015. Sectoral environmental plans and municipal environmental conservation projects will make great contributions to the embodiment and implementation of the comprehensive national environmental plan, so as to realize the blue print for making Korea an advanced environmental country.

**Figure 11. Target of Environmental Improvement in 2015**

(unit : thousand)



Source: MOE, “ Green Vision 21, “ 2005

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