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## CONCLUSIONS AND RECOMMENDATIONS\*

After the 1997 financial crisis, the Republic of Korea displayed one of the highest rates of economic growth in the OECD: about 6% annually. Korea's GDP per capita reached USD 14 100 at current prices and exchange rates. GDP growth is largely driven by exports. Despite incentives offered in three free economic zones, foreign direct investment is relatively low. Industry accounts for 42.5% of GDP (well above the 29% OECD average). Manufacturing and energy-intensive industry remain predominant (Korea has the world's largest shipbuilding industry and the fifth largest steel production) though information and communication technology are growing. With a population of 48 million living in an area of just under 100 000 km<sup>2</sup>, Korea has the highest population density (484 inhabitants per square kilometre) in the OECD. The Seoul megalopolis, with 48% of the population, produces 53% of the Korean GDP.

Further to good environmental progress during 1990-97, a period marked by Korea's accession to the OECD, the review period (1997-2005) saw major progress in addressing air, water and waste management, particularly in urban areas, and adopting new environmental legislation. However, indicators of carbon, energy and some material intensities still remain among the highest in the OECD. Priority sustainable development challenges, as reflected in the mandate of the Presidential Commission on Sustainable Development, include: i) recommending major policy directions and plans for sustainable development that integrate economic, social and environmental concerns; ii) proposing major policy directions in areas such as water and energy; iii) providing advice on the implementation of major international environmental agreements, such as the UN Framework Convention on Climate Change (UNFCCC); iv) proposing solutions for societal conflicts and disputes related to the country's sustainable development; v) promoting and facilitating implementation of Agenda 21 as well as the Johannesburg Action Plan; and vi) reviewing proposed national long-term strategies with respect to sustainability. Overall, further and strengthened efforts will be needed on the road towards environmental convergence within the OECD area.

Korea will need to: i) strengthen the implementation of its environmental policies; ii) enhance the integration of environmental concerns into economic decisions (e.g. energy, agriculture, transport, forestry, fiscal and land-use decisions); and iii) further gradually reinforce its international co-operation on environmental issues.

This report examines progress made by Korea since the previous OECD Environmental Performance Review in 1997, and evaluates the extent to which the country's domestic objectives and international commitments are being met. It also reviews progress in the context of the OECD Environmental Strategy.\*\* Some 54 recommendations are made that could help strengthen Korea's

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\* Conclusions and Recommendations reviewed and approved by the Working Party on Environmental Performance at its meeting on 23 January 2006.

\*\* The Objectives of the "OECD Environmental Strategy for the First Decade of the 21<sup>st</sup> Century" are covered in the following sections of these Conclusions and Recommendations: maintaining the integrity of ecosystems (Section 1), decoupling of

environmental performance in the context of sustainable development.

## 1. Environmental Management

### *Strengthening the implementation of environmental policies*

Achievements since the previous OECD environmental performance review (1997) include striking progress with air management (major cuts in SO<sub>x</sub>, particulate pollution), water infrastructure (massive investment in sanitation, totalling about USD 20 billion since 1997), water management (establishment of river basin management), waste management (recycling, incineration and sanitary landfill infrastructure), and nature/biodiversity protection. New environmental legislation was adopted (18 new acts) and more bills are pending in the National Assembly. Korea is gradually changing its approach to environmental management. New legislation has been enacted to foster the use of economic instruments in environmental protection (e.g. Special Act on Metropolitan Air Quality Improvement for the capital region) and to introduce mandatory public green procurement (as part of the Act on Promoting the Purchase of Environmentally-Friendly Products). To improve environmental management at the territorial level, river basin environmental offices and a metropolitan air quality management office were established under the supervision of the Ministry of Environment. Public-private partnership platforms with business and environmental non-governmental organisations (NGOs) have contributed to addressing many environmental issues. Many firms have adopted environmental management systems and industry is actively engaged in voluntary approaches, notably in the areas of oil spill remediation, chemical management and energy saving. NGOs have been allowed to participate in environmental inspections. Continuous monitoring systems have been introduced, and monitoring by civilian groups has increased. Environmental impact assessment (EIA) of projects has been strengthened and reinforced to be more preventive through development of the prior environmental review system (PERS) in 1999; the effectiveness and enforcement of both EIA and PERS requires further attention. Integration of environmental concerns in land-use planning improved with a land-use reform and adoption of the principle “plan first, develop later” supported by two new acts. Pollution abatement and control expenditure increased in volume and remained at a robust rate of 1.6 to 1.9% of GDP. Environmental expenditure (including also expenditure on water supply and nature protection) is well over 2% of GDP. Overall, Korea has thus taken a range of actions to pursue environmental protection together with economic development and institutional decentralisation.

However, the sharing of environmental responsibilities (e.g. Ministry of Environment; Ministry of Construction and Transportation; Ministry of Commerce, Industry and Energy; Ministry of Maritime Affairs and Fisheries; Korean Forest Service) could be usefully reviewed and revised. In addition, important challenges remain concerning water, nature and air management. There are very high pressures associated with CO<sub>2</sub> emissions and with use of water, pesticides and fertilisers. The permitting and enforcement systems have been weakened in recent years. Following the 2002 transfer of all enforcement duties in the areas of air, water quality and municipal waste management to local authorities, the number of inspections and the proportions leading to violations and prosecutions have decreased. The permitting system is still single-media in approach, and lacks regular renewal procedures. Integrated permits for large stationary sources should be considered. The OECD recommendation in 1997 to foster local capacity building has not been fully implemented. There is a risk of environmental concerns being too often superseded by development interests in local decision-making. The integration of pollution and nature protection concerns in land-use plans varies greatly among municipalities. Economic instruments should be reviewed to enhance their effectiveness and efficiency (e.g. streamlining, increased rates to induce changes in behaviour and to internalise externalities). The Framework Act on Environmental Policy of 1990 requires all levels of government to prepare five- and ten-year environmental management plans.

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environmental pressures from economic growth (Sections 2.1 and 2.2), and global environmental interdependence (Section 3).

Recommendations:

- review and revise, as needed, national, regional and local inspection and enforcement regimes. Increase inspection and enforcement capacity at the local level and strengthen the mechanisms of supervision and evaluation at the national level to ensure effective and efficient implementation;
- introduce a periodic permit renewal system, and consider introducing integrated pollution prevention and control permits for large stationary sources at the national and regional levels;
- continue to increase the use of economic instruments (e.g. environmental charges, trading mechanisms) to further internalise environmental externalities;
- further integrate environmental concerns (i.e. pollution, natural resources, nature concerns) at all levels of land-use planning, and implement such land-use plans. Further use environmental impact assessment for projects and expand the range of administrative plans subject to prior environmental review;
- strengthen public-private partnerships and industry-driven environmental progress, including for small and medium-sized subcontractors of large firms.

*Air*

Overall, Korea has continued to progress in managing air pollution with determination and with very significant results. While the Korean economy and the number of road vehicles grew substantially during the review period, emissions of SO<sub>x</sub> were strongly decoupled from economic growth and those of CO, NO<sub>x</sub>, PM<sub>10</sub>, lead and volatile organic compounds (VOCs) were weakly decoupled. Emissions per unit of GDP are half the OECD average for SO<sub>x</sub> and well below the OECD average for NO<sub>x</sub>. Both indicators now place Korea in the middle range of OECD countries. The SO<sub>2</sub> decoupling is due primarily to the use of cleaner fuels (e.g. liquefied natural gas (LNG) and low sulphur oil), to flue gas desulphurisation for large emission sources (e.g. power plants), and to cleaner industrial processes. For other pollutants, the main factors are the tightening of emission limits, stepwise improvement of fuel quality, switching to cleaner fuel, stringent controls on motor vehicle emissions, and the use of economic instruments (e.g. taxes/charges on polluting activities). On the whole, ambient concentrations of criteria air pollutants decreased during the review period. The goals of Korea's 1995-2005 environmental plan (Green Vision 21) for improved air quality in urban areas were generally achieved for SO<sub>2</sub> and, for the cities outside the Seoul metropolitan area, for NO<sub>2</sub> and particulates. Korea updated its body of air pollution laws and tightened its ambient air quality standards, which are now generally close to WHO guidelines. It enacted the Special Act on Metropolitan Air Quality Improvement in 2003 to address the air pollution issue in the Seoul capital region. Further market-based and flexible approaches were introduced. An emission trading ("cap-and-trade") system will be used in the Seoul capital region for SO<sub>x</sub>, NO<sub>x</sub> and total suspended particulates starting in 2007. A voluntary agreement with paint manufacturers seeks to reduce VOC emissions and a start was made with the control of hazardous air pollutants. With respect to energy, Korea surpassed its Green Vision target for increasing the use of LNG.

Despite this progress, several challenges remain, mainly concerning PM<sub>10</sub>, ground-level ozone, NO<sub>x</sub> concentrations and CO<sub>2</sub> emissions. The incidence of adverse health effects caused by air pollution is estimated to remain very high, and would make further air pollution abatement highly cost-effective in the country with the highest population density in the OECD and a rapidly growing economy. In the Seoul capital region, the concentration of NO<sub>2</sub> and particulates is still higher than in many large cities of other OECD countries. The rapid growth of the vehicle fleet and automobile use causes emissions to outpace improvements in fuel quality and engine technology. Ground-level ozone problems are widespread and increasing in frequency. PM<sub>10</sub> concentrations in the Seoul capital region remain very close to the Korean standard of 70 µg/m<sup>3</sup> (compared to the WHO guideline of 40 µg/m<sup>3</sup>). Comprehensive measures to tackle air pollution issues have been taken in the Seoul metropolitan area, but not in other major cities and

industrial complexes. Little attention has so far been paid to air quality in rural areas or the effects of air pollution on vegetation and ecosystems. Higher priority should be given to hazardous air pollutants, which adversely affect health. Integration of environmental concerns into decision-making in the energy sector remains limited and is one of the main priorities for energy policies. Despite some gradual improvement during the review period, Korea had problems in reducing energy intensity (i.e. energy use per unit of GDP) and now has one of the most energy-intensive economies, but it has been carrying out policies to reduce energy intensity and needs to strengthen these policies further. Likewise, the CO<sub>2</sub> intensity of the Korean economy is now well above the OECD average. The share of renewable energy sources in the energy supply (2.1%) remains very low.

Recommendations:

- complete and firmly implement the comprehensive air management plan for the Seoul metropolitan area;
- formulate and implement comprehensive air quality plans (including cost-benefit analyses) for the major cities and industrial complexes outside the Seoul metropolitan area;
- strengthen the management of hazardous air pollutants: monitor their concentration, analyse their health effects and reduce their emissions (e.g. from existing coal-fired power plants); take further measures to reduce emissions of VOCs;
- further improve energy efficiency so as to reduce energy dependency, air pollution and greenhouse gas emissions; bolster current efforts to expand the use of renewable energy sources; continue efforts to ensure that energy prices reflect environmental costs;
- ensure that work on energy being done by the Presidential Commission on Sustainable Development and the proposed National Energy Committee takes full account of the pivotal role of energy issues in sustainable development;
- ensure that efforts to manage air quality are commensurate with the magnitude of the problem, including the damage to public health, by: further integrating air pollution and sectoral policies (e.g. energy, industry, transport and urban planning); building capacity in local government; and expanding awareness of the health effects of air pollution and their economic burden.

### ***Water***

Korea made unmistakable progress in improving the water quality of its rivers during the review period and has set further ambitious receiving water quality targets for the future. Water quality in the country's four main water supply reservoirs improved to the extent that the Green Vision 21 target was reached a few years early. Korea extended the coverage of its waste water treatment infrastructure from 45% of the population in 1995 to an impressive 81% in 2004, and thereby surpassed another important Green Vision target for 2005. Good progress was also made in reducing industrial discharges and discharges from intensive livestock operations. Korea has begun moving away from the supply-dominated approach of the past towards a more integrated quality and quantity management of its water resources, adopting a river-basin management approach for its four major rivers. As part of this, in 2007 it will begin implementing a "total pollution load management" system to manage point-source pollution discharges. Effluent limits for sewage discharges were tightened. The use of nitrogenous chemical fertilisers was reduced by 29% during 1997-2003. Water legislation was further amended and updated during the review period, and much progress was made in implementing the user pays principle for domestic and industrial water use, although there are cross-subsidies from industry to households. Korea has made a start at trying to reverse the mounting damages caused by flooding by moving away from a sole reliance on engineering works towards a comprehensive approach that includes ecosystem management.

Despite this progress, Korea still has a considerable distance to go to meet its water quality objectives for rivers and reservoirs: in 2004, only about one-third of 194 river sections met their quality targets. Biochemical oxygen demand remains the almost exclusive focus of management, while heavy metals and persistent contaminants have so far received little attention. Aquatic species and biodiversity have been neglected altogether. “Red tides” of decomposing algae in coastal waters are a sign of serious nutrient pollution. Three-quarters of sewage sludge is still dumped at sea. Water infrastructure in rural areas lags behind that in the densely populated urban areas. The proposed strengthening of regulations for industrial effluents has yet to be implemented. The impact of intensive agriculture on water quality and quantity has not been sufficiently brought under control. The control of diffuse pollution sources is only beginning to be addressed. In order to face the long-standing, intense pressure on its water resources, Korea needs to undertake more efforts to confront the challenge of integrated urban water management, such as rainwater harvesting, reuse of grey water and retention of storm water.

#### Recommendations:

- further strengthen demand management policies and consistently apply the user pays principle to all categories of users;
- consider how current water supply, sewerage, stormwater and waste water treatment policies can be harmonised in urban areas to achieve an integrated urban water management;
- strengthen limits on industrial effluent discharges and increase rates of pollution charges;
- speed up measures to control non-point sources of water pollution, notably from agriculture, and further reduce point discharges from livestock enterprises, including through a greater utilisation of manure;
- adopt and implement biological water quality standards for surface waters;
- ensure that basin-wide flood control plans, regional and local land-use plans, and comprehensive water resource management plans are consistent;
- consider combining the policy functions for water quantity and water quality.

#### *Waste*

Over the review period, Korea made much progress in waste management and achieved a number of top results among OECD countries. Korea decoupled the generation of municipal waste from private final consumption by limiting the increase in municipal waste to 6% between 1997 and 2003. Municipal waste amounted to 390 kg per person per year in 2003 (as in the mid-1990s). This result was achieved with a new volume-based waste fee system, as well as with measures to recycle waste and food waste. Concerning recycling and reuse, Korea surpassed its Green Vision 21 targets and can proudly present rates that are among the highest in the OECD: nearly three-quarters of all (municipal and industrial) waste was recycled in 2003. An extended producer responsibility system, implemented in 2003, further increased the recycling rate for targeted waste items by 12%. The first and second comprehensive national waste management plans adopted during the review period signalled the wish to adopt an integrated approach to waste management with quantitative targets. New legislation was enacted to deal with the growing problem of construction and demolition waste. New sanitary landfills were built, notably the world’s largest landfill site at Sudokwon in the Seoul metropolitan area, and the management of landfills was improved, including the control of leaching and the recovery and use of landfill gas. Incinerators are increasingly equipped for energy recovery. Exports of hazardous waste decreased strongly over the review period. A nationwide inventory of problematic landfill sites was made and monitoring in landfill sites was strengthened (e.g. obligation to install leachate monitoring wells). Dioxin emission standards for incinerators were set.

However, further progress towards a “circular economy” will require increased economic efficiency in waste management and additional efforts to reduce, recycle and reuse waste (the “3Rs”). This is all the more important as Korea’s economy is dependant on material imports. The generation of industrial and hazardous waste was not decoupled from economic growth during 1997-2003: industrial waste grew by 71% and hazardous waste by 31%, whereas the economy grew by 27%. The most important factor in the growth of industrial waste has been the rise in construction and demolition waste, a consequence of the extensive renovation and replacement of large apartment buildings built 30 or more years ago. Efforts to promote cleaner technologies have not been taken up sufficiently by small and medium-sized enterprises. Waste management policies at the national, provincial and municipal levels are not yet as well integrated as they might be. Korea still counts many small and medium-sized incinerators that do not always meet emission standards, although the number is decreasing. While waste legislation has enabled public participation in decision-making and the payment of compensation to communities close to waste facilities, problems remain in finding efficient waste treatment solutions. The polluter pays principle is still only partially applied (volume-based waste pricing only represented some 43% of municipal waste collection and disposal costs in 2003). Markets for some recycled materials remain underdeveloped, notwithstanding the extension of the green public procurement system during the review period. Illegal waste dumping and dumping at sea remain an issue. Cost-benefit analysis should become standard practice in waste management decision-making.

#### Recommendations:

- further reduce the material intensities of the Korean economy through efficient waste reduction, reuse and recycling;
- strengthen measures to reduce industrial waste generation (e.g. promoting cleaner production, broadening the scope of the extended producer responsibility system, increasing the rate of the waste treatment fee);
- further reduce municipal waste generation (e.g. increased cost recovery from the volume-based waste fee);
- encourage the development of markets for recycled products, including by further extending green government procurement;
- promote more efficient waste disposal by municipalities and industry (e.g. improved management or closure of substandard landfills and incinerators; prevention of illegal dumping of industrial waste through the waste manifest system; reducing dumping at sea of wastes such as sewage sludge and dredged spoils; close monitoring of hazardous waste management);
- foster public awareness of waste issues (e.g. reducing waste generation, preventing illegal dumping, acceptance of waste infrastructure).

#### *Nature and biodiversity*

Since 1997, Korea has further progressed in its efforts to conserve nature and protect biodiversity. It has strengthened its legal, strategic and planning framework. It has increased the staff for nature conservation. It has strengthened environmental impact assessment and extended its scope to include the impacts of rapid urban development and industrialisation on nature. Economic instruments have been used, such as an ecosystem preservation fee on large-scale developers. Protected land and marine areas are distributed across the territory and are being connected by nationwide ecological corridors (e.g. the Baekdu Daegan Mountain Range, protected coastal areas and the Demilitarised Zone). Korea has three marine and seashore parks, covering 270 000 hectares. The system of “nature sabbatical periods” for national parks, with periods of restricted access, has been effective. Concerning species, the number under legal protection has increased to 221 (following enactment of the Wildlife Protection Act in 2004), and progress has been made with the recovery of several endangered species (e.g. Asian black bear in Jiri

Mountain National Park, musk deer in Ohdae Mountain National Park). The prevention of illegal hunting has been strengthened. In addition, the management plans for forests, mostly planted in the years following the Korean War and covering 64% of the country, pursue sustainable development objectives.

However, it is not clear whether Korea's protection efforts are commensurate with the heavy pressures on nature and biodiversity that are associated with land scarcity, rapid urban and coastal development and industrialisation, and increasing demand for recreation. It has not always been possible to reconcile nature protection with economic development. Acute conflicts have arisen in peri-urban and coastal areas and in connection with the construction of transportation infrastructure and golf courses. By raising land prices, land speculation has hindered government efforts to purchase land for nature conservation, although private acquisition and protection of threatened ecosystems has increased through the National Trust of Korea (an NGO created in 2000). While around 10% of Korea's land area is under protection, most protected areas have a relatively low degree of protection (IUCN categories IV and V), although the Seorak Mountain National Park was recently upgraded to IUCN category II. Species protection and habitat conservation need to be streamlined and carried out with better co-operation among the relevant ministries, especially in coastal and forested areas. Higher priority should be given to nature conservation in land-use planning at both national and local levels. Expenditure for nature conservation and biodiversity protection are on the order of 1% of pollution abatement and control expenditure and less than 0.02% of Korea's GDP. Illegal trading of endangered species continues to occur. Scientific knowledge of species and habitats should be increased. Awareness of the ecological and economic value of nature, landscape and biodiversity (e.g. as assets for recreation and tourism, and a provider of service values such as flood protection) should be raised.

Recommendations:

- give higher priority to nature conservation and biodiversity protection; protect ecologically valuable areas in urban, peri-urban and coastal areas, e.g. by use of land-use planning, prior environmental review and environmental impact assessment; increase attention to landscape values;
- strengthen funding and human resources for nature protection; increase the purchase of land by central and local government for nature protection; develop the use of economic instruments (e.g. ecosystem conservation charge); encourage stakeholder participation in policy planning;
- increase the actual protection of designated protected areas; streamline the management of these areas by the relevant authorities; minimise the impact of recreational and tourist facilities;
- strengthen species protection, including through habitat protection, sanctions for illegal hunting and trading, recovery programmes and measures against invasive species; ensure consistency in the actions taken by different authorities;
- set targets for nature protection in coastal areas and develop appropriate funding mechanisms to reach them;
- further integrate nature and biodiversity considerations into sectoral policies and practices (e.g. agriculture, forestry and fisheries);
- further strengthen scientific knowledge of Korea's natural resources and biodiversity (e.g. through surveys in the Demilitarised Zone and other valuable areas) to support policy decisions; prepare biotope maps at the local level to support the protection of valuable areas; raise awareness of the ecological and economic value of nature, landscape and biodiversity.

## 2. Towards Sustainable Development

### *Integration of environmental concerns in economic decisions*

Korea succeeded in the review period in strongly decoupling several environmental pressures from GDP growth (e.g. SO<sub>x</sub> emissions, the use of pesticides and fertilisers in agriculture); SO<sub>x</sub> and NO<sub>x</sub> emissions per unit of GDP are below the OECD average, as is per-capita municipal waste generation. Although municipal waste generation has continued to increase, it has risen at a lower rate than GDP due to an active recycling policy, volume-based waste charging and, more broadly, Korea's emphasis on a "3Rs" (reduce, recycle, reuse) strategy for waste management. The introduction of cross-compliance in agricultural policy and of agri-environmental payments in 1996 brought positive environmental outcomes. Tourism and forestry sectoral plans have been prepared with due attention to environmental concerns. As tourism accounts for 4.8% of Korea's GDP, the second tourism development plan (2002-11) aims to increase eco-tourism and strengthen environmental impact assessment of tourism development projects. The fourth forest development plan (1998-2007) foresees conservation of 25% of planted forest ecosystems. In the fisheries sector, a total allowable catch system was adopted in 1998 and the doubling of budgetary transfers to fishery policies since 2000 was mainly to preserve the marine environment. Adoption of the Coastal Zone Management Act (1999) was followed by development of an integrated coastal zone management plan (2000). There is no evidence of environmental progress affecting the overall competitiveness of the Korean economy. On the contrary, environmental efficiency is enhancing the results of a number of Korean firms in international markets. As regards institutional arrangements, the Presidential Commission on Sustainable Development was created in 2000 (as an advisory body), and a sustainable development strategy was launched in June 2005.

However, with rapid economic growth and high population densities, Korea continues to face challenging sustainable development issues. Its intensities of energy, water, pesticide and fertiliser use as well as its CO<sub>2</sub> emissions are among the highest in the OECD. High priority should be given to further reducing the energy and CO<sub>2</sub> intensities and material intensities of the Korean economy. Further improvements in reducing air pollution should bring health and related economic benefits. The energy and transport sectoral plans have been prepared with little regard to environmental concerns. The second national energy plan projects energy demand to grow by 3.1% a year over the period 2002-11 and envisages only limited changes in the energy mix (with only 5% for renewables by 2011). The prices of electricity and natural gas for industry are kept low though being higher than production costs. Electricity is largely produced from coal (with subsidies for domestic production) and from nuclear energy (with little provision to the fund for nuclear waste management). In the agricultural sector, border protection continues to be very high and with it the level of market price support, thus creating incentives for unsustainable farm practices. Efforts to decouple direct payments from production should be pursued. No sectoral policies or plans have yet been subject to strategic environmental assessment and there is limited use of cost-benefit analysis to support policy formulation. In the context of Korea's low overall tax burden (by OECD standards), in-depth thinking about environmental tax reform is desirable. The pursuit of balanced territorial development, including the construction of a new administrative capital city and of new transportation infrastructure, will offer challenging opportunities to "green" the country's physical development.

Recommendations:

- strengthen institutional mechanisms to foster integration of environmental concerns in sectoral policy planning (strategic environmental assessment) and in large projects, under the guidance of the Presidential Commission on Sustainable Development;
- develop economic analysis capacity within the Ministry of Environment;
- establish an institutional mechanism, such as a green tax commission, to review the environmental effects of fiscal instruments, identify environmentally harmful subsidies, and improve the use of economic instruments;
- reduce the differential in energy prices (electricity, natural gas) between households and industry, with a view to fostering demand-driven energy planning policy;
- further reduce energy, material and pollution intensities performance indicators.

*Integration of environmental concerns in transport decisions*

Overall, Korea has undertaken wide ranging and often innovative efforts to address the challenges associated with transport. Concerning vehicles, a substantial strengthening of emission standards has resulted in limited growth in emissions of NO<sub>x</sub> and CO in spite of a rapid increase in the road vehicle stock. These standards were further strengthened in January 2006, to levels comparable to those of the EU and the United States. More stringent emission inspections for in-use vehicles, using both loaded tests and on-road checks, also contributed to these results. Concerning fuel quality, the lower sulphur content in diesel fuel and lower benzene content in unleaded gasoline are clear improvements. A large fleet of compressed natural gas (CNG) buses is already in use, and the 23 000 urban buses will be using CNG by 2010. Concerning traffic, economic instruments (e.g. congestion pricing, traffic generation charge, parking fee) and fiscal incentives (targeted exemption or rebates) have been strengthened to induce environmentally-friendly behaviour. Efforts have been made to improve traffic management, including the expansion of bus-only lanes and modern traffic engineering techniques (e.g. the Intelligent Transport System). Concerning infrastructure, the creation of the Seoul-Busan high-speed train line and plans to increase funding of the railway are positive developments, although road construction will continue to receive the lion's share of transport investment funds. In light of the expected further increase in transport demand, a new national infrastructure plan has been elaborated for the period to 2019, with measures to promote multi-modal freight transport and public transportation.

Nevertheless, the transport sector is still responsible for large shares of NO<sub>x</sub>, PM<sub>10</sub> and CO<sub>2</sub> emissions in Korea. Traffic congestion, and the resulting pollution by particulate matter and CO<sub>2</sub>, is worsening. PM<sub>10</sub> levels in large cities are increasing; in Seoul, they exceed the Korean air quality standards due mainly to increased use of commercial diesel vehicles. The introduction of private diesel vehicles on the Korean market should benefit from best available technology to trap particulate emissions. The average speed of traffic in some large cities is decreasing and the estimated economic cost of congestion (1.6% of GDP) is growing, although traffic demand management measures (e.g. parking fee differentiation, congestion pricing and voluntary non-driving days) have been introduced. It is expected that the success of the measures taken so far will be offset by the volume increase of car and truck use. Further efforts to manage transport demand and to achieve a better modal balance, taking into account environmental and other externalities, are clearly needed. Concerns about CO<sub>2</sub> emissions have not been fully integrated into transport policies. Average energy efficiency standards were introduced for vehicles in January 2006; related labelling could be considered. A variety of environment-related taxes and charges, such as a road fuel tax, environmental improvement charge on diesel vehicles, and traffic inducement charges will be reviewed as part of a forthcoming reform of transport-related taxes and charges. Further integration of environmental concerns into transport policy should be pursued, using the full range of available

instruments and addressing vehicles, fuels, traffic, infrastructure and financial issues associated with transport management.

Recommendations:

- continue efforts to strengthen emission and fuel efficiency standards for vehicles, as well as to improve fuel quality; continue efforts to review various policies to internalise externalities related to transport and the environment;
- give higher priority to transport demand management, e.g. through road and road fuel pricing; streamline the current economic and fiscal incentives to enhance environmentally sustainable transport;
- move towards a more environmentally sustainable modal share of freight traffic;
- pursue efforts to facilitate public transportation in urban areas, e.g. through further expansion of bus-only lanes and integrated fare systems;
- pursue integration of transport, housing and land-use policies in the context of sustainable development.

*Integration of environmental and social decisions*

Since 1997, Korea has made progress in strengthening its environmental democracy. Environmental information, as well as access to it, has improved. Efforts have been made to strengthen participation and partnerships between government and other stakeholders including business and a growing range of environmental NGOs. Mechanisms for resolving environmental disputes have included promoting dialogue (through the Presidential Commission on Sustainable Development) and public participation (through environmental impact assessment of development projects), as well as providing access to administrative and judicial procedures (through national and local environmental dispute resolution commissions). These have helped to prevent some conflicts and increase the dialogue with stakeholders on emerging environmental issues. A draft law addressing prevention and resolution of environmental and social disputes is in Parliament. Korea has made efforts to reduce adverse health effects caused by environmental pollution, particularly air and water pollution. In January 2006, Korea adopted a national environmental health action plan. Considerable progress has been made in environmental awareness and in further developing environmental education and training in schools and society at large.

However, further improvement is needed of the various mechanisms for preventing and resolving environmental conflicts, including conflicts over new infrastructure and other development projects and over competition for the use of scarce land (e.g. at the periphery of urban areas, on coastal areas). Environmental indicators should help measure environmental progress and support environmental management at strategic, planning and programming levels. Despite recognising the importance of environmental health, Korea has yet to streamline its environmental health measures, especially those for indoor air and occupational health. The number of people affected by asthma and respiratory disease has increased. There are issues regarding occupational disease (e.g. pneumoconiosis, hearing loss, heavy metal poisoning, solvent toxicity, chemical substance poisoning) and work-related disorders (e.g. musculoskeletal disorders). While the capital area produces half of the country's GDP, multiple regional disparities have increased, requiring a strengthening of the policies for balanced regional development. Such efforts should address disparities in water-related services, waste services, and compliance with air and noise regulations. Access to environmental services should also be considered in the context of household income and social security coverage.

Recommendations:

- further strengthen mechanisms for preventing and resolving environmental conflicts; strengthen and broaden public participation, especially in preparing and implementing development projects and assessing their environmental impact; strengthen the liability legislation in order to better compensate for damage to the environment in line with the polluter pays principle;
- develop and use environmental indicators to support environmental management at strategic, planning and programming levels; continue to expand the scope of and access to the pollutant release and transfer register;
- expand analysis of environmental health issues (including monitoring, epidemiological studies, economic analysis), especially for large cities and industrial complexes and near contaminated soils; ensure implementation of the ten-year National Environmental Health Action Plan; monitor its implementation with appropriate indicators; strengthen management of indoor air quality and occupational health;
- review and improve water supply management on the basis of equity, efficiency and financing criteria;
- further raise public awareness of environmental issues and promote sustainable consumption patterns and land use.

### 3. International Co-operation

Korea made impressive progress during 1997-2005 in projecting internationally its environmental values, influence and leadership. This reflects Korea's commitment to environmental protection domestically and globally, as well as its recognition of the obligations and capabilities associated with its rapid economic growth and its new responsibilities as a member of the OECD community of industrialised nations. Since the previous OECD Environmental Performance Review, Korea has hosted numerous major international environmental meetings (e.g. the 2005 UN-ESCAP Ministerial Conference on Environment and Development in Asia and the Pacific, the 2004 UNEP Special Session of the Governing Council and Global Ministerial Environment Forum), participated much more extensively and actively in multilateral and regional organisations, and played a lead role regionally in advancing environmental capacity-building and programme initiatives. Ratification of global conventions on oil spills, wildlife conservation, chemicals, hazardous wastes and climate change was followed up rapidly by implementation of national legislation, reporting and public awareness campaigns. Similarly, Korea fulfilled its commitment to adhere to the body of OECD Decisions and Recommendations on environmental matters, following its accession to the Organisation in 1996. Korea expanded its outreach systematically to now include memorandums of understanding and technical exchanges with developing countries in Southeast Asia, the Middle East and Africa. It provided leadership within the Northeast Asia region by focusing attention and resources on transboundary problems of special interest to Korea, including dust and sandstorms, acid rain, marine fisheries and migratory wildlife. A strong, comprehensive national marine fisheries management regime was established. And the Republic of Korea's efforts to engage North Korea in protecting the unique ecological resources of the Demilitarised Zone gained international attention and endorsement.

On the other hand, the absence of specific greenhouse gas reduction targets in Korea's three-year national action plans on climate change weakens pressures and incentives for reducing greenhouse gas emissions meaningfully in the foreseeable future. Korea met its initial 2005 commitment under the Montreal Protocol for the phase-out of CFC production, after having been granted an extended phase-out schedule as a "developing country" under the protocol; and it has prepared a 2005-10 CFC reduction plan. While Korea's official development assistance and its environmental component have been increasing, the funding levels are well below those of other OECD donors and are not commensurate with Korea's economic status. Inspection and enforcement remain weak for ensuring compliance with domestic laws

and international commitments on the transboundary movement of hazardous waste, trade in endangered species and chemicals, and ship-based marine pollution. Some progress has been made in reducing land-based sources of marine pollution, including the dumping of sewage sludge and dredged spoils in coastal waters, but this remains an issue. Concern about overfishing has emerged. Overall, the Korean economy is evolving from a developing country status (especially since Korea's accession to the OECD in 1996) towards convergence with other OECD countries' economies (with the aim of reaching a GDP per capita of USD 20 000 in the coming years). In parallel, environmental convergence has advanced with the adoption of the body of OECD environmentally related Council Acts and engagement in regional and multilateral environmental co-operation. However, the road to full environmental convergence will require strengthened efforts, particularly concerning climate, stratospheric ozone, aid and marine issues.

Recommendations:

- continue to strengthen and build on Korea's recent expansion of international engagement, co-operation and leadership in regional and global environmental problems;
- set out in the next national plan on climate change specific objectives and precise measures to be taken over the next few years to reduce the rate of growth of greenhouse gas emissions in order to participate actively in the UNFCCC process;
- reduce Korea's production and export of ozone-depleting chemicals to ensure that the nation's responsibilities under the Montreal Protocol are fully met on schedule;
- continue to expand support to developing countries through public and private bilateral institutions and programmes as well as through financial and in-kind support for regional and multilateral banks and programmes, while seeking to increase the environmental dimension of Korea's official development assistance;
- continue to tackle marine pollution problems, including pollution in Korean waters and eutrophication of shallow coastal waters; further strengthen oil pollution prevention, preparedness and response;
- upgrade Korea's environmental enforcement capabilities to comply with international commitments on transboundary movement of hazardous wastes and on trade in endangered species, forest products and restricted chemicals, including ozone-depleting substances;
- enable ongoing multi-national planning, modeling and monitoring programmes on critical regional problems of acid rain, dust and sandstorm pollution, and fisheries management to move into the operational problem-solving phase at an early date;
- pursue, bilaterally and in concert with other nations and international organisations, a strategy for ensuring sound environmental management of the Demilitarised Zone, including its possible designation as a UNESCO Biosphere Reserve.